

## Industrial Controls

### Parameterization, Configuration and Visualization with SIRIUS SIRIUS engineering Safety ES V1.0


Operating Manual


<u>Introduction</u>	<b>1</b>
<u>Safety information</u>	<b>2</b>
<u>Software description</u>	<b>3</b>
<u>Software user interface</u>	<b>4</b>
<u>Software installation</u>	<b>5</b>
<u>Operation (software)</u>	<b>6</b>
<u>Configuring</u>	<b>7</b>
<u>Function elements</u>	<b>8</b>
<u>Diagnostics</u>	<b>9</b>


## Legal information

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 <b>DANGER</b>
indicates that death or severe personal injury <b>will</b> result if proper precautions are not taken.

 <b>WARNING</b>
indicates that death or severe personal injury <b>may</b> result if proper precautions are not taken.

 <b>CAUTION</b>
indicates that minor personal injury can result if proper precautions are not taken.

<b>NOTICE</b>
indicates that property damage can result if proper precautions are not taken.


If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

### Qualified Personnel

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# Table of contents

<b>1</b>	<b>Introduction .....</b>	<b>11</b>
1.1	Purpose of this manual .....	11
1.2	Required basic knowledge .....	11
1.3	Validity range .....	11
1.4	Additional documentation .....	12
1.5	Siemens Industry Online Support .....	13
1.6	DataMatrix code and Siemens Industry app .....	14
1.7	Support Request .....	15
1.8	Configurator for safety relays.....	16
1.9	Evaluation of safety functions .....	16
1.10	User responsibility for system design and function.....	16
<b>2</b>	<b>Safety information.....</b>	<b>19</b>
2.1	General safety notes .....	19
2.2	Recycling and disposal .....	21
2.3	Intended use.....	21
2.4	Safety information for hazardous areas.....	24
2.5	Current information about operational safety .....	24
2.6	Security information .....	24
2.7	Information on data protection .....	25
<b>3</b>	<b>Software description .....</b>	<b>27</b>
3.1	Application areas for safety systems .....	27
3.2	Interfaces .....	29
3.3	Safety ES .....	30
3.4	License-dependant available menu commands.....	32
<b>4</b>	<b>Software user interface .....</b>	<b>37</b>
4.1	Design of the user interface .....	37
4.2	Toolbar .....	38
4.3	Status bar .....	39
<b>5</b>	<b>Software installation .....</b>	<b>41</b>
5.1	Requirements .....	41
5.2	Usage authorizations via the Automation License Manager.....	41

5.3	Installing the Automation License Manager .....	42
5.4	Rules for using license keys .....	43
5.5	Installation .....	44
5.6	Starting the program.....	44
<b>6</b>	<b>Operation (software) .....</b>	<b>47</b>
6.1	Description of the menu commands .....	47
6.1.1	Switching device menu .....	47
6.1.1.1	New.....	47
6.1.1.2	Open... ..	48
6.1.1.3	Import... ..	48
6.1.1.4	Open online.....	49
6.1.1.5	Save .....	51
6.1.1.6	Save as... ..	51
6.1.1.7	Export .....	51
6.1.1.8	Close .....	52
6.1.1.9	Information about the print options .....	52
6.1.1.10	Page Setup... ..	52
6.1.1.11	Print preview.....	55
6.1.1.12	Print... ..	56
6.1.1.13	List of the files last used .....	56
6.1.1.14	Exit.....	57
6.1.2	Edit menu.....	57
6.1.2.1	Undo .....	57
6.1.2.2	Redo.....	57
6.1.2.3	Cut .....	58
6.1.2.4	Copy.....	58
6.1.2.5	Paste .....	58
6.1.2.6	Delete.....	58
6.1.2.7	Select all.....	59
6.1.2.8	Go to... ..	59
6.1.2.9	Insert comment .....	60
6.1.2.10	Realign graphic.....	60
6.1.2.11	Interrupt connection .....	60
6.1.2.12	Redraw partial connection .....	61
6.1.2.13	Add diagram .....	61
6.1.2.14	Remove diagram.....	62
6.1.2.15	Create macro... ..	62
6.1.2.16	Edit terminal identifier.....	63
6.1.2.17	Object properties... ..	63
6.1.2.18	Check consistency.....	63
6.1.2.19	Password for project access.....	64
6.1.2.20	Forgot password .....	65
6.1.2.21	Reset password for project access.....	65
6.1.2.22	Password for device access.....	66
6.1.2.23	Password for test mode.....	67
6.1.2.24	Offline logbook viewer... ..	68
6.1.2.25	Compare with file.....	69
6.1.2.26	Compare with switching device.....	70
6.1.3	Target system menu .....	70

6.1.3.1	Load to switching device.....	70
6.1.3.2	Load to PC... ..	71
6.1.3.3	Go offline.....	71
6.1.3.4	Undo the fixed assignment of the interface.....	72
6.1.3.5	PROFIBUS DP line view... ..	72
6.1.3.6	PROFINET IO line view.....	73
6.1.3.7	Learn ASIsafe code tables.....	73
6.1.3.8	Prepare configuration test... ..	75
6.1.3.9	Approve configuration.....	75
6.1.3.10	Cancel configuration release.....	77
6.1.3.11	Configuring mode.....	77
6.1.3.12	Test mode.....	77
6.1.3.13	Safety mode.....	78
6.1.3.14	Commands... ..	79
6.1.3.15	Diagnostics configuration.....	81
6.1.3.16	Diagnostics logic.....	82
6.1.3.17	Device logbooks.....	83
6.1.4	View menu.....	86
6.1.4.1	Toolbar.....	86
6.1.4.2	Status bar.....	87
6.1.4.3	Zoom in.....	87
6.1.4.4	Zoom out.....	88
6.1.4.5	Zoom dialog.....	88
6.1.4.6	Overall view.....	88
6.1.4.7	Display settings.....	89
6.1.4.8	Grid settings.....	89
6.1.4.9	Move diagram.....	89
6.1.4.10	Highlight signal flow.....	90
6.1.4.11	Delete highlighting.....	90
6.1.4.12	Navigation window.....	91
6.1.4.13	Output window.....	91
6.1.4.14	Catalog window.....	91
6.1.4.15	Minimize / restore online dialogs.....	91
6.1.5	Options menu.....	92
6.1.5.1	Basic settings... ..	92
6.1.5.2	Settings of Safety ES - "General settings" tab.....	93
6.1.5.3	Settings of Safety ES - "Download options" tab.....	94
6.1.5.4	Settings of Safety ES - "Logic" tab.....	95
6.1.5.5	Cross references.....	96
6.1.5.6	Symbol list.....	97
6.1.5.7	Terminal list.....	98
6.1.5.8	Export macros.....	99
6.1.5.9	Import macros... ..	100
6.1.5.10	Release information... ..	100
6.1.5.11	Set PG/PC interface... ..	101
6.1.6	Help Menu.....	101
6.1.6.1	Help topics.....	101
6.1.6.2	Info.....	102
6.2	Identification.....	102
6.2.1	Basic unit.....	102
6.2.2	Marking.....	104
6.2.3	Project.....	105

6.3	Configuration.....	106
6.3.1	Main system .....	106
6.3.2	Swap slots .....	108
6.3.3	Properties of the HMI module.....	109
6.3.4	Properties of interface module .....	109
6.3.5	Basic unit properties .....	112
6.3.6	Properties of expansion module .....	113
6.3.7	AS-i subsystem.....	114
6.3.8	Properties of AS-i slaves .....	116
6.4	Logic diagram .....	117
6.4.1	Overview.....	117
6.4.2	Working with the logic diagram.....	118
6.4.2.1	Inserting, printing and deleting logic diagrams.....	118
6.4.2.2	Selecting function elements and using them in the diagram .....	119
6.4.2.3	Connecting function elements .....	119
6.4.2.4	Selecting .....	121
6.4.2.5	Delete.....	121
6.4.2.6	Display of graphical conflicts .....	122
6.4.2.7	Realign graphic.....	124
6.4.2.8	Move diagram.....	125
6.4.2.9	Zooming.....	126
6.4.2.10	Overall view.....	126
6.4.2.11	Insert comment .....	126
6.4.2.12	Interrupt connection .....	127
6.4.2.13	Redraw partial connection .....	129
6.4.2.14	Highlight signal flow .....	130
6.4.2.15	Delete highlighting .....	131
6.4.2.16	Display settings.....	131
6.4.2.17	Grids and lines.....	132
6.4.2.18	Errors and system callbacks.....	134
6.4.2.19	Macro functionality.....	134
6.5	Passwords.....	136
6.5.1	Passwords.....	136
6.5.2	Enter password .....	140
<b>7</b>	<b>Configuring .....</b>	<b>141</b>
7.1	General information.....	141
7.2	Modes .....	141
7.3	Creating a configuration in Safety ES .....	143
7.4	Interconnecting the signals (terminals) .....	144
7.5	Connection rules.....	147
7.6	Commissioning.....	153
7.7	Testing the configuration .....	156
7.8	Forcing .....	158
7.9	Configuration release .....	159
7.10	Safety mode .....	160

7.11	Tips and Tricks .....	161
7.11.1	Comparison function .....	161
7.11.2	Cross references.....	163
7.11.3	Symbol list.....	164
7.11.4	Terminal list.....	165
7.11.5	Flags (3SK2 safety relay) .....	166
7.11.6	Creation, modification, and release of the configuration without the actual system .....	167
7.11.7	Converting projects from MSS 3RK3 to 3SK2.....	168
<b>8</b>	<b>Function elements .....</b>	<b>171</b>
8.1	Notes on parameter assignment.....	171
8.1.1	Compatibility lists .....	171
8.1.2	Parameterization of times .....	173
8.1.3	Parameterization of start conditions .....	174
8.1.4	Discrepancy monitoring .....	175
8.1.5	Cross-circuit detection.....	176
8.1.6	Parameter - input type .....	177
8.1.7	Fault signaling output (FAULT) .....	177
8.2	Cell function .....	177
8.2.1	Input cell .....	177
8.2.2	Output cell .....	178
8.3	Monitoring functions .....	179
8.3.1	Monitoring Universal.....	179
8.3.2	EMERGENCY STOP.....	182
8.3.3	ESPE (electro-sensitive protective equipment).....	184
8.3.4	Safety shutdown mat (NC principle) .....	186
8.3.5	Safety shutdown mat (cross-circuit principle).....	188
8.3.6	Protective door .....	190
8.3.7	Protective door with tumbler.....	193
8.3.8	Enabling button .....	200
8.3.9	Two-hand operation.....	202
8.3.10	Mode selector switch .....	205
8.3.11	AS-i 2F-DI .....	206
8.4	Muting functions .....	208
8.4.1	Muting safety circuit .....	208
8.4.2	Description of the "muting" function .....	212
8.4.3	Clearing the muting section .....	216
8.4.4	Muting (2-sensor-parallel).....	217
8.4.5	Muting (4-sensor-parallel).....	220
8.4.6	Muting (4-sensor-sequential) .....	223
8.5	Status functions.....	225
8.5.1	Device status .....	225
8.5.2	Element status.....	226
8.6	Control functions .....	227
8.6.1	Device command .....	227
8.7	Logic functions .....	228
8.7.1	AND.....	228
8.7.2	OR.....	229
8.7.3	XOR.....	229

8.7.4	NAND .....	230
8.7.5	NOR.....	231
8.7.6	NEGATION (NEG) .....	231
8.8	Flip-flop.....	232
8.8.1	FF-SR.....	232
8.9	Counter functions .....	233
8.9.1	Counter (0 -> 1) .....	233
8.9.2	Counter (1 -> 0) .....	235
8.9.3	Counter (0 -> 1 / 1 -> 0) .....	236
8.10	Timer functions .....	238
8.10.1	With ON delay.....	238
8.10.2	With ON delay (trigger) .....	242
8.10.3	Passing make contact.....	246
8.10.4	Passing make contact (trigger) .....	250
8.10.5	With OFF delay .....	254
8.10.6	With OFF delay (trigger) .....	258
8.10.7	Clocking .....	262
8.11	Start functions .....	266
8.11.1	Monitored start.....	266
8.11.2	Manual start .....	267
8.12	Output functions .....	267
8.12.1	Standard output.....	267
8.12.2	F output .....	269
8.12.3	Standard output delayed .....	271
8.12.4	F output delayed.....	273
8.12.5	AS-i 1..4F-DO.....	278
<b>9</b>	<b>Diagnostics .....</b>	<b>281</b>
9.1	Diagnostics configuration.....	281
9.1.1	Module status.....	281
9.1.2	Dialog "Device messages" > "Overview" tab.....	282
9.1.3	"Device messages" dialog box > "Status" tab.....	283
9.1.4	Dialog "Device messages" > "Engineering" tab.....	285
9.1.5	"Device messages" dialog box > "Configuration" tab .....	287
9.1.6	Dialog "Device messages" > "PROFINET IO" tab.....	288
9.1.7	Dialog "Device messages" > "PROFIBUS DP" tab .....	289
9.1.8	Dialog "Device messages" > "Device bus interface" tab .....	290
9.1.9	"Device messages" dialog box > "AS-Interface" tab .....	291
9.2	Diagnostics logic.....	293
9.2.1	Monitoring .....	293
9.2.2	Messages of the function elements .....	294
9.2.2.1	Element messages .....	294
9.2.2.2	Messages for Monitoring Universal.....	294
9.2.2.3	EMERGENCY STOP messages .....	296
9.2.2.4	Messages for ESPE .....	297
9.2.2.5	Messages for safety shutdown mat (NC principle).....	299
9.2.2.6	Messages for safety shutdown mat (cross-circuit principle) .....	300
9.2.2.7	Messages for protective door.....	301
9.2.2.8	Messages for protective door with lock.....	303



9.2.2.9	Messages for enabling button .....	304
9.2.2.10	Messages for two-hand operation .....	306
9.2.2.11	Messages for mode selector switch .....	307
9.2.2.12	Messages for the muting functions.....	308
9.2.2.13	Messages for counter functions.....	309
9.2.2.14	Messages for timer functions .....	310
9.2.2.15	Messages for start functions.....	311
9.2.2.16	Messages for output functions .....	311
9.2.2.17	Messages for AS-i 1..4F-DO .....	313
9.3	Messages during the consistency check.....	314
9.3.1	Messages during the consistency check - Identification .....	314
9.3.2	Messages during the consistency check - Configuration .....	315
9.3.3	Messages during the consistency check - Logic .....	315
9.4	Safety ES messages .....	318
9.4.1	Error reading a data set .....	318
9.4.2	The file <file name> cannot be opened .....	318
9.4.3	The file <file name> cannot be written.....	319
9.4.4	The file <file name> cannot be read .....	319
9.4.5	Online function not available .....	320
9.4.6	Error while executing the action.....	320
9.4.7	Error during download to safety relay .....	321
9.4.8	Error during download to PC .....	321
9.4.9	Printout could not be created .....	322
9.4.10	Print preview could not be generated .....	322
9.4.11	Imported activation code is incorrect.....	323
9.4.12	The file with the activation code for resetting... ..	323
9.4.13	Connection to the safety relay could not be established... ..	324
9.4.14	Connection to device cannot be opened! Please check... ..	325
9.4.15	The configuration on the connected safety relay... ..	325
9.4.16	No consistency check could be executed... ..	326
9.4.17	Printout or print preview could not be created .....	326
9.4.18	The configuration on the connected safety relay... ..	327
9.4.19	Data set with release data could not be read.....	327
9.4.20	Data set with release data could not... ..	328
9.4.21	Error during download to safety relay... ..	328
9.4.22	Safety System ES cannot read required status information... ..	329
9.4.23	An access path to the connected safety relay cannot.....	329
9.4.24	Device error. For this reason, change to test mode is.....	330
9.4.25	Logic diagram could not be initialized. Reason: .....	330
9.4.26	Inconsistencies were detected while reading data set xxx. ....	331
9.4.27	Do you want to activate test mode for the safety relay that contains the configuration with the... ..	331
9.4.28	An error occurred during transfer of configuration from safety relay.....	332
9.4.29	Error reading configuration data.....	332
9.4.30	Error during communication with the connected safety relay... ..	333
<b>Glossary</b> .....		<b>335</b>
<b>Index</b> .....		<b>349</b>



# Introduction

## 1.1 Purpose of this manual

This documentation contains a detailed description of the SIRIUS engineering Safety ES software. The documentation provides you with the information you require for configuring, planning, parameterizing and diagnosing a 3SK2 safety relay or a 3RK3 Modular Safety System with the Safety ES software.

## 1.2 Required basic knowledge

A general knowledge of the following areas is needed in order to understand this manual:

- Low-voltage switchgear
- Digital circuit logic
- Automation systems
- Safety systems

## 1.3 Validity range

This manual is valid for the components listed below:

Component	Article number
<b>Safety ES (parameterization software)</b>	<b>3ZS1316-*</b>
Safety ES V1.0 Basic	3ZS1316-4CC10-0YA5
Safety ES V1.0 Basic / License Download	3ZS1316-4CE10-0YB5
Safety ES V1.0 Standard	3ZS1316-5CC10-0YA5
Safety ES V1.0 Standard / License Download	3ZS1316-5CE10-0YB5
Safety ES V1.0 Premium	3ZS1316-6CC10-0YA5
Safety ES V1.0 Premium / License Download	3ZS1316-6CE10-0YB5
<b>3SK2 safety relays</b>	
3SK2 safety relay 22.5 mm (basic unit)	3SK2112-xAA10
3SK2 safety relay 45 mm (basic unit)	3SK2122-xAA10
<b>3RK3 Modular Safety System</b>	
3RK3 Basic (central unit)	3RK3111-xAA10
3RK3 Advanced (central unit)	3RK3131-xAC10

## 1.4 Additional documentation

Component	Article number
3RK3 ASIsafe basic (central unit)	3RK3121-xAC00
3RK3 ASIsafe extended (central unit)	3RK3122-xAC00
4/8F-DI (expansion module)	3RK3211-xAA10
2/4F-DI 1/2F-RO (expansion module)	3RK3221-xAA10
2/4F-DI 2F-DO (expansion module)	3RK3231-xAA10
4F-DO (expansion module)	3RK3242-xAA10
4/8F-RO (expansion module)	3RK3251-xAA10
8DI (expansion module)	3RK3321-xAA10
8DO (expansion module)	3RK3311-xAA10
<b>Accessories</b>	
PROFINET interface 3SK25 (interface module)	3SK2511-xFA10
Diagnostics display	3RK3611-3AA00 3SK2611-3AA00
DP interface (interface module)	3RK3511-xBA10

x = 1: Version with screw-type terminals:

x = 2: Version with spring-loaded terminals:

SIEMENS reserves the right to include updated information about new components or new versions of components in a Product Information.

## 1.4 Additional documentation

### List of references

You will find further manuals in the table that may be of interest for your project planning. They are available to download from the Internet free of charge. You can create your own individual system documentation in the Siemens Industry Online Support under "mySupport".

Title of the manual	Document number
SIRIUS 3RK3 Modular Safety System	3ZX1012-0RK31-1AB1
SIRIUS 3SK2 Safety Relays	3ZX1012-0SK21-1AB1
SIRIUS 3SK1 Safety Relays	3ZX1012-0SK11-0AB0
SIRIUS 3RM1 motor starters	3ZX1012-0RM10-2AB1
SIRIUS Safety Integrated	3ZX1012-0SK11-1AB1
PROFIBUS Network Manual	C79000-G8900-C124-03
AS-Interface	3RK2703-3AB02-1AA1
SIMATIC PROFINET System Description	A5E00298287-06

## Interesting links

- Manuals in Siemens Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/ps/man>)
- FAQs about safety engineering (<http://support.automation.siemens.com/WW/view/en/60763768/133000>)
- Safety Evaluation Tool (<http://www.siemens.com/safety-evaluation-tool>)
- Systematic industrial safety engineering: Safety Integrated (<http://www.siemens.com/safety-integrated>)
- Further information on PROFINET (<https://www.siemens.com/global/en/home/products/automation/industrial-communication/profinet.html>)
- The EMC Directive 2014/30/EU in Practice (<https://www.siemens.com/global/en/home/markets/panel-building/control-cabinet/emc-optimization.html>)
- Industrial Control Panels and Electronic Equipment of Industrial Machinery for North America (<https://www.siemens.com/global/en/home/markets/panel-building/control-cabinet/north-america.html>)
- Control Panels compliant with IEC Standards and European Directives (<https://www.siemens.com/global/en/home/markets/panel-building/control-cabinet/eu-directives.html>)

## 1.5 Siemens Industry Online Support

### Information and service

At Siemens Industry Online Support you can obtain up-to-date information from our global support database:

- Product support
- Application examples
- Forum
- mySupport

**Link:** Siemens Industry Online Support (<https://support.industry.siemens.com/cs/de/en>)

### Product support

You can find information and comprehensive know-how covering all aspects of your product here:

- **FAQs**  
Answers to frequently asked questions
- **Manuals/operating instructions**  
Read online or download, available as PDF or individually configurable.
- **Certificates**  
Clearly sorted according to approving authority, type and country.

- **Characteristics**  
For support in planning and configuring your system.
- **Product announcements**  
The latest information and news concerning our products.
- **Downloads**  
Here you will find updates, service packs, HSPs and much more for your product.
- **Application examples**  
Function blocks, background and system descriptions, performance statements, demonstration systems, and application examples, clearly explained and represented.
- **Technical data**  
Technical product data for support in planning and implementing your project

**Link:** Product support (<https://support.industry.siemens.com/cs/ww/en/ps>)

## mySupport

The following functions are available in your personal work area "mySupport":

- **Support Request**  
Search for request number, product or subject
- **My filters**  
With filters, you limit the content of the online support to different focal points.
- **My favorites**  
With favorites you bookmark articles and products that you need frequently.
- **My notifications**  
Your personal mailbox for exchanging information and managing your contacts. You can compile your own individual newsletter in the "Notifications" section.
- **My products**  
With product lists you can virtually map your control cabinet, your system or your entire automation project.
- **My documentation**  
Configure your individual documentation from different manuals.
- **CAX data**  
Easy access to CAX data, e.g. 3D models, 2D dimension drawings, EPLAN macros, device circuit diagrams
- **My IBase registrations**  
Register your Siemens products, systems and software.

## 1.6 DataMatrix code and Siemens Industry app

### DataMatrix code

A DataMatrix code is lasered onto the lower terminal cover of all 3SK2 safety relays.

DataMatrix codes are standardized in ISO/IEC 16022. The DataMatrix codes on Siemens devices use ECC200 coding for powerful error correction.

The following device information is encoded in the DataMatrix codes as a bit stream:

- Article number
- Serial number
- If applicable, MAC address

This information is stored in the following format in the DataMatrix code:

1P	Article number	+	S serial number (+ 23S MAC address)
Data identifier	Net content	Separator	

#### Note

The information content is displayed without spaces.

This machine-readable information simplifies and accelerates handling of the respective devices. As well as fast access to the serial numbers of the respective devices for unique identification, the DataMatrix codes simplify communication with Siemens Technical Support.

## SIEMENS Industry Support App

DataMatrix codes primarily enable extremely fast and convenient access to all the device-specific information available on an article number in the SIEMENS Service & Support Portal, such as operating instructions, manuals, data sheets, FAQs, etc.

We offer the SIEMENS Industry Support App free for this purpose. It can be used on most commercially available smartphones and tablets.

The SIEMENS Industry Support App is available for iOS and Android-based devices and can be accessed via the following links:



Link for Android



Link for iOS

## 1.7 Support Request

After you have registered, you can use the Support Request form in the online support to send your question directly to Technical Support:

<b>Support Request:</b>	Internet ( <a href="https://www.siemens.com/support-request">https://www.siemens.com/support-request</a> )
-------------------------	--

## 1.8 Configurator for safety relays

### Configurator

Various configurators are available online to assist you during the engineering process.

The configurator for safety relays with accessories is a selection and Engineering tool. You can select the individual components and plan your system in accordance with your specific requirements. You can save your selection, export it as a text file or you can order it directly.

The configurator automatically compiles a document list of the information available in Service & Support for every component. You can use it as the basis for putting together your system documentation.

**Link:** Configurator (<https://www.siemens.com/sirius/configurators>)

## 1.9 Evaluation of safety functions

### Safety Evaluation Tool

The Siemens Safety Evaluation Tool for the IEC 62061 and ISO 13849-1 standards supports you in evaluating the safety functions of your machine. The TÜV-tested online tool guides you step by step, from specifying the structure of the safety system and selecting the components to determining the achieved safety integrity (SIL /PL). The final result is a report in conformance with the standards that you can integrate as proof of safety into the documentation.

**Link:** Safety Evaluation Tool (<http://www.siemens.com/safety-evaluation-tool/>)

### Safety Integrated

Just like the safety relay, the Safety Evaluation Tool is part of Safety Integrated, the intelligent safety solution from Siemens that features a complete product portfolio. Our certified safety technology complies with all relevant standards and is already contained in the Safety Evaluation Tool.

**Link:** Safety Integrated (<http://www.siemens.com/safety-integrated>)

## 1.10 User responsibility for system design and function

The products described here were developed to perform safety-related functions as part of an overall installation or machine.

A complete, safety-related system is generally equipped with sensors, evaluation units, and signaling units, and uses reliable shutdown concepts.

It is the responsibility of the manufacturer to ensure that the system or machine is functioning properly as a whole.

Siemens AG, its regional offices, and associated companies (hereinafter referred to as "Siemens") cannot guarantee all the properties of a whole installation or machine that has not been designed by Siemens.



Nor can Siemens assume liability for recommendations that appear or are implied in the following description. No new guarantee, warranty, or liability claims beyond the scope of the Siemens general terms of supply are to be derived or inferred from the following description.



## Safety information

### 2.1 General safety notes

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#### Note

**SIL 3 in accordance with EN 62061**

**PL e / Cat. 4 in accordance with EN ISO 13849-1**

The safety relays are designed in such a way as to allow implementation of applications up to SILCL 3 in accordance with EN 62061, PL e / Cat. 4 in accordance with EN ISO 13849-1.

---

#### WARNING

**Hazardous Voltage.  
Can Cause Death, Serious Injury, or Property Damage.**

Hazardous electrical voltages can cause electric shock, burns and damage.

- Turn off and lock out all power supplying the system and device before working on the device.
- To ensure protection against the hazard of electric shock from the 3SK2 safety relay when the terminal cover is open, screw in all terminal screws that are not needed to clamp conductors.
- Close the terminal covers on the 3SK2 safety relay and always keep them closed during operation.

#### WARNING

**Risk from conductive contamination  
Can Cause Death, Serious Injury, or Property Damage.**

The devices must be protected against conductive contamination while taking account of the ambient conditions. One way you can do this is to install the devices in a control cabinet with the appropriate degree of protection.


You will find further information in the IEC 60529 standard "*Degrees of protection provided by enclosures (IP Code)*".


#### WARNING

**Loss of the safety functions of the 3SK2 safety relay  
Can Cause Death, Serious Injury, or Property Damage.**

3SK1 output expansions and 3RM1 Failsafe motor starters that are connected to the 3SK2 safety relay via 3ZY12 device connectors are supplied with voltage via the device connectors.

Do not directly connect any separate supply voltage to a 3SK1 output expansion (A1 / A2) or to a 3RM1 Failsafe motor starter (A1 / A2) as otherwise the safety function will be bypassed.

 <b>WARNING</b>
<b>Safe functional extra-low voltage of 3SK2 safety relay.</b> The 3SK2 safety relays with a supply voltage of 24 V DC must be operated by means of a fail-safe power supply with safe functional extra-low voltage (SELV, PELV). This means these modules may only be subjected to a voltage of $U_m$ even in the event of a fault. The following applies for 3SK2 safety relays: Around < 60.0 V. You can find more detailed information about safety functional extra-low voltage in the data sheets of the power supplies to be used.

 <b>WARNING</b>
<b>Loss of the safety function when slide switch is moved on 3SK1 output expansions in the case of the 3SK2 safety relay Can Cause Death, Serious Injury, or Property Damage.</b> Parameterization of the logic of the 3SK2 safety relay in Safety ES must correspond to the slide switch setting on the 3SK1 output expansion in order for the safety function not to be rendered inactive. <ul style="list-style-type: none"><li>• Make sure that the setting of the slide switch on the 3SK1 output expansion corresponds to your logic parameterized in Safety ES.</li><li>• Use a cover seal to protect the slide switch of the 3SK1 output expansion against unauthorized and unintentional adjustment.</li></ul>

<b>NOTICE</b>
<b>Electromagnetic interference</b> The following must be grounded in accordance with the regulations to ensure noise immunity of all system components: <ul style="list-style-type: none"><li>• All system components</li><li>• PELV / SELV power supply units (please also note the documentation for the respective power supply unit in this regard).</li></ul> PROFINET / PROFIBUS must be grounded according to the installation guidelines for PROFINET / PROFIBUS networks.

<b>NOTICE</b>
<b>Damage caused by electrostatic charge</b> When handling and installing the system components, ensure that the components are protected from electrostatic charge. Changes to the system configuration and wiring are only permissible while the supply voltage is switched off. Connection of safety relays is only permissible when the power supply is switched off.

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**Note**  
**Operational faults and malfunctions in communication**  
If the EMC Directive 2004/108/EC is not complied with when plants and devices are installed, communication breaks may occur.

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**Note****Simultaneity of signals**

Depending on when a signal change takes place within the cycle, the signal change is detected either in the same cycle or not until the following cycle time.

This means it is possible for supposedly simultaneous signal changes to be detected at two different inputs by the logic, but not simultaneously.

Take this behavior into account when creating your configuration.

---

**Note**

Cover all unused system interfaces.

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## 2.2 Recycling and disposal

For environmentally friendly recycling and disposal of your old device, please contact a company certified for the disposal of old electrical and/or electronic devices and dispose of the device in accordance with the regulations in your country.

## 2.3 Intended use

**WARNING****Incorrect use of hardware products.****Can Cause Death, Serious Injury, or Property Damage.**

This equipment is only allowed to be used for the applications described in the catalog and in the technical description, and only in conjunction with non-Siemens equipment and components recommended by Siemens.

Correct transport, storage, installation and assembly, as well as careful operation and maintenance, are required to ensure that the product operates safely and without faults.

Before you run any sample programs or programs you have written yourself, make sure that running the plant cannot cause injury to anyone else or damage to the machine itself.

EU note regarding machine safety: Commissioning is absolutely prohibited until it has been ensured that the machine in which the component described here is to be installed complies with the stipulations of the Directive 2006/42/EC.

 **WARNING**

**Incorrect use of software products.  
Can Cause Death, Serious Injury, or Property Damage.**

The software may be used only for the applications described in the catalog or the technical description, and only in combination with the software products, components and devices of other manufacturers where recommended or permitted by Siemens.

Before you run any sample programs or programs you have written yourself, make sure that running the plant cannot cause injury to anyone else or damage to the machine itself.

 **WARNING**

**Hazardous system state  
Can Cause Death, Serious Injury, or Property Damage.**

Safe state (safety concept)

The basis of the safety concept is that a safe state exists for all process variables. With the safety relay, this is the value "0". This applies to sensors and actuators.

Note that the use of inverting functions either in the logic diagram or in the wiring outside the system may prevent the safe state from being reached.

 **WARNING**

**Loss of the safety function through changes to the system.  
Can Cause Death, Serious Injury, or Property Damage**

To ensure the safety of the system, any changes to it or any replacement of defective components must be followed by a thorough and successfully completed function test of the system.

A complete function test consists of the following tests:

- Configuration test (test of the configuration)
- System test (wiring test of the connected sensors and actuators)

 **WARNING****Loss of the safety function due to missing function test.  
Can Cause Death, Serious Injury, or Property Damage.**

When using actuators such as 3SK1 output expansions, contactors or relays, a function test interval (shutdown test)  $\leq 1$  year for SILCL 2 or  $\leq 1$  month for SILCL 3 is required. Only then do the safety values apply.

Exception: A function test interval  $\leq 1$  year is also permissible for SIL3 applications in the process industry (in accordance with IEC 61511), exclusively for low-demand use, due to a significantly lower failure rate/probability of the electromechanical components. This does not apply to safety-related applications in accordance with the Machinery Directive 2006/42/EC.

**Function test procedure for actuators with contacts:**

- Actuate the connected sensors.
- Check their effect on the safety relay and the downstream actuators\*.
- Activate the safety relay via the connected sensors.
- Check their effect on the safety relay and the downstream actuators\*.
- Defective devices must be replaced.

\*Since the read-back time of the delayable output functions is retriggerable, the actuation duration for switching on and off for the regular function test must be longer than the time set in the "Switching time" parameter. Only in this way can it be ensured that the expected switching state has also been set on the connected actuator.

For additional information on the parameters, please refer to chapter "F output delayed (Page 273)".

 **WARNING****Loss of the safety function.  
Can Cause Death, Serious Injury, or Property Damage.**


Test interval for safe AS-i input slaves

The calculated failure probabilities for safe transmission of AS-i input slaves is based on an actuation interval of one year.

For this reason, all sensors that are recorded using safety-related AS-i input slaves must be actuated at least once every 12 months in order to test their function.


If the mechanism of the safety-related AS-i input slaves is used for direct data exchange, a corresponding signal change must also take place here at least once every 12 months, same as for the safety-related AS-i input slaves.

## 2.4 Safety information for hazardous areas

 <b>WARNING</b>
<b>Explosion hazard in hazardous areas. Can Cause Death, Serious Injury, or Property Damage.</b>
The components of the safety relay are <b>not</b> suitable for installation in hazardous areas. Please contact your ATEX specialist.

## 2.5 Current information about operational safety

### Important note for maintaining operational safety of your system

 <b>WARNING</b>
<b>Loss of safety functions due to obsolete information. Can Cause Death, Serious Injury, or Property Damage.</b>
Please take note of our latest information
Systems with safety-related characteristics are subject to special operational safety requirements on the part of the operator. The supplier is also obliged to comply with special product monitoring measures. For this reason, we publish a special newsletter containing information on product developments and features that are (or could be) relevant to operation of safety-related systems. By subscribing to the appropriate newsletter, you will ensure that you are always up-to-date and able to make changes to your system, when necessary:
For this purpose, go to the page: Safety Integrated for industrial safety technology ( <a href="https://www.siemens.com/safety-integrated">https://www.siemens.com/safety-integrated</a> )
Click "Subscribe to newsletter".

## 2.6 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.



For additional information on industrial security measures that may be implemented, please visit <https://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under <https://www.siemens.com/industrialsecurity>.

## 2.7 Information on data protection

Siemens observes standard data protection principles, in particular the principle of privacy by design.

For this Safety ES product, this means:

The product processes/saves the following personal data: "Name of project engineer", "Configuration engineer company name", "Responsible department", "Author", "Name of releasing party" and "Company name of releasing party".

The above-mentioned data is required for documentation of the application. Data is saved for a specific purpose and limited to that which is absolutely necessary to identify authorized operators.

SIEMENS AG does not use the stored information nor forward it to third parties.



# Software description

## 3.1 Application areas for safety systems

### Safety systems

Safety systems are part of machines and plants. Their task is to minimize possible hazards for humans, machines and the environment. To this end, they monitor safety functions such as Emergency Stop and switch off the plant or system in a safety-related fashion. A safety system consists of sensors for sensing signals of the protective equipment (e.g. protective doors) from safety relays (e.g. 3SK2 safety relays) that evaluate these signals, and of actuators (e.g. 3RM1 Failsafe motor starters; 3RT contactors) that are controlled by the safety system and respond accordingly.

In most countries in the world there are binding regulations on the safeguarding of machines and plants. For Europe, the European Machinery Directive (2006/42/EC) defines the basic requirements for machine safety. The technical details of these requirements are specified in "harmonized" standards such as EN 62061 or EN ISO 13849-1 with the highest classification SILCL 3 or PL e/Cat. 4 for production automation.

### 3SK2 safety relays

3SK2 safety relays are safety relays that can be parameterized with software and using which you can interconnect several safety applications with each other. In this way, you can set shutdown ranges, for example, and freely define other dependencies. 3SK2 safety relays are generally suitable for applications involving two or more safety-related functions. SIRIUS 3SK1 safety relays are available for applications with only one safety-related function.

3SK2 safety relays read sensor signals via inputs, interconnect these signals according to the parameterizable logic, and use the processed signals to control the outputs, and thus actuators, in a fail-safe manner.

Depending on the version of the device and the external connection of sensors and actuators, applications can be implemented at up to SILCL 3 in accordance with EN 62061 and PL e/Cat. 4 in accordance with EN ISO 13849-1.

At least one 3SK2 basic unit and the Safety ES parameterization and diagnostics software are required for every system configuration. You can decide between two safety relay sizes with different functional scopes.

### Safety ES parameterization and diagnostics software

The safety functions are parameterized via the Safety ES software. The software represents the wiring of the individual functions using graphical parameterization. All safety or logic functions are available as blocks and can also be easily configured and then logically combined with one another. The software checks the interconnection for errors before the safety program can be loaded into the safety relay.

#### Forcing

### 3.1 Application areas for safety systems

Test operation of the software assists you during commissioning. Here, output signals of function elements can be forced in order to test the logic processing or already installed system sections. Forcing means that the output signals in the logic can be set to 1 or 0, irrespective of the real signal.

#### **Deactivating safety functions**

Functions can be specifically deactivated in the software and assigned substitute values. This means that a complete safety program can be created and tested for the maximum configuration for a system. The system can then be commissioned with a partial configuration, while the parts that are not needed in the safety program remain deactivated. If the system is later expanded, these steps mean that you only need to reactivate the applicable parts of the safety program.

#### **Diagnostics**

The software allows you to monitor the safety system and, to this end, visualizes the status of the safety functions and the status of the devices. The status of each element and the configuration as a whole can be viewed online.

#### **Documentation of the safety functions**

Documentation is also created for the safety functions and, after printing, can be used for system documentation purposes in compliance with DIN EN ISO 7200.

### **Device connector interface**

3SK2 safety relays can be connected to the following actuators using 3ZY12 device connectors:

- 3SK1 output expansions (24 V DC)
- 3RM1 Failsafe motor starters (24 V DC)

3SK1 output expansions and safety-related 3RM1 Failsafe motor starters can be controlled and monitored for correct function using these 3ZY12 device connectors.

The device connectors quickly, easily and flawlessly take over the safety-related wiring. This reduces your wiring effort and costs and possible troubleshooting.

### **Interface modules for communication via bus systems and integration in TIA**

The 3SK2 safety relays communicate with higher-level controllers via an optional interface module. Thus, the basic unit can be interfaced to a PLC via PROFINET/PROFIBUS, for example, and therefore also be integrated in TIA. Fault diagnostics and status information can be passed on cyclically and acyclically.

Via the interface module, the 3SK2 safety relays offer the option of exchanging process signals with a higher-level controller. This is possible in both directions. Up to 64 bits are available for this purpose in each direction. The individual signals are manually interconnected in the user program. This makes it possible to generate individual diagnostics messages, for example. Operational switching signals (such as unlocking commands for protective doors with tumblers) as well as fault acknowledgement and starting commands can be sent from the PLC to 3SK2 safety relays.

## Diagnostics display

Pending messages with detailed information shown as text are displayed on the optional diagnostics display. The diagnostics display enables time-saving troubleshooting without connection to a PG / PC with Safety ES. The cause of a fault can be located quickly and easily and you can respond directly to it. The diagnostics display can be installed in the control cabinet door and is operable from the outside. You do not need any complex parameterization to be able to use the diagnostics display. It is sufficient to assign corresponding names or identifiers when creating the safety application. These names and identifiers are then read directly from the device by the diagnostics display and displayed.

## Diagnostics

The 3SK2 safety relays possess multiple diagnostics options:

- Diagnostics via displays on the device/LEDs
- Diagnostics with Safety ES
- Diagnostics with diagnostics display (if a diagnostics display is available)
- Diagnostics via PROFINET (if PROFINET interface is available)
- Diagnostics via PROFIBUS (if DP interface is available)

## 3.2 Interfaces

### Interfaces

The safety relay can be accessed by Safety ES via an RS232, USB or fieldbus interface. The communication via the fieldbus interface is implemented via an optional interface module.

 **WARNING**

**Unauthorized access to safety functions via fieldbus.  
Can Cause Death or Serious Injury.**

Unauthorized access to the safety relay via fieldbus, such as PROFINET or PROFIBUS, can result in configuration changes and overriding of safety functions.

To prevent unauthorized access to the safety relay via the fieldbus, assign a password for accessing the device in Safety ES. If you operate several safety relays in one fieldbus network, you must assign a separate password for each safety relay to prevent confusion when accessing via the fieldbus. In other words, the passwords must not be identical.

### 3.3 Safety ES

#### The engineering software (ES)

The SIRIUS Safety ES engineering software is the software for configuring, parameterizing and diagnosing the safety relays.

It provides the following functions:

- Simple configuration of the devices of a system configuration, including the graphical parameterization of the function elements, e.g. monitoring functions
- Test and commissioning functions, e.g. device diagnostics, monitoring of logic elements, forcing of logic elements
- Tool for creating the system documentation, e.g. documentation of the circuits, device comments, module names

#### Communication

Safety ES communicates with the safety relay via the device interface of the safety relay or via the fieldbus.

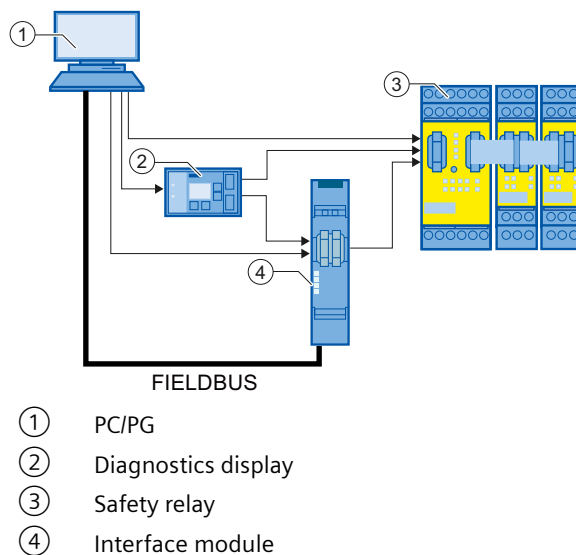


Figure 3-1 Communication options of Safety ES

**WARNING****Unauthorized access to safety functions via fieldbus.  
Can Cause Death or Serious Injury.**

To prevent unauthorized access to the safety relay via the fieldbus, e.g. PROFINET or PROFIBUS, assign a password for accessing the device in Safety ES.

If you operate several safety relays in one fieldbus network, you must assign a separate password for each safety relay to prevent mix-ups when accessing via the fieldbus. In other words, the passwords must not be identical.

## Licenses

The Safety ES parameterization software is available in three different license versions with different functional scopes:

- Basic license
  - CD with a license on a USB stick
  - License download
- Standard license
  - CD with a license on a USB stick
  - License download
- Premium license
  - CD with a license on a USB stick
  - License download

For the functional scope of each license version, see the chapter "License-dependant available menu commands (Page 32)".

The software package contains:

Software	Application
Safety ES	Configuring of the safety relay
Automation License Manager	License management
.NET Framework	Required for generating the printout or print preview
MSI	Execution of the setup
Readme (Readme.rtf)	Important information you require before installation.
7Zip	Unzipping files

**Note**

The licenses are implemented exclusively as a floating license. You will find additional information in the chapter "Installing the Automation License Manager (Page 42)".

### 3.4 License-dependant available menu commands

The Safety ES software is available in 3 different license variants:

- Basic license: This license contains a reduced functional scope and is suitable for basic and low-cost diagnostics.
- Standard license: This license contains a full range of functions for creating configurations.
- Premium license: Compared with the standard license, this license enables Safety ES to also communicate with the safety relay via the fieldbus (PROFINET or PROFIBUS). This license version also features macro functionality.

Not all functions are available with all licenses. If a function is not available with your license version, the associated menu option is always grayed out.

#### Overview: Availability of menu options

The following table provides an overview of which commands are available with which license version:

Menu option		Basic license	Standard license	Premium license
Switching device	New...	✓	✓	✓
	Open...	✓	✓	✓
	Import ...	-	✓	✓
	Open Online...	✓	✓	✓
	Save	✓	✓	✓
	Save as...	-	✓	✓
	Export...	-	✓	✓
	Close	✓	✓	✓
	Page Setup...	-	✓	✓
	Print Preview...	-	✓	✓
	Print...	✓	✓	✓
	Most recently used files	-	✓	✓
	Exit	✓	✓	✓



## 3.4 License-dependant available menu commands

Menu option		Basic license	Standard license	Premium license
Edit	Undo	-	✓	✓
	Restore	-	✓	✓
	Cut	-	✓	✓
	Copy	-	✓	✓
	Paste	-	✓	✓
	Delete	✓	✓	✓
	Select all	-	✓	✓
	Go to...	-	✓	✓
	Insert comment	-	✓	✓
	Realign graphic	-	✓	✓
	Interrupt connection	-	✓	✓
	Redraw partial connection	-	✓	✓
	Add diagram	-	✓	✓
	Remove diagram	-	✓	✓
	Create macro...	-	-	✓
	Edit terminal identifier...	-	✓	✓
	Object properties...	✓	✓	✓
	Check consistency	✓	✓	✓
	Password for project access...	✓	✓	✓
	Reset password for project access...	✓	✓	✓
	Password for device access...	✓	✓	✓
	Password for test mode...	✓	✓	✓
	Offline logbook viewer...	✓	✓	✓
Compare with file...	-	✓	✓	
Compare with switching device ...	-	✓	✓	

## 3.4 License-dependant available menu commands

Menu option		Basic license	Standard license	Premium license
Target system	Load to switching device ...	✓	✓	✓
	Load to PC ...	✓	✓	✓
	Go Offline	✓	✓	✓
	Undo the fixed assignment of the interface	✓	✓	✓
	PROFINET IO line view...	-	-	✓
	PROFIBUS DP line view...	-	-	✓
	Learn ASIsafe code tables...	✓	✓	✓
	Prepare configuration test ...	✓	✓	✓
	Approve configuration ...	✓	✓	✓
	Cancel configuration release	✓	✓	✓
	Configuring mode	✓	✓	✓
	Test mode	-	✓	✓
	Safety mode	✓	✓	✓
	Commands...	-	✓	✓
	Diagnostics configuration	✓	✓	✓
	Diagnostics logic	✓	✓	✓
	Device logbooks	✓	✓	✓
View	Toolbar	-	✓	✓
	Status bar	-	✓	✓
	Zoom in	✓	✓	✓
	Zoom out	✓	✓	✓
	Zoom dialog	-	✓	✓
	Overall view	-	✓	✓
	Display settings	✓	✓	✓
	Grid properties	✓	✓	✓
	Move diagram	✓	✓	✓
	Highlight signal flow	-	✓	✓
	Delete highlighting	-	✓	✓
	Navigation window	✓	✓	✓
	Output window	✓	✓	✓
	Catalog window	✓	✓	✓
	Minimize/restore online dialogs	-	✓	✓
Options	Basic Settings...	✓	✓	✓
	Settings of Safety ES...	✓	✓	✓
	Cross references	-	✓	✓
	Symbol list	-	✓	✓
	Terminal list	-	✓	✓
	Export macros...	-	-	✓
	Import macros...	-	-	✓
	Release information...	✓	✓	✓
	Set PC/PG interface...	-	-	✓

Menu option		Basic license	Standard license	Premium license
Help	Help topics	✓	✓	✓
	Info	✓	✓	✓

### Which device is supported by which software version?

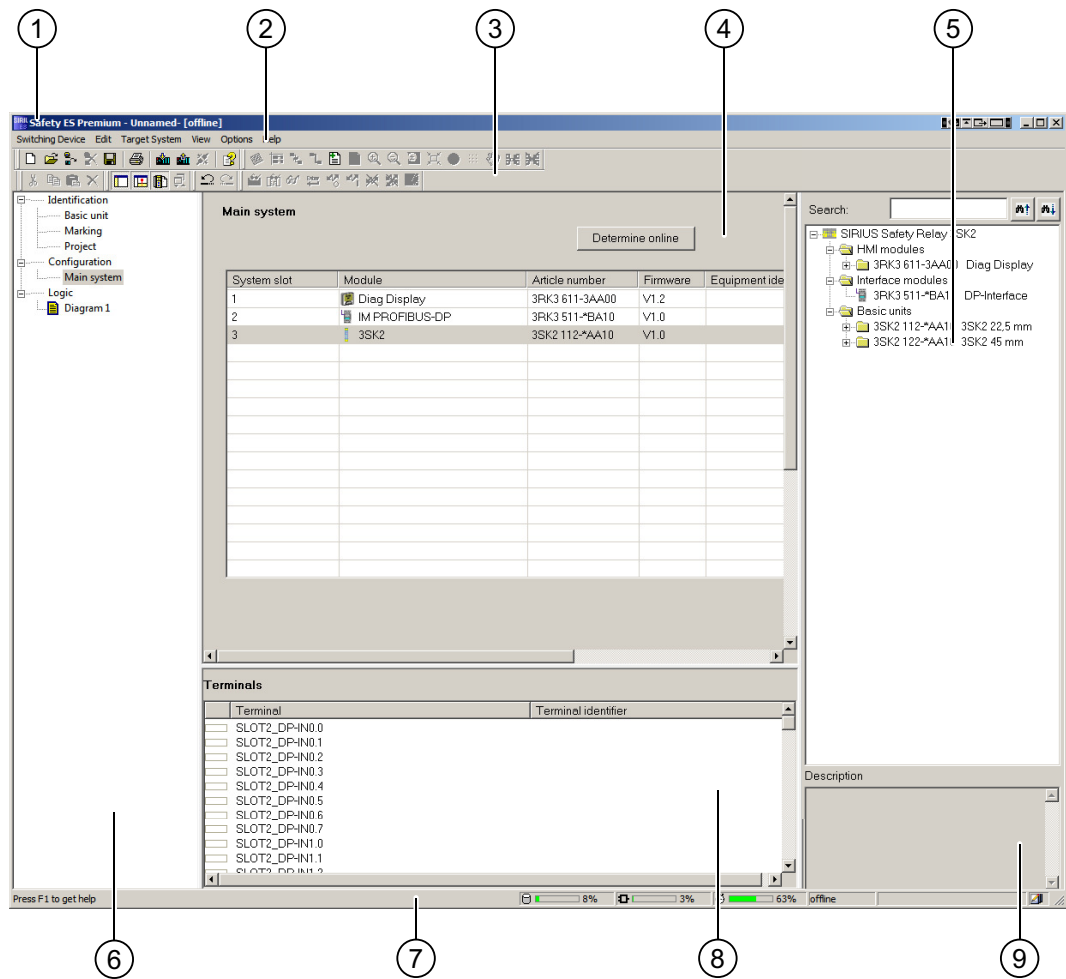
Device	Safety ES V1.0	Safety ES V1.0 SP3
<b>3SK2 basic units</b>		
3SK2 safety relay 22.5 mm	✓	✓
3SK2 safety relay 45 mm	✓	✓
<b>3RK3 central units</b>		
MSS 3RK3 Basic	✓	✓
MSS 3RK3 Advanced	✓	✓
MSS 3RK3 ASIsafe basic	✓	✓
MSS 3RK3 ASIsafe extended	✓	✓
<b>3RK3 interface modules</b>		
PROFINET interface	-	✓
DP interface	✓	✓
<b>3RK3 expansion modules</b>		
4/8 F-DI	✓	✓
2/4 F-DI 2 F-DO	✓	✓
2/4 F-DI 1/2 F-RO	✓	✓
8 DO	✓	✓
4 F-DO	✓	✓
4/8 F-RO	✓	✓
8 DI	✓	✓
<b>3RK3 / 3SK2 HMI modules</b>		
Diagnostics display	✓	✓

3.4 License-dependant available menu commands

## Software user interface

### 4.1 Design of the user interface

When you start the software of the safety relay (Safety ES) and create a new project using the menu command "Switching device" > "New", then the user interface opens in the "Configuration" > "Main system" setting. The central work space of this setting is the configuration table.



- ① Title line
- ② Menu bar
- ③ Toolbar
- ④ Work space
- ⑤ Catalog window
- ⑥ Navigation window
- ⑦ Status bar
- ⑧ Output window
- ⑨ Information window

4.2 Toolbar

Number	Description	Function
①	Title line	Contains general information: <ul style="list-style-type: none"> <li>• The type of license: Basic / Standard / Premium</li> <li>• "Unnamed": Project not yet saved</li> <li>• &lt;File name&gt;: Project already saved</li> <li>• The connection status: [Online] / [Offline]</li> <li>• Name of the displayed logic diagram</li> </ul>
②	Menu bar	Providing all of the functions required for program control.
③	Toolbar	Contains buttons for frequently used program commands.
④	Work space	Depending on the selected view in the navigation window, this contains tables or diagrams for editing the project: <ul style="list-style-type: none"> <li>• Identification parameters</li> <li>• Configuration table</li> <li>• Logic diagram</li> </ul>
⑤	Catalog window	Depending on the selected view in the navigation window, this contains the components needed for the configuration: <ul style="list-style-type: none"> <li>• Configuration: Devices for hardware configuration</li> <li>• Logic diagram: Function elements for the safety logic</li> </ul>
⑥	Navigation window	Allows the various views of the open project to be selected: <ul style="list-style-type: none"> <li>• Identification: Safety relay, marking, project</li> <li>• Configuration: Main system</li> <li>• Logic: Diagram 1 / diagram n</li> </ul>
⑦	Status bar	Contains information on the program status of Safety ES for selected menu commands and buttons.
⑧	Output window	Contains information on the project which does not appear in dialog boxes, e.g. cross reference lists and symbol lists.
⑨	Information window	Contains information on the components selected in the catalog window.

## 4.2 Toolbar

Menu option		Basic license	Standard license	Premium license
View	Toolbar	-	✓	✓

### Actions

To display or hide the toolbar at the top of the application screen, choose "View" > "Toolbar".

## Properties of the toolbar



Figure 4-1 Toolbar in Safety ES

- The toolbar has icons that make the most important menu functions directly accessible. If you allow the mouse pointer to rest on an icon for about one second, its function is briefly displayed as a tool tip and in the status bar in plain text.
- To print data, click on the printer icon. All other icons correspond to the function of the associated menu command.
- You cannot change the number or assignment of the icons for the individual menu commands.

## 4.3 Status bar

Menu option		Basic license	Standard license	Premium license
View	Status bar	-	✓	✓

### Actions

To display or hide the status bar at the bottom of the application screen, choose "View" > "Status bar".

### Properties of the status bar

The status bar contains the standard information and additional information.

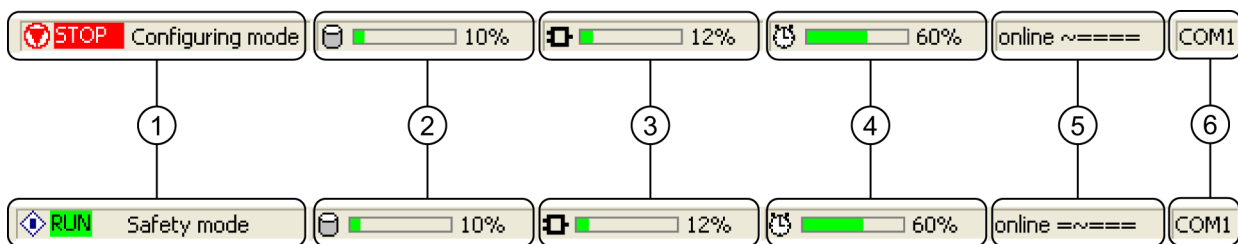


Figure 4-2 Status bar in Safety ES

No.	Meaning
①	Displays the operating state of the safety relay and the status of the user program STOP: Circuit is not being processed RUN: Circuit is being processed
②	Shows the current utilization of the user memory.
③	Display of the current utilization of the internal memory of the safety relay (depends on the type and number of function elements used).
④	Shows the current utilization of the parameterized program cycle time.

### 4.3 Status bar

<b>No.</b>	<b>Meaning</b>
⑤	Connection status (online / offline).
⑥	Type of online connection (e.g. COM1 (= serial interface), DP 42 (= PROFIBUS connection to a switching device with address 42) IP 192.168.0.2 (= PROFINET connection to a switching device with IP address 192.168.0.2)



# Software installation

## 5.1 Requirements

To be able to work with Safety ES, you must meet the following requirements:

### Software requirements

To configure the devices, you need a programming device or PC with the MS Windows 7 Ultimate / Professional / Enterprise or MS Windows 10 Professional / Enterprise operating system. The readme file (Readme.rtf) contains the current software requirements.

- You need administrator rights to install Safety ES. To be able to work with Safety ES under MS Windows 7 Ultimate / Professional / Enterprise or MS Windows 10 Professional / Enterprise, at least the main user rights are required.
- When Safety ES is installed, the administrator must grant full access rights to the Safety ES setup directory to all users wishing to work with Safety ES on this computer. You can find information on assigning access rights in the documentation of your operating system.

### Hardware requirements

- A programming device or PC is required for using Safety ES:  
Refer to the readme file (Readme.rtf) in which the current hardware requirements are listed.

### Required knowledge

Understanding of this documentation and software requires the following:

- General knowledge of the operating system used.
- Basic knowledge of parameterizing, configuring, and commissioning safety relays.

## 5.2 Usage authorizations via the Automation License Manager

### Automation License Manager

To use the programming software, you need a product-specific license key (usage authorization), which is installed using the Automation License Manager.

The Automation License Manager is a software product developed by Siemens AG that is used to manage license keys (technical representation of licenses) on a system-wide basis.

### 5.3 Installing the Automation License Manager

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The Automation License Manager is available:

- On the product CDs of Safety ES
- On the Internet as a download (<http://support.automation.siemens.com/WW/view/en/114358>)

The Automation License Manager features an online help function that you can use to call up context-specific information via the F1 key or by choosing "Help" > "Help for Automation License Manager". This help function contains detailed information about how to use the Automation License Manager and the functions it offers.

#### License keys

The license key acts as the technical representation of a license (electronic license stamp).

SIEMENS AG issues a license key for all license-protected software. The software can only be used in accordance with the license and usage conditions associated with the license key once the system has established that a valid license key has been installed on the computer when the software is launched.

License keys can be stored as follows and transferred from one storage medium to another:

- On license key data carriers
- On local hard disks
- On the hard disks of computers in the network

For more information about using license keys, please refer to the online help for the Automation License Manager.

---

#### Note

- Safety ES cannot be used without a license key.
  - To familiarize yourself with the operator interface and the range of functions, you can activate one trial license, allowing you to work with the system for 14 days. Following this period, you must acquire a valid license. Otherwise you cannot continue to work with Safety ES.
- 

## 5.3 Installing the Automation License Manager

### Installing Automation License Manager

Automation License Manager is installed by a setup program. You will find the installation software for the Automation License Manager on the Safety ES product CDs.

You can install the Automation License Manager together with Safety ES or later.

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**Note**

- For detailed information on the setup procedure for the Automation License Manager, read the latest readme file (Readme.rtf).
  - The online help for the Automation License Manager contains all the information you need about using license keys and the functions they offer.
- 

### Installing license keys at a later date

When you start the Safety ES software without installed license keys, the system displays a corresponding message.

You can install license keys later in the following ways:

- Install license keys from a USB stick
- Install license keys downloaded from the Internet (license keys must be ordered first)
- Using floating license keys available on the network.

Refer to the online help for the Automation License Manager for detailed information on installing license keys. To access this context-sensitive help function, press F1 or select the menu command "Help" > "Help on Automation License Manager".

---

**Note**

- License keys will only be operational if they are installed on a hard disk on which write access is allowed.
  - Floating licenses can also be used within a network ("remote" use).
- 

## 5.4 Rules for using license keys

### Additional information

You can open the context-sensitive online help for the Automation License Manager by pressing F1 or by selecting the menu command "Help" > "Help on Automation License Manager".

This help contains all the information you need about the functions and handling of license keys.

<b>NOTICE</b>
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Read the information on handling license keys contained in the online help and readme file for the Automation License Manager. If you do not follow these instructions, the license keys may be irretrievably lost.
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## 5.5 Installation

### Requirements

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**Note**

You require administrator rights to install Safety ES.

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### Before installing:

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**Note**

Read the "readme.rtf" file on the CD ROM before installing Safety ES.

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### Installation of the software from CD ROM

The installation program starts automatically after you insert the CD ROM, if this function is activated on your computer.

If the installation program does not start automatically, proceed as follows:

- Open the main directory on the CD ROM.
- Double click on the "setup.exe" file to start the setup program. The setup program guides you step by step through the entire process of installing Safety ES.

### Installation of the software after download

Save the downloaded \*.exe file and unzip it.

- Double click on the "setup.exe" file to start the setup program. The setup program guides you step by step through the entire process of installing Safety ES.

## 5.6 Starting the program

### Starting the Safety ES program on the PC

After terminating the installation program, and after restarting your computer (if prompted to do so during setup), you can start Safety ES as follows:

- By double-clicking on the "Safety ES" icon on the desktop.

## Start wizard

After the program has been started, a deactivatable Start wizard appears with which you can execute the following actions:

- Create a new configuration ("New")
- Open an existing configuration file ("Open")
- Read out a configuration online from a safety relay ("Open online")




## Operation (software)

### 6.1 Description of the menu commands

#### 6.1.1 Switching device menu

##### 6.1.1.1 New...

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	New...		✓	✓	✓

#### Actions

To create a new project, choose "Switching device" > "New."

A list containing the short codes for the available switching devices is displayed. You can select one of these switching devices for processing or you can search for a specific switching device for further processing.

In the display window underneath a short description of the selected switching device is displayed. If you install SIRIUS engineering for other switching devices, the new switching devices are added to the hardware catalog.

#### Searching for a switching device

To search for a specific switching device, proceed as follows:

1. Enter the name or article number of the switching device in the search dialog box either in full or in part.
2. Click on the up and down search buttons to look for the switching device.

If the switching device could not be found the following error message appears:

"The device being searched does not exist in the catalog."

As a remedy, change the search text and click on the search buttons again.


#### Selecting a switching device

To choose the switching device, select it and then click "OK" or simply double-click the required device name.

To open or close the sub-directories of the switching device tree displayed, click [+] or [-].

6.1 Description of the menu commands

6.1.1.2 Open...

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Open...		✓	✓	✓

**Actions**

To open parameter files that were generated with Safety ES and that have the file extension \*.sdp (switching device parameters), choose the "Switching device" > "Open..." menu command. When a file is selected, the directory that was last used is always displayed from which you can navigate to the required file.

6.1.1.3 Import...

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Import...	-	-	✓	✓

**Actions**

To overwrite the diagrams currently in use with the values from the file, choose "Switching Device" > "Import...." The current focus of the program does not change (that is, if you make changes, for example, these will not be saved in the imported file but in the originally opened file).

**Error message when parameters are overwritten**

The current parameters are overwritten with those from the file.

If the content of the file is not compatible with the current safety relay, an error message is displayed (Example: You are processing the parameters of Safety ES and have opened the parameter file for a motor starter.)

---

**Note**

**Overwriting parameters**

When you choose the "Import" menu command, the parameters in the main memory are overwritten without you being prompted to confirm this.


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**Storage directory display**

When a file is selected, the directory that was last used is always displayed from which you can navigate to the required file.



### 6.1.1.4 Open online...

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Open online...		✓	✓	✓

### Actions


The "Switching device > Open online..." switching command establishes a data connection between the PC and a switching device via the local device interface or the fieldbus and downloads the data from a switching device once to the work memory of the PC. The data connection remains in place,

### Local device interface

The "Local interface" tab is only present when a RS232 interface is available, or a USB-PC cable or a USB-to-serial adapter is connected to the PC / PG. To load the data from a switching device into the working memory of the PC through the local device interface, proceed as follows:

- Specify the COMx interface.
- Confirm the dialog with "OK".
- The program establishes a connection with the specified safety relay, checks whether the parameters that are currently displayed are compatible with this safety relay, and then reads all the parameters from the device.
  - If no configuration is open when the "Open online..." action is performed, a graphical diagram will be created in which the function elements are arranged automatically.
  - If a configuration is open when the "Open online..." action is performed, the offline configuration will be compared with the online data. The graphical arrangement of the function elements of the offline parameters is retained as far as possible.

### PROFIBUS DP

 <b>WARNING</b>
<p><b>Unauthorized access to safety functions via PROFIBUS. Can Cause Death or Serious Injury.</b></p> <p>As a result of unauthorized access to the safety relay via PROFIBUS, the configuration can be changed and safety functions stopped.</p> <p>To prevent unauthorized access to the safety relay via the PROFIBUS network, assign a password for accessing the device in Safety ES.</p> <p>If you operate several safety relays in one PROFIBUS network, you must assign a separate password for each safety relay to prevent mix-ups when accessing via the fieldbus. In other words, the passwords must not be identical.</p>

6.1 Description of the menu commands

The preconditions for access over PROFIBUS are the use of the DP interface module, a PROFIBUS interface in the PC / PG and a Premium license.

Perform the following steps:

1. Connect the DP interface to the PC / PG using a PROFIBUS cable.
2. Start Safety ES.
3. Open the "Switching device" > "Open online..." menu.
4. Select the access point under "Options" > "Set PG/PC interface..."
5. Enter the DP address under "Preferred address," or select the corresponding address under "Available stations."
6. Click OK to confirm.


---

**Note**

Without configuration or with the factory settings, the safety relay logs on to the PROFIBUS with address 126.

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**PROFINET IO**


 <b>WARNING</b>
<b>Unauthorized access to safety functions via PROFINET.</b>
<b>Can Cause Death or Serious Injury.</b>
As a result of unauthorized access to the safety relay via PROFINET, the configuration can be changed and safety functions stopped. To prevent unauthorized access to the safety relay via the PROFINET network, assign a password for accessing the device in Safety ES.
If you operate several safety relays in one PROFINET network, you must assign a separate password for each safety relay to prevent mix-ups when accessing via PROFINET. In other words, the passwords must not be identical.

The preconditions for access over PROFINET are the use of the PROFINET interface module, an Ethernet interface in the PC/PG and a Premium license. Perform the following steps:

1. Connect the PROFINET interface to the PC/PG using a connecting cable.
2. Start Safety ES.
3. Open the "Switching device" > "Open online..." menu.
4. Select the access point under "Options" > "Set PG/PC interface..."

5. Enter the DP address under "IP address," or select the corresponding IP address under "Accessible nodes". With this IP address you can communicate with the PC/PG with the PROFINET interface.  
Note that you can change the IP address in Safety ES. During download to the switching device, this new IP address is stored in the PROFINET interface. You can prevent a change by setting the "Station address - Change authorizations" parameter accordingly. To ensure communication with the controller, the assigned IP addresses in the automation software must match the IP address set in the PROFINET interface.
6. Click OK to confirm.

### 6.1.1.5 Save

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Save		✓	✓	✓

#### Actions

With the "Switching device > Save" menu command, you save existing parameters in the standard format (\*.sdp) on a data medium.

If no file is open at this point (e.g. because you have selected "Switching device" > "New" to select a new safety relay for processing), the "Save as..." dialog box will open instead.

### 6.1.1.6 Save as...

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Save as...	-	-	✓	✓

#### Actions

With the menu command "Switching device" > "Save as...", you save the current data under a new name.

### 6.1.1.7 Export ...

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Export...	-	-	✓	✓

6.1 Description of the menu commands

**Actions**

With the "Switching device" > "Export..." menu command, you can copy the currently displayed parameters to a parameter file.

**6.1.1.8 Close**

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Close	-	✓	✓	✓

**Actions**

With the menu command "Switching device" > "Close", you exit the function for processing the current parameters. The menu command has the following effect:

- An opened parameter file is closed.
- An existing online connection to a safety relay is terminated.
- If you have changed any parameters, you are asked if you want to save the changes before you exit the program.

**6.1.1.9 Information about the print options**

**Required settings**

A default printer must be set up on the target system.

**Print on DIN A3**

To print on DIN A3, a DIN A3-capable printer must be installed and defined as the default printer. To select the DIN A3 format, choose "Switching device" > "Page setup..."

**6.1.1.10 Page Setup...**

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Page Setup...	-	-	✓	✓

**Actions**

To call up a dialog in which you can set the print options, select "Switching device" > "Page setup...". These settings are copied for a specific project (\*.sdp file) or device.

## Setting options

The Wizard contains the following four pages:

- Page 1 - General settings: choosing the page format
- Page 2 - Header: maintaining the header fields
- Page 3 - Footer: maintaining the footer fields
- Page 4 - Contents: selecting the data to be printed, paper orientation, margins

## Page 1 - General settings

### Settings on the 1st page

On page 1 of the "Page setup" dialog, you can define the general settings. These functions include:

- The paper format for the entire report (default: A4)
- What happens when you close a dialog (print preview is displayed, printout is triggered)
- Display of initial page

---

#### Note

##### Further format settings

You can define further format settings (e.g. page margins and document alignment) on page 4 of the "Page setup" dialog.

---

## Page 2 - Header

### Maintaining the header

On page 2 of the "Page setup" dialog (header), you can maintain the header fields.

### Inserting elements in the header

You can insert the following elements left justified, centrally, or right justified via the context menu (can be selected using the "+" pushbuttons):

Element	Note
Date short	Date in short format as defined in the control panel under "Regional and Language Options".
Date	Date in long format as defined in the control panel under "Regional and Language Options".
System time	Time as defined in the control panel under "Regional and Language Options".
Time 24h	Time 24 hour clock format.

6.1 Description of the menu commands

Element	Note
Path	Path of the *.sdp file that is currently open.
Document name	Name of the current *.sdp file / DP address / COM port
Page (curr.)	Current number of pages.
Pages (tot.)	Total number of pages.
My text	When you select "My text", the system displays a field in which you can enter your own text.
My image	You can add a picture or logo here.

To remove any elements, choose "-".

Page 3 - Footer

Maintaining the footer

On page 3 of the "Page setup" dialog (footer), you can maintain most of the fields in the (tabular) footer.

Standard DIN EN ISO 7200

The tabular footer is structured in accordance with DIN EN ISO 7200.

Overview of all the fields in the footer:

Footer field	Meaning	Maintaining
<b>Specific section of the footer of Safety ES</b>		
Diagram	Number of the logic diagram	Automatic
Diagram name	Configured name of the logic diagram	Automatic
Diagram sheet	Page and pages, including the logic diagram	Automatic
Last change	Date and time of last change saved	Automatic
Configuration CRC	Cyclic Redundancy Check which saves all safety-relevant configuration data (4 bytes).	Automatic
<b>Standard-compliant part of the footer</b>		
Department responsible	Name of the department which, at the time the document is released, is responsible for the technical content and updating the document.	In the "Page setup" dialog
Technical reference	Company contact for technical queries regarding the content of the document.	In the "Page setup" dialog
Document type	Indicates the content and format of the document (intended specifically for searching for documents).	In the "Page setup" dialog
Document status	Status of the document within the lifecycle (e.g. "Being processed", "Released", "Withdrawn").	In the "Page setup" dialog
Owner	Name of the company that is the legal owner of the document (an abbreviated trade name or logo can also be entered) With Safety ES: Configuration engineer's company name	in the "Identification" > "Project" output window
Created by	Name of the person who created or revised the document. With Safety ES: Name of configuration engineer	in the "Identification" > "Project" output window

Footer field	Meaning	Maintaining
Approved by	For approvals/releases with signature (e.g. releases required for acceptance inspections performed by certification centers).	handwritten on the printout
Title	Unique name for the parameters or project With Safety ES: Project name	in the "Identification" > "Project" output window
Item number	Establishes a unique reference to the document.	In the "Page setup" dialog
Modification	Indicates the different versions with combinations of letters and/or numbers.	In the "Page setup" dialog
Release date	Date on which the document was approved/released.	handwritten on the printout
Language	Indicates the document language (in max. 4 characters).	In the "Page setup" dialog
Sheet	Current page / total number of pages	Automatic

## Page 4 - Contents

### Selecting the configuration data to be printed.

On page 4 of the "Page setup" dialog, you can select which configuration data is to be printed. In the selection tree, select the checkbox in front of the data you want to print out. You can either select individual elements or higher-level elements with all the associated sub-elements. You must select at least one element before you can close the dialog.

### Separate page layout for level 2 elements

In the various tab dialog boxes on the right, you can define a separate page layout for level 2 elements (e.g. parameters). This layout is valid for all levels below this. You can also select the paper orientation (portrait/landscape) and the margins. You have already set the paper format (e.g. A4) on page 1 of the "Page setup" dialog. This setting applies to the entire report.

### Applying the settings

Once you have made all the required settings, you can exit the dialog and apply all your settings by choosing "Finish".

#### 6.1.1.11 Print preview...

Menu option		Button	Basic license	Standard license	Premium license
Switching device	Print Preview...	-	-	✓	✓

### Actions


To call up a print preview that displays the document with the current settings, choose "Switching device" > "Print preview...". On page 1 of the "Page setup" dialog, you can specify that the print preview is displayed automatically when you close the dialog.

6.1 Description of the menu commands

**Export from print preview**

You have the option of saving the contents of the print preview as a PDF. To do so, click on the diskette icon in the toolbar in the Print Preview window.

**6.1.1.12 Print...**

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Print...		✓	✓	✓

**Actions**

To open the standard Windows "Print" dialog, choose the "Switching Device" > "Print..." menu command. You can make the following settings in this dialog, for example:

- Printer selection
- Select the pages to be printed (e.g., pages 1 to 11)
- Number of copies
- Printer driver settings

**Further print options**

You can also print a document by selecting the "Printer" icon in the toolbar. The document is then printed with the current print settings. You can also print documents from page 1 of the "Page setup" dialog box (General settings) by closing the dialog box.

**6.1.1.13 List of the files last used**

Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Most recently used files	-	-	✓	✓

**Actions**

Under the menu command "Switching device" the last nine files used are listed. When you click one of the files, it is displayed.



### 6.1.1.14 Exit


Menu option		Button	Basic license	Standard li- cense	Premium li- cense
Switching de- vice	Exit	-	✓	✓	✓

#### Actions

To exit the program, select "Switching device" > "Exit". If you have changed any parameters, you are asked if you want to save the changes before you exit the program.

## 6.1.2 Edit menu

### 6.1.2.1 Undo


Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Undo		-	✓	✓

#### Actions

The menu command "Edit" > "Undo" performs the following actions:

- You can undo changes to parameters and changes in the logic diagram (moving blocks, changing connections, etc.).  
Position changes (e.g. dialog selection, scroll, select) cannot be undone.
- Once you have executed this menu command, the system displays the view that was active before the action you have just undone.
- File functions (e.g. "Save," "Load," "Download," "Open Online") delete the entire undo history ("Undo" can no longer be used).

### 6.1.2.2 Redo


Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Restore		-	✓	✓

#### Actions

The menu command "Edit" > "Redo" cancels one (or more) previous undo actions.

6.1 Description of the menu commands


6.1.2.3 Cut

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Cut		-	✓	✓

**Actions**

The menu command "Edit" > "Cut" transfers selected objects to the clipboard which can then be pasted using the "Edit" > "Paste" menu command. The selected objects are deleted at the source location.


6.1.2.4 Copy

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Copy		-	✓	✓

**Actions**

The menu command "Edit" > "Copy" transfers selected objects to the clipboard which can then be pasted using the "Edit" > "Paste" menu command.


6.1.2.5 Paste

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Paste		-	✓	✓

**Actions**

The menu command "Edit" > "Paste" pastes objects that were copied to the clipboard by the menu command "Edit" > "Copy".

6.1.2.6 Delete

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Delete		✓	✓	✓

**Actions**

The menu command "Edit" > "Delete" removes selected objects.

**6.1.2.7 Select all**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Select all	-	-	✓	✓

**Requirements**

This menu command can only be selected if the logic diagram is active.

**Actions**

The "Edit" > "Select all" menu command selects all of the graphical objects (circuit elements, connections, comments and reference points).

**6.1.2.8 Go to...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Go to...	-	-	✓	✓

**Requirements**

This menu command can only be selected if the logic diagram is active.


**Actions**

The "Edit" > "Go to..." menu command opens a dialog box in which you can select and enter the search criteria:

Action	Result
Searching by "Element number"	The chosen function element is selected.
Searching by "Name"	The function element to which the specified element identifier is assigned is selected.
Searching by "Page"	The page with the page number selected by you in the current diagram is displayed. The page number is structured as follows: <Diagram name:H1V1>. This page number is indicated in the logic diagram view and on every printout at the bottom right.

6.1 Description of the menu commands

6.1.2.9 Insert comment

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Insert com- ment		-	✓	✓


Requirements

This menu command can only be selected if you are in the offline mode and the logic diagram is active.

Actions

Using the "Edit" > "Insert comment" menu command, you can insert a comment anywhere in the logic diagram.

6.1.2.10 Realign graphic

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Realign graphic		-	✓	✓

Requirements


This menu command can only be selected if you are in the offline mode and the logic diagram is active.

Actions

Using the "Edit" > "Realign graphic" menu command, you can optimize the arrangement of the safety circuit in the graphical view (in the logic diagram):

- Overlaps are removed.
- Function elements that overlap connections, each other, or page limits are moved.
- Connections that overlap each other are moved.
- The function elements are arranged according to the signal flow.

6.1.2.11 Interrupt connection

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Interrupt con- nection		-	✓	✓


## Requirements

This menu command can only be selected if the logic diagram is active and an interrupted connection is selected.

## Actions

The "Edit" > "Interrupt connection" menu command replaces the connecting line between two function elements with arrows to keep the configuration in the logic diagram clear. The connection is retained.

### 6.1.2.12 Redraw partial connection

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Redraw partial connection		-	✓	✓


## Requirements

This menu command can only be selected if the logic diagram is active and an interrupted connection is selected.

## Actions

The "Edit" > "Redraw partial connection" menu command undoes the "Interrupt connection" command. The connecting line reappears.

### 6.1.2.13 Add diagram

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Add diagram		-	✓	✓

## Requirements

This menu command can only be selected if you are in the offline mode and the logic diagram is active.

## Actions


Using the "Edit" > "Add diagram" menu command, you can insert another diagram for your safety logic.

6.1 Description of the menu commands

**Naming / renaming a diagram**

You can modify the diagram name by double-clicking on "Diagram 1" in the navigation window. Enter the desired name in the "Properties - Diagram" dialog box.

**6.1.2.14 Remove diagram**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Remove dia- gram		-	✓	✓

**Requirements**

This menu command can only be selected if the logic diagram is active.

**Actions**

The "Edit" > "Remove diagram" menu command deletes the current diagram from the navigation window.

**Note**

It is only possible to split up the safety logic in connection with an offline project.

**Note**

**Remove diagram**

If you delete a diagram, all of the connections, function elements, and comments will also be deleted with it.

**6.1.2.15 Create macro...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Create macro	-	-	-	✓

**Requirements**

This menu command can only be selected if the logic diagram is active and at least one function element is selected.

**Actions**

With the "Edit" > "Create macro" menu command, you create a macro from the selected function elements that you can reuse as a block in other projects.

**6.1.2.16 Edit terminal identifier...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Edit terminal identifier...	-	-	✓	✓

**Requirements**

This menu command can only be selected if a device or a real AS-i slave has been selected in the main system or subsystem. Terminal identifiers can only be assigned for terminals if the terminals can also be interconnected in the logic diagram.

**Actions**

The "Edit" > "Edit terminal identifier..." menu command opens a dialog box for entering the identifiers for the terminals.

The result only appears in the logic diagram when the relevant checkbox on the "Logic" tab under "Options" > "Settings of Safety ES..." is selected.

**6.1.2.17 Object properties...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Object properties	-	✓	✓	✓

**Requirements**

This menu command can only be selected if a device, a real AS-i slave, or a function element in the logic diagram has been selected in the main system or subsystem.

**Actions**

Using the "Edit" > "Object properties" menu command, you can call up the parameter assignment dialogs for the circuit elements of the safety circuit or for the devices.

**6.1.2.18 Check consistency**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Check consistency	-	✓	✓	✓

6.1 Description of the menu commands

**Actions**

The "Edit" > "Check consistency" menu command is used to check the configuration for consistency.

---

**Note**

A consistency check is carried out every time the configuration is saved.

---

The errors found during this check appear in the output window "Consistency check results" below the work space.

**6.1.2.19 Password for project access...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Password for project ac- cess...	-	✓	✓	✓

**Requirements**

This menu command can only be selected if an offline configuration is open in Safety ES.

**Actions**

Using the "Edit" > "Password for project access..." menu command, you can perform the following actions:

- Assigning the password for project access for the first time.

---

**Note**

**Password length**

The password must consist of a maximum of 8 characters.

---

- To modify the password for project access: enter the old password and then enter the new password twice.
- To reset the password protection for project access: enter the old password and then leave the new password empty (do not enter any content) and confirm with "OK."
- If the password for project access is lost: create a code for release with the "Forgotten password" button.

**Password prompt**

This password prompt appears in the "Enter password" dialog box when you open an offline configuration.



### 6.1.2.20 Forgot password

#### Actions

With the "Edit" > "Password for project access..." menu command, you can request a file for releasing the password from the Siemens hotline if the password is lost.

#### Activate password

If lost, activate the password as follows:

- Under the "Password for project access..." menu command, click on the "Forgot password..." button.  
In the dialog box, enter "Forgot password":
  - Your name
  - Company name
  - The name of the file in which your password is encoded and saved
- Submit a Support Request (Page 15).
- The Siemens hotline will send you a file with an activation code.
- Import the file with the activation code using the "Edit" > "Password for project access..." menu command. This menu command can only be selected if you have previously created the activation data.
- Assign a new password (max. 8 characters) for project access.

---

#### Note

The activation code is only valid once.

---

### 6.1.2.21 Reset password for project access...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Reset password for project ac- cess	-	✓	✓	✓

#### Requirements

This menu command can only be selected if you have previously created the file for resetting forgotten passwords in the "Forgot password" dialog box using the "Password for project access" menu command.

6.1 Description of the menu commands

**Actions**

Reset the password as follows:

- In the "Reset password for project access" dialog box, click on the "Import" button.
- In the "Open" window that follows, open the file containing the data saved for resetting the passwords, which you received from the Siemens hotline.
- When prompted, assign a new password (max. 8 characters) for project access.
- After the password has been correctly assigned, you will receive confirmation that the access password has been successfully reset.

**6.1.2.22 Password for device access...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Password for device access	-	✓	✓	✓

**Requirements**

This menu command can only be selected if there is a connection with the safety relay.

<p><b>⚠ WARNING</b></p> <p><b>Unauthorized access to safety functions via fieldbus. Can Cause Death or Serious Injury.</b></p> <p>To prevent unauthorized access to the safety relay via the fieldbus, e.g. PROFINET or PROFIBUS, assign a password for accessing the device in Safety ES.</p> <p>If you operate several safety relays in one fieldbus network, you must assign a separate password for each safety relay to prevent mix-ups when accessing via the fieldbus. In other words, the passwords must not be identical.</p>
--

<p><b>⚠ WARNING</b></p> <p><b>Unauthorized access to the safety relay Can Cause Death or Serious Injury.</b></p> <p>To prevent unauthorized access to the safety relay, assign a password in Safety ES for device access.</p> <p>In the case of several safety relays, you must assign a separate password to each device for device access.</p>
--

## Actions

Using the "Edit" > "Password for device access..." menu command, you can carry out the following actions:

- Assign/change/reset the password for device access

---

### Note

The password must consist of a maximum of 8 characters.

The password must not be identical to the "Password for test mode". If you have assigned an identical password for both, a change to test mode does not take place.

---

- Set the protection level

## Password prompt

This password prompt appears in the "Enter password" dialog box when you open a password-protected device access or when you open an online configuration.

---

### Note

If you have forgotten the password for device access, you must restore the factory settings of the safety relay. You must do this on the safety relay because commands in Safety ES are password-protected. You must then load the required configuration into the safety relay again.

---

### 6.1.2.23 Password for test mode...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Password for test mode...	-	✓	✓	✓

## Requirements

This menu command can only be selected if there is a connection with the safety relay.

## Actions

With the "Edit" > "Password for test mode..." menu command, you can assign and change a password for switching to test mode.

---

### Note

The password must consist of a maximum of 8 characters.

The password must not be identical to the "Password for device access". If you have assigned an identical password for both, a change to test mode does not take place.

---

6.1 Description of the menu commands

**Password prompt**

This password is prompted when you switch to test mode using the "Target system" > "Test mode" menu command.

**Note**

If you have forgotten the password for changing to test mode, you must restore the factory settings of the safety relay. You can do this on the safety relay or by means of a command (Page 79) in Safety ES. You must then load the required configuration into the safety relay again.

You can find out how to restore the factory settings on the device in the manual of the safety relay used, see chapter "Additional documentation (Page 12)".

**6.1.2.24 Offline logbook viewer...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Offline logbook viewer...	-	✓	✓	✓

**Requirements**

This menu command can only be selected if an offline configuration is open in Safety ES.

**Actions**

Use the "Edit" > "Offline logbook viewer..." command to open the dialog window "Offline logbook viewer...". With the "Import" button, you can open and view a saved logbook (\*.csv file).

You can learn how to save a logbook (\*.csv file) in chapter "Device logbooks (Page 83)".

**Logbooks**

The logbooks saved in the file are displayed in the dialog window. You can sort the logbooks by clicking on the column title.

The following information on the entries is displayed:

Column	Description
Type	The following logbooks are displayed, see also the legend: <ul style="list-style-type: none"> <li>• Error</li> <li>• Operating Error</li> <li>• Warning</li> <li>• Prewarning</li> <li>• Event</li> </ul> By activating the checkboxes <input checked="" type="checkbox"/> , you specify which logbooks are displayed in the dialog window.
Index	Consecutive number of the entries of all logbooks that indicates how many entries are available in the logbook; the index is not sorted.
Source	Message source: <ul style="list-style-type: none"> <li>• 1 = device</li> <li>• 2 = Function element</li> <li>• 3 = Communication</li> </ul>
Operating hours	Operating hours count at which the message occurred
Element No.	Number of the affected element function, not relevant for messages from the sources "Device" or "Communication"
Element function	Type of element function for which the message occurred
Message	Pending message, incoming messages are marked "+", outgoing (acknowledged) messages are marked "-"; the messages are not sorted.

### 6.1.2.25 Compare with file...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Compare with file...	-	-	✓	✓

#### Actions

The "Edit" > "Compare with file..." menu command compares the parameters in the current configuration with the parameters of a selected file.

#### Result

the system lists any differences.

6.1 Description of the menu commands

6.1.2.26 Compare with switching device...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Edit	Compare with switching de- vice...	-	-	✓	✓

**Actions**


The "Edit" > "Compare with switching device..." menu command compares the parameters in the current configuration with the parameters of a safety relay that has been opened online.

**Result**

the system lists any differences.

6.1.3 Target system menu

6.1.3.1 Load to switching device...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Load to switch- ing device...		✓	✓	✓

**Actions**

The "Target system" > "Load to switching device..." menu command saves the parameters of the current configuration to a safety relay over an online connection.

**Note**

**Overwriting the parameters**


When you choose this menu command, the parameters in the safety relay are overwritten without you being prompted to confirm this.

## Transferring the parameters

Transfer the parameters as follows:

- Open an online connection to a safety relay via the connection dialog box.
- Click "OK" to close the dialog box.
- The program establishes a connection with the specified safety relay, checks whether the parameters that are currently displayed are compatible with this safety relay, and then loads all the parameters to the safety relay.

### 6.1.3.2 Load to PC...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Load to PC...		✓	✓	✓

## Actions

The "Target system" > "Load to PC..." menu command downloads the parameters currently stored in the safety relay to the PC over an online connection.

### Note

#### Overwriting the parameters


When you choose this menu command, the parameters in the main memory are immediately overwritten.

## Transferring the data

Transfer the data as follows:

- Open an online connection to a safety relay via the connection dialog box.
- Click "OK" to close the dialog box.
- The program establishes a connection with the specified switching device and reads all parameters from the device to the PC.

### 6.1.3.3 Go offline

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Go Offline		✓	✓	✓

6.1 Description of the menu commands

**Actions**

The menu command "Target system" > "Go offline" terminates an existing online connection to a switching device.

The application remembers the status it was in prior to setting up the online connection. It does this by taking a snapshot of all important information in the background. (Which SIRIUS engineering product was launched? Is a file open? What values do the individual parameters have? ...)


After the online connection has been terminated, you are asked whether you want to keep the parameters that are currently displayed now that you are offline.

- If you answer "No", the snapshot is restored.
- If you answer "Yes", nothing happens (except that the online connection has been terminated).

**Exception:**

If the parameter values stored in the snapshot are identical to the parameter values that are currently displayed, the above question is skipped because both answers would have the same effect.

**6.1.3.4 Undo the fixed assignment of the interface**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Undo the fixed assignment of the interface		✓	✓	✓

**Actions**

The "Target system" > "Undo the fixed assignment of the interface" menu command undoes the assignment set in the "Load to switching device" dialog box. By clicking the menu option or the corresponding icon in the toolbar, you reopen the connection dialog the next time the software attempts to establish an online connection.

**6.1.3.5 PROFIBUS DP line view...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	PROFIBUS DP line view...	-	✓	✓	✓

**Actions**

To display all the devices in the PROFIBUS segment, choose "Target system" > "PROFIBUS DP Line view".



## Reference

You can find more information in the online help in the section *Line view*.

### 6.1.3.6 PROFINET IO line view

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	PROFINET IO line view...	-	-	-	-

## Requirements

This menu option is only active if the PROFINET IO driver is installed.

## Actions

To display all the devices in the network segment, choose "Target System" > "PROFINET IO line view".

### 6.1.3.7 Learn ASIsafe code tables...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Learn ASIsafe code tables...	--	✓	✓	✓

## Requirements

This menu command can only be selected if the 3RK3 Advanced, 3RK3 ASIsafe basic or 3RK3 ASIsafe extended central unit is configured and an online connection exists with a device.

## Actions

With the "Target system" > "Learn ASIsafe code tables..." menu command, you can open the dialog box for teaching and diagnosing the code tables of the safety-related AS-i input slaves.

## Slave status 0..15 / slave status 16..31

Status	Color	Meaning
Addr. 0 ... 31	--	Address of F slave
Slave	red	One configured AS-i slave is missing.
	yellow	An AS-i slave that does not correspond to the target configuration has been detected.
	green	A new AS-i slave has been detected. The AS-i slave has not been configured in Safety ES.
	Green with check mark	The configured AS-i slave has been detected. The structure corresponds to the set configuration.
	gray	No AS-i slave exists at this address and no AS-i slave has been configured.
Code table	red	The code table is missing or is unknown.
	yellow	At least 2 AS-i slaves have the same code table.
	green	A new code table has been detected; the code tables can be learned. The code tables can be applied using the "Apply code tables" button.
	Green with check mark	The configured code table has been detected. The structure corresponds to the set configuration.
	gray	No slave exists at this address and no slave has been configured.
F-IN1 / 2 F-OUT 1 ... 4	red	The signal is erroneous.
	yellow	A safety-related AS-i slave has been detected, but no code sequence transmitted.
	green	The signal is 1.
	White	The signal is 0.
	gray	This terminal does not exist.

## Teach

- Start teaching  
If the MSS 3RK3 detects missing code sequence tables during startup or after changes to the AS-i bus, an automatic attempt is made to teach these.

**Note**

Each slave only transmits the code sequence if the inputs are closed. For that reason, you must set and reset all input contacts of the safety-related input slaves during the teaching phase and control the safety-related outputs, so that all code sequences can be determined.

- Progress bar "Teaching in progress":  
The active teaching operation is displayed with a continuous progress bar.
- Slaves after teaching:  
The slaves whose code sequence has been acquired by teaching and the total number of safety-related slaves with a code sequence are displayed. The progress is additionally displayed as a percentage.
- "Apply code table" button:  
To apply the determined code tables and store them as targets, click the "Apply code tables" button.

The code sequences are stored in the memory module. No reteaching of code sequences is therefore necessary when devices are replaced.

### 6.1.3.8 Prepare configuration test...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Prepare config- uration test...	-	✓	✓	✓

The prerequisite for approving a configuration is a successfully carried out configuration test.

#### Requirements

This menu command can only be selected if offline configuration is opened.

#### Actions

Using the "Target system" > "Prepare configuration test..." menu command, you can create the printouts that you can use to support the configuration test.

#### Create configuration data

- Call up the "Target system" > "Prepare configuration test..." menu command.
- In the dialog box that now opens, define the access path (local device interface, PROFINET or PROFIBUS).
- Confirm with "OK". A connection to the safety relay is established.
- Then the following actions are carried out:
  - Comparison to see whether the opened configuration agrees with the online configuration in the safety relay. If the comparison reveals differences, it is aborted and an error message is displayed.
  - Consistency check (also of the logic diagram)
  - If an error is detected, the process is aborted.
  - The online configuration is opened.
  - Print preview in which you can decide whether the configuration data should be printed out or saved as a PDF file.

#### More information

You can find more information on this topic in the chapter "Configuration test".

### 6.1.3.9 Approve configuration...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Approve config- uration...	-	✓	✓	✓

## Requirements

This menu command can only be selected under the following conditions:

- An offline configuration is open.
- A connection to the safety relay exists.
- Safety relay is in configuring mode.



### **WARNING**

**Loss of the safety function.  
Can Cause Death, Serious Injury, or Property Damage.**

A configuration may only be released if a complete function test of the configuration has been successfully completed.

## Actions

Using the "Target system" > "Approve configuration..." menu command, you create a file with the release data for a configuration.

## Approve configuration

To create a printout with the required configuration release specifications, proceed as follows:

- Call up the "Target system" > "Approve configuration..." menu command.
- In the dialog box that now opens, define the access path (local device interface, PROFINET or PROFIBUS).
- Confirm with "OK". A connection to the safety relay is established. Acknowledge the dialog with OK.
- Then the following actions are carried out:
  - Comparison to see whether the opened configuration agrees with the online configuration in the safety relay. If not, an error message is displayed.
  - Displaying the dialog box  
The CRC is displayed. Check whether this matches the CRC of the system documentation. Then enter the following data:
    - ◆ Your name
    - ◆ Your company name
  - Password prompt for device access, if assigned.
  - Print preview in which you can decide whether the release data should be printed out or saved as a PDF file.

## Result

After the configuration is released, you can switch the safety relay to safety mode.

### 6.1.3.10 Cancel configuration release

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Cancel configu- ration release	-	✓	✓	✓

#### Requirements

This menu command can only be selected under the following conditions:

- A safety relay is opened online
- The safety relay is in "configuring mode."

#### Actions

The "Target system" > "Cancel configuration release" menu command cancels the release of the configuration on the safety relay.

### 6.1.3.11 Configuring mode

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Configuring mode	-	✓	✓	✓

#### Actions

Using the "Target system" > "Configuring mode" menu command, you switch the operating mode of the safety relay to configuring mode.

#### Result

In configuring mode, the safety relay will be in the following state:

- The safety relay is ready to accept new configuration data.
- No logic processing is performed.

### 6.1.3.12 Test mode


Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Test mode	-	-	✓	✓

6.1 Description of the menu commands

Requirements

This menu command can only be selected under the following conditions:

- A safety relay is opened online
- The safety relay is in "configuring mode."
- The configuration must be error-free. However, the configuration does not have to be released.
- To switch to test mode, you must enter the password for "Switching to test mode".

 <b>WARNING</b> <b>Automatic system starting in the test mode          Can Cause Death, Serious Injury, or Property Damage.</b> In the test mode, the safety program is executed and the outputs are controlled according to the safety program. Take appropriate organizational measures, such as deactivating the main circuit or cordoning off parts of the system, to ensure safety for persons and the system.
---

Actions

Using the "Target system" > "Test mode" menu command, you switch the operating mode of the target system to test mode.

Application

You can use this operating mode for support when conducting the prescribed function test of the safety circuit. For example, you can force the outputs of function elements in test mode.

6.1.3.13 Safety mode

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Safety mode	-	✓	✓	✓

Requirements

This menu command can only be selected under the following conditions:

- A safety relay is opened online.
- The safety relay is in "configuring mode."
- The configuration must be fault-free and released.

## Actions

Using the "Target system" > "Safety mode" menu command, you switch the operating mode of the target system to safety mode.

## Result

In the safety mode, the safety relay will be in the following state:

- The configured safety circuit is active.
- The outputs are controlled according to the "Circuit parameter assignment" (= circuit diagram).

### 6.1.3.14 Commands...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Commands...	-	-	✓	✓

## Requirements

This menu command can only be selected under the following conditions:

- A safety relay is opened online.
- The available commands also depend on the mode; see the table below.

## Actions

Using the "Target system" > "Commands" menu command, you can activate device commands as additional functions on the safety relay.

The procedure is as follows:

- Select the "Target system" > "Commands" menu command. The "Commands" dialog box opens.
- Select a command from the drop down list.
- Send the command to the safety relay using the "Send" button.

You can start another command once the previous command is executed and the "Send" button is active again.

## Monitoring command processing

A list in the "Commands" dialog box shows the current status of the command processing and the feedback messages from the diagnostics data memory determined by Safety ES. The list is expanded with each sent command. It is deleted when the dialog box is closed.

6.1 Description of the menu commands

**Device commands**

The following device commands are available:

Device commands	Description	Can be activated in	Feedback
Factory settings	All of the parameter values are reset to their default values. After the factory settings have been restored, the device executes a restart autonomously, the connection to the safety relay is interrupted, and the configuration is closed.	<ul style="list-style-type: none"> <li>Configuring mode</li> </ul>	<ul style="list-style-type: none"> <li>Factory settings restored</li> <li>The restart is executed.</li> </ul>
Reset	Tripping, i.e. a shutdown due to a protection violation, can be acknowledged using this command. All of the errors whose causes have been eliminated are acknowledged together	<ul style="list-style-type: none"> <li>Configuring mode</li> <li>Test mode</li> <li>Safety mode</li> </ul>	<ul style="list-style-type: none"> <li>Reset implemented.</li> <li>Reset not possible.</li> </ul>
Restart	Causes a "hardware reset" of the safety relay.	<ul style="list-style-type: none"> <li>Configuring mode</li> <li>Test mode</li> <li>Safety mode</li> </ul>	<ul style="list-style-type: none"> <li>Transmission ok</li> </ul>
Delete memory module	Deletes the data on the memory module of the connected safety relay. Note: With this command, the connection to the safety relay is interrupted and the configuration is closed. After the memory module has been deleted, a reset (using the RESET button) or a complete restart of the safety relay has to be performed as otherwise an online connection to the safety relay is not possible. Note: The command is not available on the 3SK2 safety relay 22.5 mm.	<ul style="list-style-type: none"> <li>Configuring mode</li> </ul>	<ul style="list-style-type: none"> <li>Memory module not plugged in</li> <li>Memory module defective</li> <li>Programming active</li> <li>Programming successful</li> <li>Programming error</li> </ul>
Cancel access rights	Cancels all passwords, i.e. all access rights are revoked.	<ul style="list-style-type: none"> <li>Configuring mode</li> <li>Safety mode</li> </ul>	<ul style="list-style-type: none"> <li>Access authorization exists: No</li> </ul>
Apply code tables	The determined code tables are applied and stored as the target setting.	<ul style="list-style-type: none"> <li>Configuring mode</li> <li>Test mode</li> <li>Safety mode</li> </ul>	<ul style="list-style-type: none"> <li>Code tables missing</li> <li>8x4-bit code sequence errors</li> <li>Multiple code tables</li> <li>New codes tables</li> <li>Code tables known</li> </ul>



Device commands	Description	Can be activated in	Feedback
Open access path	The required access path is opened by the safety relay (if no other access path is already open): Write/controlling access	<ul style="list-style-type: none"> <li>Configuring mode</li> <li>Safety mode</li> </ul>	<ul style="list-style-type: none"> <li>Access path to fieldbus control is open</li> <li>Access path to fieldbus Safety ES is open</li> <li>Access path to device interface is open</li> </ul>
Close access path	The open access path is closed	<ul style="list-style-type: none"> <li>Configuring mode</li> <li>Safety mode</li> </ul>	<ul style="list-style-type: none"> <li>Access path is closed</li> </ul>

### 6.1.3.15 Diagnostics configuration

Menu option		Symbol	Basic license	Standard license	Premium license
Target system	Diagnostics configuration	-	✓	✓	✓

#### Actions

Using the "Target system" > "Diagnostics configuration" menu command, activate the following submenu options:

#### Module status

- Module status: You activate the module status display which is displayed in color in the configuration table.
- This menu command can only be selected if the following conditions are met:
  - A safety relay is opened online.
  - The main system / subsystem is activated in the navigation window.

#### Device messages

- Device messages: You activate the "Device messages" dialog box.
- This menu command can only be selected if the following conditions are met:
  - A safety relay is opened online.

### 6.1.3.16 Diagnostics logic

Menu option		Symbol	Basic license	Standard license	Premium license
Target system	Diagnostics logic	-	✓	✓	✓

#### Actions

Using the "Target system" > "Diagnostics logic" menu command, activate the following submenu options:

#### Monitoring

- The "Target system" > "Diagnostics logic" > "Monitor" menu command shows the statuses of the inputs and outputs, of the function elements and of the connections between the function elements according to their status.
- This menu command can only be selected if the following conditions are met:
  - A safety relay is opened online.
  - The device is in safety or test mode.
  - The logic diagram with the safety circuit is activated.


#### Element messages...

- The "Target system" > "Diagnostics logic" > "Element messages" menu command shows the status messages for a function element that is selected in the logic diagram. You can monitor status messages of several function elements simultaneously.
- This menu command can only be selected if the following conditions are met:
  - The safety relay is opened online.
  - The device is in safety or test mode.
  - The logic diagram with the safety circuit is active.
  - At least one function element must be selected.

#### Element reset

- The "Target system" > "Diagnostics logic" > "Element reset" menu command acknowledges the errors of one or several selected function elements.
- This menu command can only be selected if the following conditions are met:
  - A safety relay is opened online.
  - The device is in safety or test mode.
  - The logic diagram with the safety circuit is activated.
  - One or more function elements are selected.

## Forcing

 <b>WARNING</b>
<p><b>Automatic system starting in the test mode Can Cause Death, Serious Injury, or Property Damage.</b></p> <p>In the test mode, the safety program is executed and the outputs are controlled according to the safety program.</p> <p>Take appropriate organizational measures, such as deactivating the main circuit or cordoning off parts of the system, to ensure safety for persons and the system.</p>

- The "Target system" > "Diagnostics logic" > "Force" menu command preassigns fixed values to the outputs of function elements (= forcing). You can select the following assignments:
  - Force to "0"
  - Force to "1"
  - Cancel forcing
  - Cancel forcing (all)
- This menu command can only be selected if the following conditions are met:
  - The "test mode" is activated.
  - The logic diagram with the safety circuit is activated.
  - An online connection is available.
  - At least one connection of a function element is selected.

### 6.1.3.17 Device logbooks

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Target system	Device log- books...	-	✓	✓	✓

## Requirements

This menu command can only be selected if there is a connection to a 3SK2 safety relay.

## Actions

With the "Target system" > "Logbooks..." menu command, the logbooks of the safety relay are displayed in a dialog window.

## Logbooks

In the logbooks of the safety relay, all messages are saved with a time stamp and a log is thus created. The log is stored in the device. This makes it possible to evaluate the events later.

6.1 Description of the menu commands

The safety relay saves the following logbooks in separate memories. Above a certain number, the oldest entries are overwritten with the new messages.

Number	Message source	Message type
1	Device	Error (device fault)
2		Operating Error
3		Warning
4		Prewarning
5		Event
6	Elements	Error (wiring error)
7		Operating Error (logic error)
8		Warning
9		Prewarning
10		Event
11	Communication	Error
12		Operating Error
13		Warning
14		Prewarning
15		Event

**Logbook update**

There are two ways of updating the logbook display:

- Automatic update  
To activate the automatic update of the logbook, set the check mark for "Cyclically update logbook data". This setting enables the relevant data to be read out at regular intervals. This can affect the speed of Safety ES.
- Manual update  
If the automatic update feature is deactivated, you can display the latest logbook entries by pressing the "Update" button. This does not affect the speed of Safety ES.

**Display**

You can sort the logbooks by clicking on the column title. The following information on the entries is saved:

---

**Note**

**Grayed-out logbook entries or red logbook entry "Configuration changed"**

If a new, changed configuration is loaded into the safety relay, this is indicated with a red logbook entry "Configuration changed". All older logbook entries of the elements are grayed out.

---

Column	Description
Type	The following logbooks are displayed, see also the legend: <ul style="list-style-type: none"> <li>• Error</li> <li>• Operating Error</li> <li>• Warning</li> <li>• Prewarning</li> <li>• Event</li> </ul> By activating the checkboxes <input checked="" type="checkbox"/> , you specify which logbooks are displayed in the dialog window.
Index	Consecutive number of the entries of all logbooks that indicates how many entries are available in the logbook; the index is not sorted
Source	Message source: <ul style="list-style-type: none"> <li>• 1 = device</li> <li>• 2 = Function element</li> <li>• 3 = Communication</li> </ul>
Operating hours	Operating hours count at which the message occurred
Element No.	Number of the affected element function, not relevant for messages from the sources "Device" or "Communication"
Element function	Type of element function for which the message occurred
Message	Pending message, incoming messages are marked "+", outgoing (acknowledged) messages are marked "-".

### Delete logbook entries

You can delete the entries of a logbook in the device using the "Delete" button. While the dialog box is open, the logbooks remain saved in Safety ES. You can recognize deleted logbooks by the green symbol.

---

#### Note

##### Exception

Device errors are not deleted

---

#### Note

##### Factory settings

In the factory settings, the logbooks are not deleted.

---

6.1 Description of the menu commands

Save logbooks as \*.csv file

Using the "Save as..." button, you can save logbooks or selected logbook entries in a \*.csv file:

- Selected logbook entries  
Select individual entries for this purpose by clicking on the corresponding entry in the Type column.  
You can select several entries by pressing the CTRL key at the same time, and you can select a consecutive list by pressing the shift key at the same time.
- Displayed logbooks  
Using the checkbox at top left, you determine which logbooks are displayed and saved.
- All logbooks  
This also saves the logbooks that are not displayed.
- Support information  
With this selection, the logbooks are prepared for Technical Support and stored in a \*.csv file.

6.1.4 View menu

6.1.4.1 Toolbar

Menu option		Basic license	Standard license	Premium license
View	Toolbar	-	✓	✓

Actions

To display or hide the toolbar at the top of the application screen, choose "View" > "Toolbar".

Properties of the toolbar



Figure 6-1 Toolbar in Safety ES

- The toolbar has icons that make the most important menu functions directly accessible. If you allow the mouse pointer to rest on an icon for about one second, its function is briefly displayed as a tool tip and in the status bar in plain text.
- To print data, click on the printer icon. All other icons correspond to the function of the associated menu command.
- You cannot change the number or assignment of the icons for the individual menu commands.

### 6.1.4.2 Status bar

Menu option		Basic license	Standard license	Premium license
View	Status bar	-	✓	✓

#### Actions

To display or hide the status bar at the bottom of the application screen, choose "View" > "Status bar".

#### Properties of the status bar

The status bar contains the standard information and additional information.

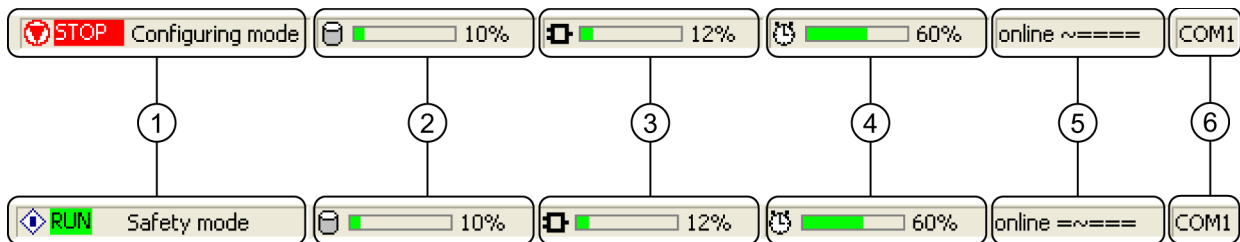


Figure 6-2 Status bar in Safety ES

No.	Meaning
①	Displays the operating state of the safety relay and the status of the user program STOP: Circuit is not being processed RUN: Circuit is being processed
②	Shows the current utilization of the user memory.
③	Display of the current utilization of the internal memory of the safety relay (depends on the type and number of function elements used).
④	Shows the current utilization of the parameterized program cycle time.
⑤	Connection status (online / offline).
⑥	Type of online connection (e.g. COM1 (= serial interface), DP 42 (= PROFIBUS connection to a switching device with address 42) IP 192.168.0.2 (= PROFINET connection to a switching device with IP address 192.168.0.2)

### 6.1.4.3 Zoom in

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Zoom in		✓	✓	✓

#### Requirements


This menu command can only be selected if the logic diagram is active.

6.1 Description of the menu commands

**Actions**

The "View" > "Zoom in" command enlarges the current view by one zoom level.

**6.1.4.4 Zoom out**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Zoom out		✓	✓	✓


**Requirements**

This menu command can only be selected if the logic diagram is active.

**Actions**

The "View" > "Zoom out" command reduces the current view by one zoom level.

**6.1.4.5 Zoom dialog**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Zoom dialog		-	✓	✓


**Requirements**

This menu command can only be selected if the logic diagram is active.

**Actions**

The "View" > "Zoom dialog" menu command opens the zoom dialog box of the logic diagram. A zoom level can be selected there.

**6.1.4.6 Overall view**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Overall view		-	✓	✓

**Requirements**


This menu command can only be selected if the logic diagram is active.



**Actions**

Using the "View" > "Overall view" menu command, you can set the zoom level in such a way that the entire diagram is visible on the screen.

**6.1.4.7 Display settings**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Display settings		-	✓	✓


**Requirements**

This menu command can only be selected if the logic diagram is active.

**Actions**

With the "View" > "Display properties" menu command, you open the "Display properties" dialog box. You can set the display properties there.

**6.1.4.8 Grid settings**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Grid setting		-	✓	✓


**Requirements**

This menu command can only be selected if the logic diagram is active.

**Actions**

With the "View" > "Grid settings" menu command, you open the "Screen grid" dialog box. You can set the grid there.

**6.1.4.9 Move diagram**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Move diagram		-	✓	✓

6.1 Description of the menu commands


**Requirements**

This menu command can only be selected if the logic diagram is active.

**Actions**

With the "View" > "Move diagram" menu command, you switch to move mode. The diagram can only be moved with the mouse.

**6.1.4.10 Highlight signal flow**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Highlight sig- nal flow		-	✓	✓


**Requirements**

This menu command can only be selected if the logic diagram is active and an element (e.g. a function element or connection) is selected.

**Actions**

The "View" > "Highlight signal flow" menu command visually highlights all of the elements located in the signal flow to the left (input side) and right (output side) of the selected element.

**6.1.4.11 Delete highlighting**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Delete high- lighting		-	✓	✓


**Requirements**

This menu command can only be selected if the logic diagram is active and a signal flow is highlighted.

**Actions**

The "View" > "Delete highlighting" menu command deletes all markings that resulted from the "Highlight signal flow" menu command.


**6.1.4.12 Navigation window**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Navigation win- dow		✓	✓	✓

**Actions**

The "View" > "Navigation window" menu command shows/hides the navigation window.


**6.1.4.13 Output window**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Output window		✓	✓	✓

**Actions**

The "View" > "Output window" menu command shows/hides the output window.


**6.1.4.14 Catalog window**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Catalog win- dow		✓	✓	✓

**Actions**

The "View" > "Catalog window" menu command shows/hides the catalog window.

**6.1.4.15 Minimize / restore online dialogs**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
View	Minimize / re- store online di- alogs		-	✓	✓

6.1 Description of the menu commands

**Requirements**

A safety relay is open online and at least one online dialog is open, e.g. the "Device messages" dialog.

**Actions**

Use the "View" > "Minimize/restore online dialogs" menu command to collectively minimize or restore the display of all open online dialog boxes.

**Which commands are executed?**

- If an online dialog box is open, the menu command executes the function: "Minimize all open online dialog boxes".
- If all open online dialog boxes are minimized, the menu command executes the function: "Restore all minimized online dialog boxes".

**6.1.5 Options menu**

**6.1.5.1 Basic settings...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Basic Settings...	-	✓	✓	✓

**Changing the basic settings**

The menu command "Options" > "Basic settings..." starts a dialog box in which you can change the basic behavior and appearance of SIRIUS engineering. Any changes you make do not become effective until you choose "OK" or "Apply".

**Change options**

You can make the following settings in this dialog box:

- "Language"  
All available languages are shown in the selection list. When you change the language, this affects all the displayed texts in Safety ES (menu texts, dialog texts, parameter names, etc.). Other installed SIRIUS engineering products are not affected. Switching to a different language does not in any way affect how SIRIUS engineering functions.
- "Show picture at startup of SIRIUS engineering"  
If you activate this checkbox, SIRIUS engineering displays a picture for a few seconds in the middle of the screen when the program starts.

- In "Offline" state: Automatic "Online" after "Load to switching device"  
This setting is only effective if you choose "Target system" > "Load to switching device" before an online connection to a safety relay has been established. In this case, the program establishes a new connection, transfers the parameters to the device, and then terminates the connection immediately afterwards.  
The behavior at this point depends on whether you have activated the checkbox: In "Offline" state: Automatic "Online" after "Load to switching device":
  - Activated: the program reestablishes a connection with the same device, loads its parameters to the PC, and maintains the online connection. You can check the parameters and determine how they affect the behavior of the device.
  - Deactivated: no further automatic actions are carried out. The program has the same status as it did before the action "Load to switching device".
- "Show startup wizard"  
If you activate this checkbox, a startup wizard opens when you start Safety ES. With the help of this startup wizard, you can:
  - Create a new project
  - Open an existing project
  - Open a project online with an existing connection to the safety relay

### 6.1.5.2 Settings of Safety ES - "General settings" tab

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Settings of Safety ES	-	✓	✓	✓

### Requirements

This menu command can only be selected if a configuration is opened in SIRIUS Safety ES.

### Actions

Using the "Options" > "Settings of Safety ES..." menu command, you can set the desired response of the Safety ES.

### "General settings" tab

The "General settings" tab contains the following settings:

- "Display object properties automatically on insert":  
If you select "Display object properties automatically on insert," a dialog box for the properties of the respective object (in which you can set the parameters) will immediately appear after a device is inserted in the hardware configuration tables or after a function element is inserted in the logic diagram.
- "Show consistency check messages when saving"
- "Cyclic data updates in online dialogs every ... seconds":  
The data sets required for open online dialog boxes are read from the safety relay in this time interval.

#### 6.1.5.3 Settings of Safety ES - "Download options" tab

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Settings of Safety ES...	-	✓	✓	✓

### Requirements

This menu command can only be selected if a configuration is open in Safety ES.

### Actions

Using the "Options" > "Settings of Safety ES..." menu command, you can set the desired response of the Safety ES.

### "Download settings" tab

In the "Download settings" tab, you can define which parts of the system documentation are to be loaded to the safety relay when the configuration is downloaded:

- Equipment identifier (BMK)
- Element name
- Element comment
- Terminal identifier
- Element positions
- Module list of the device connector

## Save memory space

You do not have to load the system documentation to the safety relay because the system documentation is not evaluated by the safety relay and is therefore not needed for the safety relay to function.

### 6.1.5.4 Settings of Safety ES - "Logic" tab

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Settings of Safety ES...	-	✓	✓	✓

## Requirements

This menu command can only be selected if a configuration is open in Safety ES.

## Actions

Using the "Options" > "Settings of Safety ES..." menu command, you can set the desired response of the Safety ES.

## "Logic" tab

The "Logic" tab contains the following settings for the display options:

- "Label page transitions of connections also on screen":  
Defines whether the labels of the connections on the page transitions will be visible on the screen.
- "Displaying element comments"  
The comments of the function elements are visible in the logic diagram.
- "Display terminal identifiers":  
Here you can set whether the terminal identifiers are to be displayed.
- "Retain element numbers in macros if possible"  
If the element number is not yet used in the current diagram, the element number that the function element had when the macro was created (and that is stored in it) will be assigned to the function element again when it is reused.  
If this setting is deactivated, the next free element number will be assigned to the function element, starting at 1.

6.1 Description of the menu commands

- "Display settings" button:
  - Select a display element.
  - The current color of the selected element is specified.
  - You can change the color of the selected element.
  - You can restore the basic settings.
  - Confirm with "OK," to apply your changes.
  - You will find additional information in chapter "Display settings (Page 131)."
- "Realign graphic" button:
  - Here, you can define the layout strategy by selecting whether and how to "Avoid connections crossing function elements."
    - ◆ Interrupt connections if possible
    - ◆ Move function elements down
  - You can also apply a "Standard column grid across all subnetworks of a function diagram" if you select the corresponding checkbox.
  - You can position the output cells in a separate column on the far right (for each subnetwork) if you select the lowermost checkbox.
  - Confirm with "OK," to apply your changes.
- "Screen grid" button:
  - The graphical grid influences the moving of graphical elements. You can choose whether objects are to be aligned to the grid and / or whether objects are to be aligned to other objects. Select the appropriate checkboxes for this.
  - You can set the grid size (mm) in "Distance."
  - You can define how the grid will be displayed by setting which grid points will be shown.
  - You can activate or deactivate display of the grid by selecting the relevant checkboxes.
  - Confirm with "OK," to apply your changes.
  - You will find additional information in chapter "Grids and lines (Page 132)."

6.1.5.5 Cross references

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Cross referen- ces	-	-	✓	✓

Requirements

This menu command can only be selected if a configuration is open in Safety ES.



## Actions

The "Options" > "Cross references" menu command shows the cross references in tabular form in the output window.

### Structure of the cross reference list

Operand	Kind	Type	Usage location	Diagram	Page
Device Channel Terminal identifier Device status function	Access: WR = write RO = read	Type of operand	Element type and element number of the function element.	Name of the diagram in which the function element is located.	Page on which the function block that is connected to the function element is located.

---

### Note

The cross reference list only displays the operands used in the safety circuit.

---

## Edit cross references

With the context menu (right mouse button) or by double-clicking on the item, you can go to the position where the cross reference is used in order to edit it.

### 6.1.5.6 Symbol list

Menu option		Symbol	Basic license	Standard license	Premium license
Options	Symbol list	-	-	✓	✓

## Requirements

This menu command can only be selected if a configuration is open in Safety ES.

## Actions

The "Options" > "Symbol list" menu command shows the plant identifier you assigned in the form of a table in the output window.

To improve the legibility of the configuration, you can assign identifiers for parts of your configuration data within the context of the system documentation. The symbol list gives an overview of the identifiers assigned by you, their assignments, and the type.

**Example of a symbol list**

Identifier	Assignment	Type
Switching device 1	SLOT5	Equipment identifier (BMK)
Terminal_1	SLOT3_F-IN1	Terminal identifier
Terminal_2	SLOT4_Q6	Terminal identifier
Press	-	Plant identifier
Hall 1	-	Location identifier
EMERGENCY STOP_1	EMERGENCY STOP [35]	Name

**Editing entries in the symbol list**

You can perform the following actions in the context menu (right mouse button):

- Delete: The selected identifier is deleted.
- Editing: The selected identifier can be changed (can also be activated if the identifier is selected and you click on it again or press F2).  
If you change or delete identifiers, then the display in the respective view is immediately updated.
- Go to: You jump to the corresponding icon, which is then selected (can also be activated by double-clicking).

Sorting:

- If you click on the column header in the columns "Identifier" and "Assignment," the items will be sorted alphabetically by this column.
- Clicking on the "Type" column header sorts the column as follows: Equipment identifier, Name, Comment, Terminal identifier, Location identifier, Plant identifier.

---

**Note**

**Editing rules**

You cannot assign the same identifier twice.

---

**6.1.5.7 Terminal list**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Terminal list	-	-	✓	✓

**Requirements**

This menu command can only be selected if a configuration is open in Safety ES.

## Actions

The "Options" > "Terminal list" menu command lists all available terminals of the slot and subslot (AS-i) modules, as well as bit memories, in the output window with the relevant terminal identifier (right-hand column) and the interconnection status in the logic diagram (left-hand column).

The terminals are also shown for which no identifier has been assigned and also those terminals that are not yet interconnected.

## Example of a terminal list

Terminal	Terminal marking
ASi#02_IN1	Pushbutton_1
SLOT3_F-IN1	Terminal_1
SLOT3_F-M1	Bit_memory_1

## Editing entries in the terminal list

You can perform the following actions in the context menu (right mouse button):

- Delete: The selected terminal identifier is deleted.
- Editing: The selected terminal identifier can be changed (can even be activated if the identifier is selected and you click on it again or press F2).  
If you change or delete identifiers, then the display in the respective view is immediately updated.
- Go to: Interconnecting terminal is in the logic will take you to the corresponding function element and select it (can also be activated by double-clicking).

Sorting:

- Clicking on the column header of the first column sorts the items of this column by their interconnection status.
- Clicking on the relevant column header sorts the items of the "Terminal" and "Terminal identifier" columns alphabetically.

### Note

#### Editing rules

You cannot assign the same terminal identifier twice.

## 6.1.5.8 Export macros...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Export mac- ros...	-	-	-	✓

6.1 Description of the menu commands

**Requirements**

This menu command can only be selected if a configuration is open in Safety ES.

**Actions**

With the "Options" > "Export macros..." menu command, you can save the existing macros on any data medium to make them available to other users.

See also chapter "Macro functionality (Page 134)."

**6.1.5.9 Import macros...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Import mac- ros...	-	-	-	✓

**Requirements**

This menu command can only be selected if a configuration is open in Safety ES.

**Actions**

With the "Options" > "Import macros..." menu command, you can import exported macros from other users to use them in your project.

See also chapter "Macro functionality (Page 134)"

**6.1.5.10 Release information...**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Release infor- mation...	-	✓	✓	✓

**Requirements**

This menu command can only be activated if the configuration has been released.

**Actions**

The "Options" > "Release information..." menu command displays the following release data in the "Display release information" dialog box for the configuration currently in Safety ES:

- Name of the person releasing
- Name of the company of the person releasing

- Release status
- Configuration CRC
- Release time stamp  
The release information can be printed out via the "Print" button.

### 6.1.5.11 Set PG/PC interface...

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Set the PG/PC interface...	-	-	-	✓

#### Actions

The "Options" > "Set the PG/PC interface..." menu command opens a dialog box in which you can set the PG/PC interface.


#### More detailed information in the help file

You will find detailed information in the S7DOS help file s7epatda.chm in the Windows system directory. Depending on the configuration of your operating system, you will find the help file either in C:\Windows\system32\s7epatda.chm or in C:\Winnt\system32\s7epatda.chm.

This can only be set if communication with SIRIUS engineering is supported via PROFIBUS DP, PROFINET IO or the SIMATIC network.

## 6.1.6 Help Menu

### 6.1.6.1 Help topics

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Help	Help topics		✓	✓	✓

#### Actions

The menu command "Help" > "Help Topics" starts the online help for Safety ES.

The online help is structured as follows:

- The left window contains the table of contents, index, and find function of the online help.
- The main window contains the individual help topics.
- You can find topics of relevance to all SIRIUS engineering products in the higher-level online help.

### 6.1.6.2 Info

Menu option		Symbol	Basic license	Standard license	Premium license
Help	Info	-	✓	✓	✓

### Actions

The "Help" > "Info" menu command provides information about the following:

- All the SIRIUS engineering products that have been installed
- Copyright
- Technical Support

## 6.2 Identification

### 6.2.1 Basic unit

#### "Basic unit" view

The "Identification" > "Basic unit" view contains an overview of the device-specific information. You can read from the file using the "Switching device" > "Open" menu command, or from the safety relay using the "Switching device" > "Open online" command.

---

#### Note

When you create a new safety relay, the content will be empty.

If no safety relay is configured, all the fields are gray in offline mode.

If a safety relay is configured, the contents are partially available in the offline mode. They are all available in online mode.

---

#### Information in the "Basic unit" dialog

The "Identification" > "Basic unit" view contains the following information:

Information	Meaning
Article No.	Article number of the safety relay.
Short designation	Short designation of the safety relay, e.g. 3RK3 Basic.
System	Designation of the line of products, e.g. "Safety relay".
Manufacturer	Name of manufacturer, e.g. "Siemens AG"

Information	Meaning
PI profile	Gives information about the PROFIBUS profile supported by the safety relay and the line of products belonging to the safety relay. This field is gray in offline mode.
Device family	Designation of the overall device family, e.g. safety-related switching device.
Device subfamily	Designation of the subfamily that is subordinate to the device family, switching devices with the same process view and data sets of identical content, e.g. safety relays.
Device class	Designation of the device class that is subordinate to the subfamily, e.g. modular.
Function group	Describes the device-specific, identical characteristics within a device subfamily, e.g. use of the same parameters from the parameter data set.
Fieldbus interface	Information on the fieldbus interface, e.g. "PROFINET IO", supported by the safety relay. This field is gray in offline mode.
System interface	Information on the internal system interface supported by the safety relay. This field is gray in offline mode.
Device interface	Information on the local interface supported by the safety relay. This field is gray in offline mode.
ID no.	Specifies the communication ID number of the safety relay. This field is gray in offline mode.
HW revision level	Product version which is entered prior to delivery. This field is gray in offline mode.
FW revision level	Information on the version of the device firmware. This field is gray in offline mode.
Revision counter	Labels changes of HW-related parameters and cannot be edited. This field is gray in offline mode.
I&M version	Version of the I&M (Identification & Maintenance) function in the safety relay. This field is gray in offline mode.
Supported I&M data	Specify which I&M blocks are supported by the safety relay. This field is gray in offline mode.
Serial number	Contains a production label with production information. This field is gray in offline mode.
Time stamp	The time stamp is written to the safety relay when the safety relay is named in the factory and specifies the date and time of production. This field is gray in offline mode.

## 6.2.2 Marking

### "Identification" view

In the "Identification" > "Marking" view, you can enter descriptions about the safety relay or system.

The descriptions are part of the plant documentation. You can read from the file using the "Switching device" > "Open" menu command or from the safety relay using the "Switching device" > "Open online" menu command.

Information	Meaning
Plant identifier	The plant identifier specifies in which part of the plant a safety relay will be installed and operated. Max length: 32 characters.
Location identifier	The location identifier specifies at which location in the plant a safety relay will be installed and operated. Max length: 22 characters.
Installation date	Enter the date the safety relay was installed in the plant here. Max. length: 16 characters.
Description	You can enter additional information here. Max length: 54 characters
Author	You can enter the name of the author of the entries here.
Comment	Here you can store additional information in the system or in the safety relay. Max. length for the Author and Comment input fields, taken together: 187 characters.

---

#### Note

This view cannot be edited in the online view.

---



### 6.2.3 Project

#### "Project" view

In the "Identification" > "Project" view, you can enter the following descriptions:

- Project name
- Name of configuration engineer
- Configuration engineer's company name

Information	Meaning
Project name	Enter at least one character
Name of configuration engineer	Enter at least one character
Configuration engineer's company name	Enter at least one character
Configuration CRC	Cyclic Redundancy Check which saves all safety-relevant configuration data (4 bytes). The transfer of safety-relevant configuration data through insecure communication channels must be secured for the safety relay.
Configuration time stamp	The Safety ES enters the current time stamp when a configuration is saved.
Configuration released	Release status of the configuration. Details can be determined via "Options" > "Release information".
Configuring tool	Specifies the software with which the opened configuration was created, e.g. Safety ES
Version of the configuring tool	Specifies the version of the software with which the opened configuration was created, e.g. K1.0.2.0
Number of slot modules	Number of slot modules in the device configuration
Number of subslot modules	Number of subslot modules (AS-i slaves) in the device configuration
Number of function elements	Number of function elements in the device parameter assignment.

## 6.3 Configuration

### 6.3.1 Main system

#### Configuration

You configure the hardware of the safety relay in the "Main system" configuration table. The rows represent the slots of the safety relay: The fixed slots 1 to 3 and the maximum number of expansion modules supported by the selectable safety relay.

---

#### Note

##### Procedures for configuring

The procedure for configuring in Safety ES has an effect on various functions.

There are two ways of configuring in Safety ES:

1. You start with configuring the hardware configuration and then configure the logic. Once you have configured a safety relay, all non-supported function elements will no longer be available in the catalog window of the logic diagram.
  2. You start with configuring the logic and then configure the hardware configuration. If you use function elements in the logic diagram that are not supported by every safety relay, the non-supported devices are then no longer available in the hardware catalog of the configuration.
- 

#### Slot assignment

Slots are assigned to the following devices:

- System slot 1: HMI modules (optional)
- System slot 2: Interface module (optional)
- System slot 3: 3RK3 central units / 3SK2 basic units
- From system slot 4: 3RK3 expansion modules (optional, number depends on the 3RK3 safety relay used)

You can assign devices to the slots as follows:

- Drag the device out of the catalog window and drop it into the table.  
When a device is selected in the catalog window, the rows in the table where the device can be positioned are highlighted in color.

#### Changing and editing entries in the configuration table

You can edit positioned devices directly in the configuration table:

- You can delete devices unless their inputs / outputs are already connected in the safety circuit. In this case, all interconnections must first be removed. If you confirm the message with "Yes", this occurs automatically.
- You can drag and drop devices from one row to another.

- When you switch or move devices, the assignment of the affected inputs/outputs in the safety circuit is adapted accordingly.
- You can copy and paste expansion modules including their parameters or swap their slots using the command "Swap slot".

---

**Note**

An equipment identifier must not exist twice. Therefore a number is added to the equipment identifier when copying. If the maximum number of characters is exceeded by adding the number, the equipment identifier is shortened.

---

### Editing the configuration table using the context menu

By pressing the right mouse button and selecting a device in the configuration table, a context menu pops up with which you can edit the entries in the table.

#### "Swap slot" command

You can swap slots of devices.

#### "Delete blank rows automatically" command

With this command you can correct an erroneous configuration in the main system. There will be no more blank rows between devices in the table.

The assignment of the affected inputs/outputs in the safety circuit is adapted accordingly, just as it is when modules are moved.

#### "Edit terminal identifier" command

The dialog box shows you the existing terminals in the "Terminal" column and you can edit the following:

- "Terminal identifier" column: A terminal designation can be entered (max. 32 characters).
- "Supplement identifiers" button: Inserts the terminal identifiers in the unassigned fields.
- "Delete identifiers" button: Deletes the terminal identifiers in the selected fields.

#### "Object properties" command

Information on the selected module is displayed in this properties window, and you can define parameters in it.

#### "Optimize column width" command

Adapts the column width optimally to the column contents.

### Further editing options in the configuration view

In the configuration view, you have the following editing options:

- **Determine online**

When a safety relay is connected, you can adopt the actual configuration, i.e. the hardware configuration of the safety relay, by clicking the "Determine online" button. The user is asked if the current configuration is to be replaced.

---

**Note**

**Diagnostics display**

The connected diagnostic display is not recognized by "Determine online."

---

- **Show hardware configuration**

When the checkbox "Show hardware configuration" is selected, an image with the devices and their required arrangement is shown in the area below the checkbox.

- **Consistency check**

The user can execute a consistency check by means of the menu command "Edit" > "Check consistency" to determine whether the configuration is possible.

### 6.3.2 Swap slots

If, for example, all the slots are assigned and you want to reorganize your configuration, you can swap the position of two expansion modules by means of the dialog "Swap slots":

- Select the slot in the configuration table where one of the two expansion modules is positioned.
- Click the right mouse button.
- Select "Swap slot" from the context menu.
- The "Swap slot" dialog is opened.
- Select the slot in the drop-down list where the other expansion module is positioned.

### Result

The slots of the two devices are swapped.

### 6.3.3 Properties of the HMI module

#### Description

You can open the "Properties of HMI module" dialog box as follows:

- Double-click on the module in the configuration table.
- Choose the "Object properties" menu option from the context menu (right mouse button).
- In the menu "Options" > "Settings of Safety ES..." under the tab "General settings", activate the checkbox "Display object properties automatically on insert". The properties dialog box will then pop up automatically when you drag the device from the catalog window into the configuration table of the project window.

#### Parameters

The parameters are described in the following table:

Parameter name	Parameter value
<b>Configuration</b>	
Module	The designation of the selected module is displayed here. The field has a gray background and cannot be changed by the user.
Article No.	The article number of the selected module is shown here. The field has a gray background and cannot be changed by the user.
Firmware	The firmware of the selected module is shown here. The field has a gray background and cannot be changed by the user.
Equipment identifier	Here you can specify a user-defined equipment identifier (max. 32 characters) for the selected module and assign it to inputs and outputs.
Inputs	The number of inputs of the selected module is shown here.
Outputs	The number of outputs of the selected module is shown here.

### 6.3.4 Properties of interface module

#### Description

You can open the "Properties of interface module" dialog box as follows:

- Double-click on a module in the configuration table.
- Choose the "Object properties" menu option from the context menu (right mouse button).
- In the menu "Options" > "Settings of Safety ES..." under the tab "General settings", activate the checkbox "Display object properties automatically on insert". The properties dialog box will then pop up automatically when you drag a module from the catalog window into the configuration table of the project window.

## Parameters for PROFINET interface

The parameters are described in the following table:

Parameter name	Parameter value
<b>Configuration</b>	
Module	The designation of the selected module is displayed here. The field has a gray background and cannot be changed by the user.
Article number	The article number of the selected module is shown here. The field has a gray background and cannot be changed by the user.
Firmware	The firmware of the selected module is shown here. The field has a gray background and cannot be changed by the user.
Equipment identifier	Here you can specify a user-defined equipment identifier (max. 32 characters) for the selected module and assign it to inputs and outputs.
Inputs	The number of inputs of the selected module is shown here.
Outputs	The number of outputs of the selected module is shown here.
<b>Parameter assignment</b>	
Baud rate	The baud rate is automatically detected by the safety relay. The field has a gray background and cannot be changed by the user.
MAC address	After opening online, the MAC address of the PROFINET interface is displayed here.
<b>Ethernet addresses</b>	
IP address	Enter the desired IP address here. On "Load to switching device...", "Open online...", the valid IP address up to then is overwritten in the PROFINET interface and the new IP address is stored in the PROFINET interface. To enable communication with the controller, the known IP addresses in the automation software must match the IP address set in the PROFINET interface. You can set the IP address in the PROFINET interface and via the automation software. To do so, the change authorizations (see above) must be set accordingly.
Subnet mask	Enter the subnet here.
Router address	Enter the address of the router here.
Device name	You assign the device name here.
Ethernet addresses - Change authorizations	Here you can define the following change authorizations at the station address: <ul style="list-style-type: none"> <li>Changes possible without restrictions (e.g. by means of PROFINET mechanisms in STEP 7 or DS 160).</li> <li>Can only be changed by means of data set (DS 160).</li> </ul>
<b>Diagnostics</b>	
Group diagnostics	Here you select whether the group diagnostics is blocked or released. If this parameter is set to "block," the "Group error diagnostics," "Group warning diagnostics," and "Group prewarning diagnostics" parameters are not significant, i.e. they are ignored by the safety relay.
Group error diagnostics	Here you select whether the group error diagnostics are blocked or released.
Group warning diagnostics	Here you select whether the group warning diagnostics are blocked or released.
Group prewarning diagnostics	Here you select whether the group prewarning diagnostics are blocked or released.

## Parameters for DP interface

The parameters are described in the following table:

Parameter name	Parameter value
<b>Configuration</b>	
Module	The designation of the selected module is displayed here. The field has a gray background and cannot be changed by the user.
Article number	The article number of the selected module is shown here. The field has a gray background and cannot be changed by the user.
Firmware	The firmware of the selected module is shown here. The field has a gray background and cannot be changed by the user.
Equipment identifier	Here you can specify a user-defined equipment identifier (max. 32 characters) for the selected module and assign it to inputs and outputs.
Inputs	The number of inputs of the selected module is shown here.
Outputs	The number of outputs of the selected module is shown here.
<b>Parameter assignment</b>	
Baud rate	The baud rate is automatically detected by the safety relay. The field has a gray background and cannot be changed by the user.
Station address	This is where you define the station address.
Station address - Change authorizations	<p>Here you can define the following change authorizations at the station address:</p> <ul style="list-style-type: none"> <li>• Changes possible without restrictions (e.g. by means of the fieldbus command "SET_SLAVE_ADD," DS 160, or setting element).</li> <li>• Can only be changed by means of data set (DS 160), which can be sent from the controller or from Safety ES, or by means of the setting element (on the DP interface).</li> <li>• Can only be changed by means of data set (DS 160).</li> </ul>
<b>Diagnostics</b>	
Group diagnostics	Here you select whether the group diagnostics is blocked or released. If this parameter is set to "block," the "Group error diagnostics," "Group warning diagnostics," and "Group prewarning diagnostics" parameters are not significant, i.e. they are ignored by the safety relay.
Group error diagnostics	Here you select whether the group error diagnostics are blocked or released.
Group warning diagnostics	Here you select whether the group warning diagnostics are blocked or released.
Group prewarning diagnostics	Here you select whether the group prewarning diagnostics are blocked or released.

### 6.3.5 Basic unit properties

#### Description

You can open the dialog window "Basic unit properties" as follows:

- Double-click on a module in the configuration table.
- Choose the "Object properties" menu option from the context menu (right mouse button).
- In the menu "Options" > "Settings of Safety ES..." under the tab "General settings", activate the checkbox "Display object properties automatically on insert". The properties dialog box will then pop up automatically when you drag a module from the catalog window into the configuration table of the project window.

#### Parameters

The parameters are described in the following table:

Parameter name	Parameter value
<b>Configuration</b>	
Module	The designation of the selected module is displayed here. The field has a gray background and cannot be changed by the user.
Article No.	The article number of the selected module is shown here. The field has a gray background and cannot be changed by the user.
Firmware	The firmware of the selected module is shown here. The field has a gray background and cannot be changed by the user.
Equipment identifier	Here you can specify a user-defined equipment identifier (max. 32 characters) for the selected module and assign it to inputs and outputs.
Inputs	The maximum number of available inputs is indicated here.
Outputs	The maximum number of available outputs is indicated here.
<b>Parameter assignment - Device response</b>	
Program cycle time [ms]	Here you define the program cycle time within a range of 10 to 60 ms in steps of 5 ms. On the 3RK3 central units with AS-i interface <sup>1)</sup> , a program cycle time of 15 ... 60 ms is possible when the AS-Interface is used. When the 3SK2 safety relay is operated with a DP interface, set a program cycle time of 15 ms.
Process data structure	Here you specify the process data width that is processed by the safety relay. The following values are available: <ul style="list-style-type: none"> <li>• 32DI/32DO</li> <li>• 64DI / 64DO (not possible for MSS 3RK3 Basic)</li> </ul> <b>Note:</b> Note that a valid GSD or GSDML file must be installed in the engineering software of the PLC. You can find more information on this in the manual of the safety relay used.
<b>Parameter assignment - AS-Interface<sup>1)</sup></b>	
AS-i interface	Activate the AS-i interface in order to be able to use standard and safety-related AS-i slaves in your configuration. If AS-i slaves are already used in the logic diagram, the AS-i interface can no longer be deactivated.
<b>Parameter assignment - AS-Interface - Simulated slaves<sup>1)</sup></b>	



Parameter name	Parameter value
Slave profile to address	<p>Here you can specify whether the MSS 3RK3 is to simulate AS-i slaves on the AS-i bus. The 3RK3 central unit supports various profiles, which can be selected. The simulated slaves determined here are entered in the subsystem and can no longer be processed there. If you have allocated an address to a slave, the MSS 3RK3 will assign the corresponding selected profile to this address on the AS-Interface.</p> <p>Addresses at which a slave is already configured in the subsystem can no longer be assigned and are therefore displayed grayed out.</p>
<b>Documentation<sup>2)</sup></b>	
Device connector	<p>For the plant documentation, you can supplement the expansions connected via 3ZY device connectors in the properties of the 3SK2 safety relays. All the expansions known and supported at the time of publication of the Online Help are available to you in a selection menu. You can assign an equipment identifier for each expansion.</p> <p>You can see the configured expansions in the print preview. The expansions are not shown in the hardware configuration.</p> <p><b>Note:</b> You can edit the entries of the selection menu and change them at will.</p> <p><b>Note:</b> You can save the configured expansions on the device, see chapter "Settings of Safety ES - "Download options" tab (Page 94)".</p>

<sup>1)</sup> 3RK3 central units with AS-i interface: MSS 3RK3 Advanced, MSS 3RK3 ASIsafe basic and MSS 3RK3 ASIsafe extended

<sup>2)</sup> 3SK2 safety relays

## 6.3.6 Properties of expansion module

### Description

You can open the "Properties of expansion module" dialog box as follows:

- Double-click on a module in the configuration table.
- Choose the "Object properties" menu option from the context menu (right mouse button).
- In the menu "Options" > "Settings of Safety ES..." under the tab "General settings", activate the checkbox "Display object properties automatically on insert". The properties dialog box will then pop up automatically when you drag a module from the catalog window into the configuration table of the project window.

### Parameters

The parameters are described in the following table:

Parameter name	Parameter value
<b>Configuration</b>	
Module	The designation of the selected module is displayed here. The field has a gray background and cannot be changed by the user.
Article No.	The article number of the selected module is shown here. The field has a gray background and cannot be changed by the user.

## 6.3 Configuration

Parameter name	Parameter value
Firmware	The firmware of the selected module is shown here. The field has a gray background and cannot be changed by the user.
Equipment identifier	Here you can specify a user-defined equipment identifier (max. 32 characters) for the selected module and assign it to inputs and outputs.
Inputs	The number of inputs of the selected module is shown here.
Outputs	The number of outputs of the selected module is shown here.

## 6.3.7 AS-i subsystem

## Configuration

You configure the AS-Interface hardware of the system configuration in the "Subsystem AS-i" configuration table.

## Determining the AS-i subslot configuration online

If a 3RK3 Advanced, 3RK3 ASIsafe basic or 3RK3 ASIsafe extended central unit with an AS-i connection is used in a system configuration, you can apply the actual configuration, i.e. the hardware configuration of the AS-i subslot configuration, by clicking on the "Determine online" button.

The result will depend on the master and slaves used. Slave profile values that cannot be determined or calculated are shown as "?" and have to be adjusted manually.

**Note****Determine online**

If the AS-i master is running and the safety relay is connected, only the ID codes of the slaves on the AS-i bus can be determined.

If the safety relay is running and the AS-i master is connected, all available information concerning the slave profiles can be determined.

The user is asked if the current configuration is to be replaced.

## Determining an existing subslot configuration online

- If the ID code at an address determined online is identical to the configured code, the parameter assignment entered will remain unchanged, even if the other values of the slave profile differ.
- If the ID code is different, the value determined online will be applied.
- If an entered AS-i slave cannot be determined online, the configured value will be retained.

## AS-i slaves

The catalog window contains slaves that you can use in your configuring:

- Safety-related slaves:  
Slaves that read the safety-related "On" or "Off" status of the connected sensor or the control device and transfer it to the master or safety monitor. The latter then switches outputs off if applicable (e.g. EMERGENCY STOP).
- AS-i standard slaves
- AS-i A/B slaves

## Simulated slaves

No more than four non-safety-related AS-i slaves can be simulated, including one as a CTT2 slave. This enables diagnostics using the CTT2 protocol. In so doing, the CTT2 protocol data are interconnected via the "Slot3\_ASi#xx\_Sx.y" and "Slot3\_ASi#xx\_Qy.z" terminals in the logic diagram. Up to 12 safety-related AS-i slaves can additionally be simulated. The number of safety-related AS-i slaves depends on the central unit used:

	MSS 3RK3 ASIsafe basic	MSS 3RK3 ASIsafe extended	MSS 3RK3 Advanced
Maximum number of simulated safety-related AS-i slaves	8	10	12

A simulated slave is provided by the 3RK3 central unit on the AS-i bus. With this function, signals from the logic diagram can be exchange with other stations on the AS-i bus.

You assign parameters to the simulated slaves in the "Basic unit properties - System slot 3" dialog box. They will then be shown (in italics) in the "Subsystem AS-i" table.

## Rules for slot allocation

- The table for the AS-i subsystem contains 62 rows. According to AS-i Spec as from Version 2.11, you can configure no more than the following:
  - 31 standard slaves or safety-related input slaves
  - 62 A/B slaves
  - a mixture of the above
- Standard or safety-related slaves can only be inserted at A addresses. If an A address is allocated, the corresponding B address is no longer available.
- Simulated slaves are determined in the Properties dialog box of the corresponding 3RK3 Advanced, 3RK3 ASIsafe basic or 3RK3 ASIsafe extended central unit and inserted at A/B addresses (addressing of the simulated AS-i slaves). Simulated slaves are shown in italics and provided with the icon of the 3RK3 central unit. They cannot be edited.
- Entries can be inserted, deleted, or cut out in any way, i.e. gaps between addresses are permitted.

### Module catalog for subsystem AS-i

This catalog contains all AS-i slaves marketed by Siemens AG that were known at the time of publication of this version of Safety ES. A universal slave must be used to incorporate more recent slaves from Siemens AG or to incorporate slaves from other manufacturers.

### 6.3.8 Properties of AS-i slaves

#### Description

You can open the "Slave properties" dialog box as follows:

- Double-click on a module in the configuration table.
- Choose the "Object properties" menu option from the context menu (right mouse button).
- In the "Options > Settings of Safety ES..." menu under the "General settings" tab, select the "Display object properties automatically on insert" checkbox. The properties dialog box will then pop up automatically when you drag a module from the selection window into the configuration table of the project window.

#### Parameters

The parameters are described in the following table:

Parameter name	Parameter value
<b>Configuration</b>	
Slave type	The designation of the selected module is displayed here. The field has a gray background and cannot be changed by the user.
Article No.	The article number of the selected module is shown here. The field has a gray background and cannot be changed by the user.
Equipment identifier	Here you can specify a user-defined equipment identifier (max. 16 characters) for the selected module and assign it to inputs and outputs.
IO code	If you use a universal slave, set the profile for this slave here.
ID code	If you use a universal slave, set the profile for this slave here.
ID1 code	If you use a universal slave, set the profile for this slave here.
ID2 code	If you use a universal slave, set the profile for this slave here.
Monitor non-safety-related I/Os	Select the checkbox for monitoring non-safety-related slaves or the non-safety-related information items of a safety-related AS-i slave. You can then interconnect the terminals in the logic diagram. The "Monitor non safe I/O" option can be set up to 14 times in one configuration.

## 6.4 Logic diagram

### 6.4.1 Overview

You can switch to the logic diagram view by selecting a diagram in the navigation window.

The logic diagram has the following features:

- Graphical connection of the function elements used and representation as a function diagram:
  - Representation of the switching elements as function elements with input connections and output connections
  - Representation of physical and logic addresses in the form of address elements
  - Representation of interconnections as connecting lines between function elements
  - Display of relevant function element parameters
- Documentation management:
  - The pages are divided automatically.
  - The individual pages are displayed on the screen as they are printed.
- Current states (e.g. digital outputs of function elements) of the safety relay can be monitored in the diagnostics mode.
- Working with the logic diagram:
  - The user can switch between languages during operation.
  - Optimization functions (e.g. arranging the function elements according to the signal flow).
  - Placing and connecting the function elements by drag & drop.
  - Function elements and connections can be moved as required.
  - Comments can be placed in the screen and printout as required.
  - Structuring of the logic by generating partial diagrams (e.g. one output circuit per diagram).
  - The clarity of a diagram can be enhanced by interrupting connections and replacing them by freely movable reference points.

---

**Note**

**Procedures for configuring**

The procedure for configuring in Safety ES has an effect on various functions.

There are two ways of configuring in Safety ES:

1. You start with configuring the hardware configuration and then configure the logic. Once you have configured a safety relay, all non-supported function elements will no longer be available in the catalog window of the logic diagram.
  2. You start with configuring the logic and then configure the hardware configuration. If you use function elements in the logic diagram that are not supported by every safety relay, these safety relays are then no longer available in the hardware catalog of the configuration.
- 

## 6.4.2 Working with the logic diagram

### 6.4.2.1 Inserting, printing and deleting logic diagrams

#### Insert logic diagram

You can insert a new logic diagram in different ways:

- using the menu command "Edit" > "Insert diagram"
- Right-click on "Logic" or on an existing logic diagram. Select "Insert diagram" in the selection menu.

#### Print logic diagram

You can print individual logic diagrams. Right-click on the logic diagram you want to print. Select the relevant printer in the dialog window.

#### Delete logic diagram

You can delete a new logic diagram in different ways:

- using the menu command "Edit" > "Delete diagram"
- Right-click on the logic diagram you want to delete. Select "Delete diagram" in the selection menu.

## 6.4.2.2 Selecting function elements and using them in the diagram

### Inserting function elements

Insert the function elements by selecting them in the catalog window and then drag and drop them into the work space.

### Defining parameters

When you drag a function element into the work space, a dialog box pops up where you can define the function element parameters. For this you must activate the checkbox "Display object properties automatically on insert" in the menu "Options" > "Settings of Safety ES..." under the tab "General settings".

You can also open the dialog box subsequently by double-clicking the function element on the work space, or by choosing "Object properties" from the context menu (right mouse button).

You will find more information about the parameters in chapter "Function elements (Page 171)."

### Finding function elements in the diagram

To display a function element already inserted in the diagram, double-click the entry of this function element in the catalog window. The first function element that is found in the diagram will be displayed. By double-clicking on this function element in the catalog window again, the next function element of this type is selected in the diagram.

## 6.4.2.3 Connecting function elements

### Rules for drawing connections

- Several connections can originate from an output of a function element.
- Only one connection can be connected to an input of a function element.

### Drawing a connection between functions

To interconnect connections of function elements, perform the following steps:

- Move the mouse pointer over an unconnected input. It is then highlighted in blue.
- Press the left mouse button and keep it pressed.
- Keep the mouse button pressed and draw a connection to an output until it is highlighted in blue.
- Release the mouse button.  
Result: A connection is established between the two terminals.

---

#### Note

You can also draw the connection from the output to the input.

---

### Connections between function elements in different diagrams

To connect function elements in different diagrams, proceed as follows:

- Select the connection point of the function element in the first diagram.
- In the context menu (right mouse button), select the command "Begin drawing connection".
- Switch to the second diagram.
- Select the connection point of the second function element.
- In the context menu (right mouse button), select the command "Finish drawing connection".

### Crossover points of connections

- Crossover points of connections are not specifically marked. The route of the lines is usually apparent.
- If due to the high number of connections the route of the lines is not immediately apparent, then select the connection and its exact route will be highlighted.

### Branches

- Branches are identified by a point.
- The system automatically sets the branch points. They cannot be selected and moved directly.
- You can move branch points indirectly by moving connections.

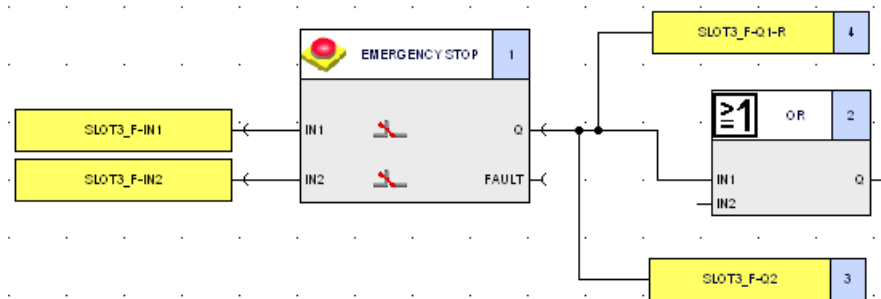


Figure 6-3 Branches

### Rerouting of connections

If you want to reroute the end (or beginning) of an existing connection to a different terminal, then draw a new connection as follows:

- Select the relevant connection (line) by left-clicking.
- Select one of the two end points by left-clicking and holding the button pressed.
- Keep the mouse button pressed and drag the end point to another terminal.



Alternatively, you can reroute several connections to a terminal simultaneously:

- Move the mouse pointer to the end point of a connection line until the blue rectangle is displayed.
- Left-click in the blue rectangle.
- Keep the mouse button pressed and reroute the connections to the respective terminal.

### Moving a function element/connection

- Keep the left mouse button pressed to move function elements and connections.
- When function elements are moved, the start and end points of connections are fixed, since they are linked to the terminals of function elements.

#### 6.4.2.4 Selecting

##### Select all

Use the "Edit" > "Select all" menu command to select all function elements, connections, and comments.

##### Lasso function

Use the lasso function to select all objects within a specific area:

Keep the left mouse button pressed and drag open a rectangle.

All objects that are completely within the rectangle are automatically marked.

##### Multiple selection


- You can select more than one element at once by pressing the "<Ctrl>" key and selecting individual elements successively.

#### 6.4.2.5 Delete

Use the menu command "Edit" > "Delete" to delete one or several selected objects and connections.

You can also delete objects/connections via the context menu (right mouse button) and the "Delete" command or by pressing the "<Del>" key.

Call:

Button	Command
	"Edit" > "Delete"

---

**Note**

**Deleting an object**

When you delete an object, you also delete all connections or interrupted connections that are linked to this function element.

---

**6.4.2.6 Display of graphical conflicts**

Graphical conflicts (part of a connection line/block is on top of another, connection lines that cross over blocks, blocks on top of page margins) are automatically highlighted in red.

Use the "Edit" > "Realign graphic" menu command to arrange the objects in succession according to the signal flow.

---

**Note**

After the "Realign graphic" command, existing comments are positioned below the interconnections on the logic diagram.

---

**Types of conflict**

The following types of conflict are shown in the figure below:

- Part of a connection line is on top of another connection line
- Part of a block is on top of another block
- Connection lines cross over blocks
- Blocks on top of page margins

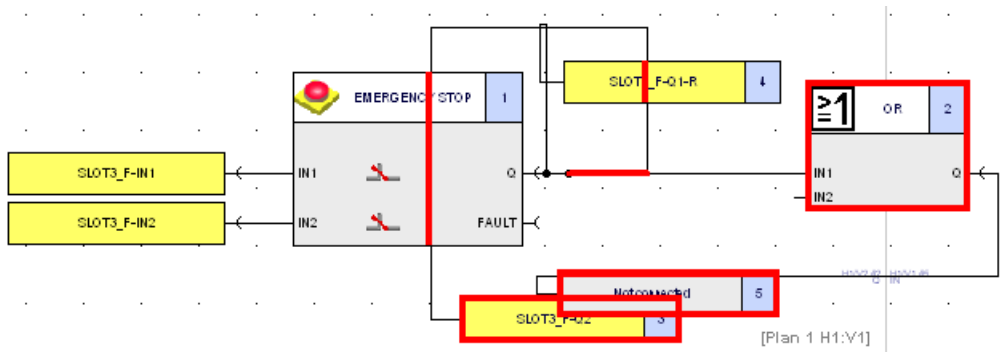


Figure 6-4 Graphical conflicts in the logic diagram

---

**Note**


Please note the following:

- Graphical conflicts can also occur at reference points.
  - During graphical configuration, it is continuously checked whether graphical conflicts occur.
  - During the consistency check, graphical conflicts are listed as warning messages in the output window.
-

### 6.4.2.7 Realign graphic

Use the "Edit" > "Realign graphic" menu command to arrange the function elements and connections according to the signal flow.

Call:

Button	Command
	"Edit" > "Realign graphic"

### Defining options

- In the menu "Options" > "Settings of Safety ES..." > "Logic", click on the button "Realign graphic".  
The window "Options - Realign graphic" is opened.
  - Select the "Avoid connections crossing functions" checkbox if you want to prevent connections from crossing function elements.
  - If the checkbox is selected, you can choose whether connections will be interrupted or whether the affected function elements will be moved down until there is no longer a conflict with connections.
  - You can also apply a "Standard column grid across all subnetworks of a function diagram" if you select the corresponding checkbox.
  - You can position the output cells in a separate column on the far right (for each subnetwork) if you select the lowermost checkbox.

### Realignment principles

- Only a graphical realignment of the objects is implemented. The configuration remains unchanged.
- Graphical conflicts are automatically eliminated.
- Automatic arrangement is also possible when the configuration is read from the safety relay (open online).
- After automatic arrangement, function elements and connections can be moved and adjusted.
- Use the menu command "Edit" > "Undo" to undo the new arrangement.

---

#### Note

After the "Realign graphic" command, existing comments are positioned below the interconnections on the logic diagram.


---

### 6.4.2.8 Move diagram

#### Activating and deactivating the move mode

With the "View" > "Move diagram" menu command, you can switch to move mode. In the move mode, you can move the diagram using the mouse if it is larger than the current window.

Call:

Button	Command
	"View" > "Move diagram"

Click the button again or choose "View" > "Move diagram" to deactivate move mode.

---

#### Note

##### Special features in the move mode

- When the move mode is activated, you cannot select and move objects or draw connections.
- The mouse pointer is represented by a hand symbol when the move mode is activated.

---

Alternately, the diagram can also be moved with the cursor keys even while move mode is not active.




### 6.4.2.9 Zooming

You can zoom in or zoom out in a diagram step by step using the menu command "View" > "Zoom in" or "View" > "Zoom out". The zoom factor is increased or decreased by a fixed value.

Zooming in and out can also be executed as follows:

- Mouse click on the graphical work space > Keep the key "<Ctrl>" pressed > Use the mouse wheel.
- Mouse click on the graphical work space > Click on the "+" or "-" key on the keyboard.

Call:

Button	Command
	"View" > "Zoom in"
	"View" > "Zoom out"
	"View" > "Zoom dialog"

### Zoom dialog

With the menu command "View" > "Zoom dialog", you can open a zoom dialog where you can directly set a zoom factor:

### Zoom center point

If no object is selected in the diagram, the center point of the screen is selected for zooming.

If one or several objects are selected in the diagram, the center point of the selected object/area is selected for zooming.


If the zoom function is carried out repeatedly this zoom center point is moved step by step to the center of the screen.

### 6.4.2.10 Overall view

#### Network overview

Use the menu command "View" > "Overall view" to obtain an overview of the network.


Call:

Button	Command
	"View" > "Overall view"

### 6.4.2.11 Insert comment

Use the menu command "Edit" > "Insert comment" to insert comments in the diagram wherever required.

Call:

Button	Command
	"Edit" > "Insert comment"

## Procedure

- Select "Insert comment" at the current mouse position in the context menu. The mouse pointer then becomes a symbol that represents a comment.
- Or click on the "Insert comment" button.
- Left-click on the required position in the diagram.
- A dialog box opens in which you can enter the comment.

## Editing a comment element

You can edit a comment element:


- Edit the comment text:
  - "Edit comment" context menu (double-click on the comment)
  - A dialog field for entering the text pops up.
- Move by means of drag and drop
- Change the size. Line breaks are automatically inserted to adapt the text to the size.
- Delete

### 6.4.2.12 Interrupt connection

#### Clear representation of large diagrams

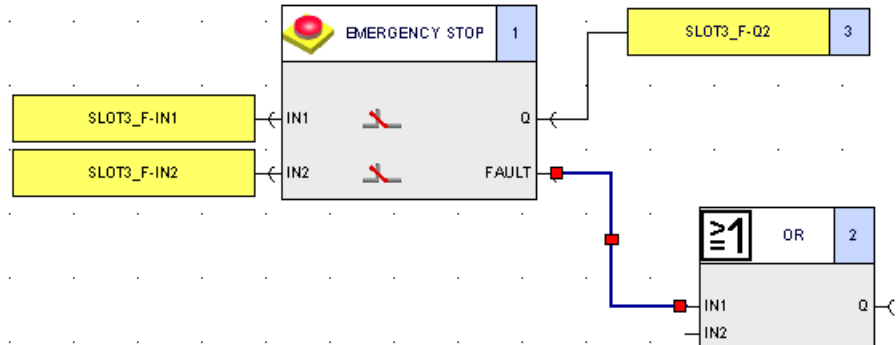
With the "Edit" > "Interrupt connection" menu command, you can interrupt connections to achieve clearer representation of large diagrams with many function elements and connections.

Call:

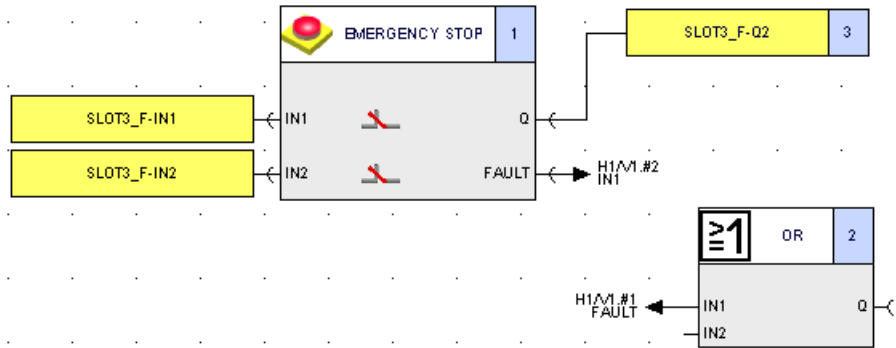
Button	Command
	"Edit > "Interrupt connection"

### Procedure

- 1. Select the connection:



- 2. Click the button or choose "Interrupt connection" from the context menu (right mouse button).
- 3. The connection is interrupted. Reference points are generated that indicate to which function element each connection is routed.



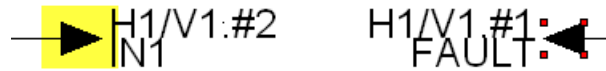
### Reference points

A reference point indicates to which function element and terminal of the function element the connection is routed (with any relevant diagram name).

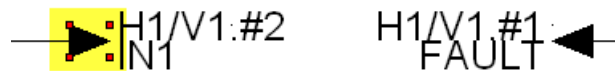


You can select, move, and delete a reference point:

- Selecting a reference point
  - Single mouse click (on the tip of the arrow):  
The reference point and the corresponding reference point are selected:



- Double mouse click (on the tip of the arrow):  
The corresponding reference point is selected (if necessary, the window is scrolled down so that the corresponding reference point becomes visible):



- Deleting a reference point
  - Select the reference point.
  - Delete the reference point and thus the entire connection between the respective function elements with the "Edit" > "Delete" menu command.
  - You can also "Delete" using the context menu (right mouse button), "Delete" command or by selecting the reference point and pressing the "<Del>" key.

---

#### Note

When a reference point or an individual partial connection is deleted, the entire connection (including the second partial connection) is deleted.


---

### 6.4.2.13 Redraw partial connection

#### Restoring an interrupted connection

Use the menu command "Edit" > "Redraw partial connection" to restore an interrupted connection.

Call:

Button	Command
	"Edit" > "Redraw partial connection"

**Procedure**

- Select the partial connection.  
Alternatively, you can also select the reference point.
- Select the menu command "Edit" > "Redraw partial connection" or click on the button "Redraw partial connection". Alternately, you can connect the partial connection using the context menu (right mouse button).


**6.4.2.14 Highlight signal flow**

**Highlight objects in color**

With the menu command "View" > "Highlight signal flow", you highlight the following objects in the logic diagram in color:

- All function elements and connections that indirectly send signals to an input of the selected block (signal flow on the input side).
- All function elements and connections to which the signals of all outputs of the selected function element are sent directly or indirectly (signal flow on the output side).

Call:

Button	Command
	"View" > "Highlight signal flow"

**Highlighted elements**

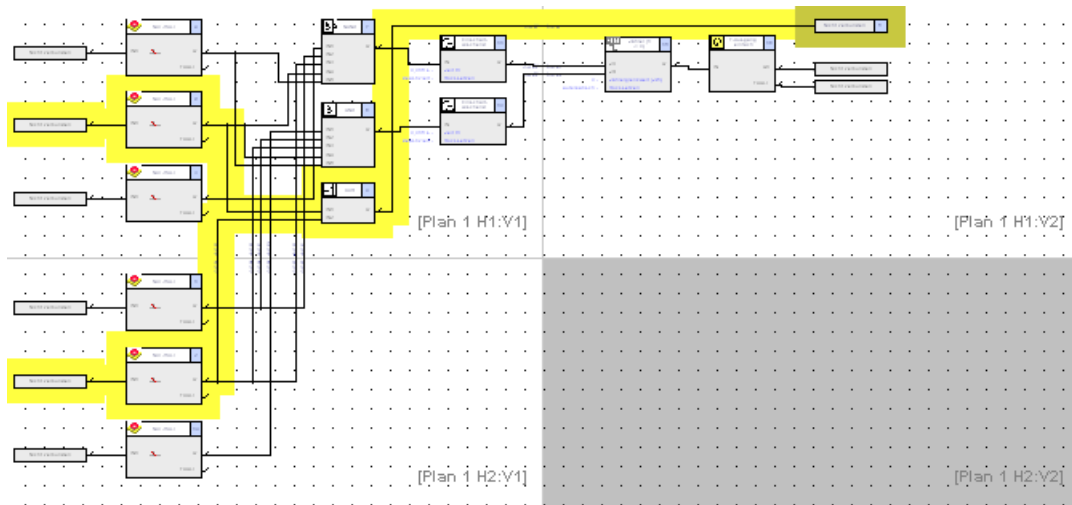


Figure 6-5 Highlight signal flow

## Delete highlighting


The highlighting is independent of the selection of the objects and is retained until one of the following events occurs:

- Another element is graphically highlighted.
- The structure of the diagram is changed, for example, by deleting an element or inserting a connection.
- A reference point is selected (in the case of an interrupted connection).
- The menu command "View" > "Delete highlighting" is executed.

### 6.4.2.15 Delete highlighting

The menu command "View" > "Delete highlighting" cancels the graphical highlighting of the selected objects.

Call:

Button	Command
	"View" > "Delete highlighting"


### 6.4.2.16 Display settings

#### Selection of the display category

In the "View" > "Display settings" dialog box, you can set how function elements will be displayed.

You can also call up this dialog with the menu command "Options" > "Settings of Safety ES..." under the tab "Logic" by clicking on the "Display settings" button.

Call:

Button	Command
	"View" > "Display settings"

#### Selecting a display element

All changeable display elements are entered in the "Display element" list.

When you select an element, its current color is shown in the box "Current color" below it:

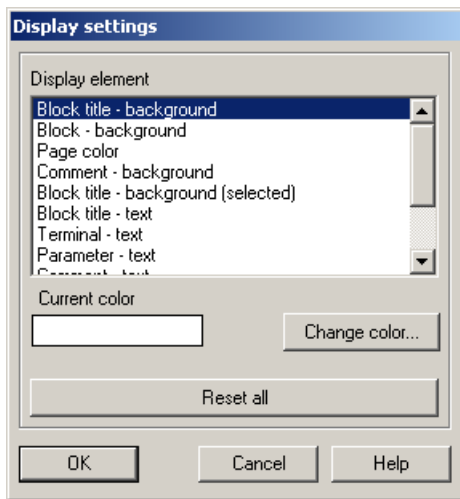


Figure 6-6 Display settings

### Change color

- Click on the "Change color" button.
- The standard Windows color dialog is opened.
- Select a predefined basic color.
- Define user-specific colors:
  - Expand the window with the button "Define colors".
  - In the expanded window, use the mouse to either select a color from the colors offered or define a corresponding color using the keyboard (tone, saturation, brightness, red, green, blue color components).
  - Click the "Add colors" button and your self-defined color will be added to the range of user-defined colors.
  - The color settings are stored and are available for further sessions. They apply for all projects.

### Reset settings

Use the button "Reset all" to restore the state after installation.


### 6.4.2.17 Grids and lines

#### Screen grid button

With the "View" > "Grid settings" command or the "Change grid settings" button, you can manually optimize the graphical display in the "Screen grid" dialog box.

You can also call up this dialog with the menu command "Options" > "Settings of Safety ES..." under the tab "Logic" by clicking on the "Screen grid" button.

Call:

Button	Command
	"View" > "Change grid settings"

### "Screen grid" dialog box

- Align objects  
You can align objects with the grid and / or with other objects. To do so, select the corresponding checkboxes.
- Grid settings  
The distance between the individual grid points can be set from 5 to 50 mm in steps of 5 mm. (Default: 30 mm)  
You can choose whether every first, second, third, fourth, fifth, or sixth grid point is to be shown. (Default: Display 1st grid point)  
Activate the option "Display grid on the screen" to display a screen grid.

### 6.4.2.18 Errors and system callbacks

If you execute impermissible actions when working with the logic diagram, error messages are displayed.

#### Meaning of the error messages and system callbacks

Error message	Meaning
It is not permitted to connect inputs to each other.	You have tried to interconnect two inputs. This is not permitted.
Connection of two outputs not possible.	You have tried to interconnect two outputs. This is not permitted.
This connection is prohibited.	You have tried to create a connection that is not possible. Inputs and outputs cannot be interconnected at will.
Inputs can only be used once.	You have tried to connect to an input that is already assigned. An input can only be the output point of one connection.
Feedbacks are not permissible.	You have tried to establish a connection between outputs and inputs with the same function element. Note that this does not have to be a direct connection, the feedback can be established across multiple function elements. Check the signal flow.

### 6.4.2.19 Macro functionality

You can use the macrofunction as follows:

- To put together a library of function units that you use particularly.
- To combine blocks (= macros) from function elements and interposed connections, partial diagrams, or whole diagrams.
- To export and import macros out of your project or into other projects.
- To reuse the macros in other projects.

#### Properties of macrofunctionality

- All macros are stored in a file in a user-specific area on the hard disk.
- Each user sees his or her own macros. Macros can be made available to other users using the export function (e.g. through a central storage location on a server).
- The number of elements in a macro is not limited.
- A macro can only be created from the elements of a single diagram.
- Freely positioned comments can be included in a macro.
- Interrupted connections are stored as such in the macro and will be interrupted when the macro is used.
- When a macro is created, connections are only included if they have a defined start and end point.
- Macros can be deleted using the context menu (right mouse button).

- Name and description of the macros can be modified subsequently using the context menu (right mouse button).
- The following actions cannot be undone:
  - Importing and exporting macros
  - Creation and deletion of macros
  - Modifying the properties of a macro

### Creation of a macro

To create a macro perform the following steps:

- In the diagram, select the function elements from which you want to assemble the macro, being sure to select the required connection lines, too.
- Choose "Create macro..." from the context menu using the right mouse button.
- The properties dialog box of the newly create macro will be shown. Enter the following details:
  - Name: Name of the macro, with which the macro will be stored in the "Macros" folder in the catalog window.
  - Description: You can enter a description of the macro here.

### Using macros

If you want to use an existing macro in your diagram, please proceed as follows:

- Define the type of element number assignment in the "Options" > "Settings" menu:
  - Assign a new element number: Starting at 1, the next free element number is assigned to the function element.
  - Retain old element numbers if possible: If the element number is not yet used in the current diagram, the element number that the function element had when the macro was created (and that is stored in it) will be assigned to the function element again when it is reused.
- Drag the macro out of the "Macros" folder in the function catalog into the diagram. This breaks down the macro into individual connections and function elements. You can modify the individual components.

The following rules apply when inserting function elements:

- Interconnections to input/output terminals are reset (to avoid duplicate assignments).
- The elements of the macro are inserted at the current mouse position.
- All elements of the macro are selected after insertion (for example, to be able to move them afterward).
- The element parameters of each individual element are retained. (They are stored in the macro.)

### Storing macros

The macros you created and imported are stored in the "Macros" folder in the function catalog with the name you assigned to them.

### Export macros

- To export macros, choose the "Export macros..." menu command from the "Options" menu. The "Export macros" dialog box opens.
- Choose the macros from the "Existing macros" list (identical with the list of the macros in the function catalog) that you wish to export.
- Insert the selected macros into the "Macros to be exported" list using the "Add" button.
- Click the "Export" button.
- In the "Save macro file as" dialog box, enter the path and filename of the macro file to be created.

### Import macros

- To import macros, choose the "Import macros..." menu command from the "Options" menu. The "Import macros" dialog box opens.
- Choose the macros you want to import from the "Importable macros" list.
- Insert the selected macros into the "Macros to be imported" list using the "Add" button.
- Click the "Import" button.

## 6.5 Passwords

### 6.5.1 Passwords

The configuration and the access to the safety relay are subject to special password protection based on safety technology. You can assign three passwords:

- Password for device access (optional)
- Password for project access (optional)
- Password for changing to test mode (mandatory)



**! WARNING****Unauthorized access to safety functions via fieldbus.  
Can Cause Death or Serious Injury.**

To prevent unauthorized access to the safety relay via the fieldbus, e.g. PROFINET or PROFIBUS, assign a password for accessing the device in Safety ES.

If you operate several safety relays in one fieldbus network, you must assign a separate password for each safety relay to prevent mix-ups when accessing via the fieldbus. In other words, the passwords must not be identical.

**Note****Secure password**

A password must consist of a maximum of 8 characters. A secure password can only be used for a single application, is 8 characters long, and contains uppercase and lowercase letters, special characters and numerals. It should not contain any common numeric sequences from the computer keyboard or words from the dictionary. Change your password at regular intervals.

**Passwords - Overview**

	Password for device access	Password for project access	Password for changing to test mode
<b>Description</b>	<ul style="list-style-type: none"> <li>This password prevents unauthorized access to the safety relay. The password is assigned when the protection level is set.</li> <li>You can control access to the safety relay by setting a protection level. For the safety relay, the following protection levels can be set: <ul style="list-style-type: none"> <li>– Write protection</li> <li>– Project write/read protection</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>This password protects an off-line configuration from unauthorized access.</li> <li>If you do not enter a password, the configuration is opened as "read only", i.e. you cannot change the configuration</li> </ul>	<ul style="list-style-type: none"> <li>This password prevents an unauthorized change to "test mode".</li> <li>It is only possible to change to "test mode" if a valid password has been entered. If no password has yet been assigned for test mode, you have to assign one when changing to test mode.</li> <li>The default password is "0000".</li> </ul>
<b>Assigning / Changing</b>	<p>In Safety ES, via the "Edit" &gt; "Password for device access" menu command.</p> <p>Requirement: You are now in configuring mode and are online.</p>	<p>In Safety ES, via the "Edit" &gt; "Password for project access" menu command.</p> <p>Requirement: You are offline.</p>	<p>In Safety ES, via the "Edit" &gt; "Password for test mode" menu command.</p> <p>Requirement: You are now in configuring mode and are online.</p> <p><b>Note:</b> This password must not be identical to the password for device access. In this case, switchover to test mode is denied.</p>

	Password for device access	Password for project access	Password for changing to test mode
<b>Prompt</b>	<ul style="list-style-type: none"> <li>• Independently of the set protection level:                             <ul style="list-style-type: none"> <li>– When changing the device access password.</li> </ul> </li> <li>• "Write protection" protection level:                             <ul style="list-style-type: none"> <li>– For write access to a safety relay (e.g. when loading), if no access rights exist.</li> </ul> </li> <li>• Protection level "Project write protection/read protection":                             <ul style="list-style-type: none"> <li>– Just as for the "Write protection" protection level</li> <li>– When opening an online configuration</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• When opening an offline configuration</li> <li>• When changing the project access password.</li> </ul>	<ul style="list-style-type: none"> <li>• When switching to test mode via the "Target system" &gt; "Test mode" menu command.</li> </ul>
<b>Validity</b>	As long as an access authorization for the safety relay exists.	As long as the offline configuration is open.	The password must be re-entered for each change to test mode.

**Note**

If you change the passwords, this has no effect on the release status of a configuration.

**Deactivate password protection (only password for project access and password for device access)**

You can deactivate the password protection again by entering a tick in the box "Deactivate password" in the dialog window. To do this, you must first enter the old password.

**Forgot password**

- The password for project access can be reset.
- Both the password for device access and the password for switching to test mode can only be reset by restoring the factory settings.

**Dialog box "Edit" > "Password for project access"**

- This password prompt appears in the "Enter password" dialog box when you open an offline configuration.
- If you have still not assigned a password for project access, enter a new password at the prompt "New password" and enter it again to "Confirm password".
- Change the project access password by entering the old password and then entering the new password twice

- Deactivate the password protection for the project by first entering the old password and then entering a blank password twice.
- Use the "Forgot password" button to create a file with the encrypted password if you lose the project access password. Send this file with the activation information to the Siemens hotline. The Siemens hotline will send you a file with an activation code. You can find more information in Chapter "Forgot password (Page 65)".

### Dialog box "Edit" > "Password for device access"

- This password is requested in the case of password-protected write device access (e.g. loading new configuration) or when going online (only in the case of protection level "Project write/read protection").
- You can assign/change/reset the password for device access.
- You can set the protection level with this menu command.

---

#### Note

If you have forgotten the password for device access, you must restore the factory settings of the safety relay. You must do this on the safety relay because commands in Safety ES are password-protected.

---

### Dialog box "Edit" > "Password for test mode"

- This password is requested every time you switch to test mode via the "Target system" > "Test mode" menu command.
- You can assign/change the password for changing to test mode.

---

#### Note

If you have forgotten the password for changing to test mode, you must restore the factory settings of the safety relay. You can do this on the safety relay or by means of a command in Safety ES.

---

### Prompt for passwords

- Enter password
  - The "Enter password" dialog appears if you open a password-protected configuration, for example.
  - Enter the password and confirm with "OK".
- Password forgotten:
  - If you have forgotten the project access password, you can open the configuration write-protected. To do this, click on the "Cancel" button. An online configuration can only be opened if the protection level has been set to "Write protection".

## 6.5.2 Enter password

### Enter password

The "Enter password" dialog appears when you open a password-protected configuration. Enter the password and confirm with "OK".

### Password lost

If you have lost the password, you can open the configuration write-protected by clicking on the "Cancel" button.

### Forgot password

Using the "Create project access password" menu command, you can reactivate access to the configuration via the "Forgot password" button.

# Configuring

## 7.1 General information

### Safety information

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#### Note

Since commissioning is an important, safety-related step, it must be carried out by qualified personnel.

---

#### WARNING

**Loss of the safety function.  
Can Cause Death, Serious Injury, or Property Damage.**

To ensure the safety of the system, a full function test of the system must be conducted and successfully completed.

A complete function test consists of the following tests:

- Configuration test (test of the configuration)
- System test (wiring test of the connected sensors and actuators)

## 7.2 Modes

The safety relay always differentiates between three operating modes:

- Configuring mode
- Test mode
- Safety mode

### Configuring mode (DEVICE LED: yellow)

The monitoring functions are not active in configuring mode. No signals are output at the terminals. In configuring mode, you can modify existing parameters. This is done by creating a configuration in the PC / PG with Safety ES and downloading it to the safety relay. It is also possible to upload and edit a configuration available in the safety relay.

The safety relay enters configuring mode after switch-on if	LED display	
	DEVICE	SF
There is no configuration in the device.	yellow	off
The configuration in the device has not been released.	yellow	off
The configuration in the device is incorrect.	yellow	red

The safety relay enters configuring mode after switch-on if	LED display	
	DEVICE	SF
A configuration error was identified in test mode.	yellow	red
The connection is interrupted in test mode.	yellow	red
A Category 1 error occurs in safety or test mode. Only diagnosis and reset possible.	Flashing red	red

### Test mode (DEVICE LED: flickering green)

Test mode can only be accessed online from configuring mode using a password-protected command. You can switch to test mode even if the configuration has not been released.

The user program is processed in test mode. All monitoring functions are active in accordance with the set parameterization. Logical outputs of function elements can be set, see Chapter "Forcing (Page 158)". This makes it easier to carry out troubleshooting in the application and check the wiring.



#### WARNING

**Automatic system starting in the test mode  
Can Cause Death, Serious Injury, or Property Damage.**

In the test mode, the safety program is executed and the outputs are controlled according to the safety program.

Take appropriate organizational measures, such as deactivating the main circuit or cordoning off parts of the system, to ensure safety for persons and the system.

### Safety mode (DEVICE LED: green)

In safety mode, all monitoring functions are active in accordance with the set parameterization. Safety mode can only be exited by means of a command.

The safety relay changes to safety mode	Display	
	DEVICE	SF
Once the system has been switched on and if the configuration has been released and the test results of the device startup are OK.	green	off
From configuring mode by means of the relevant command.	green	off

## 7.3 Creating a configuration in Safety ES

### Requirement

Before you start configuring in Safety ES, you require the following information:

- Structure/wiring of the system
- Required safety functions
- Configuration/wiring of the hardware

### Procedures for configuring in Safety ES

The procedure for configuring in Safety ES has an effect on various functions.

There are basically two ways of configuring:

1. You start with configuring the expanded hardware configuration and then configure the logic. If you have configured a device that does not support all function elements, these elements are then no longer available in the catalog window of the logic diagram.
2. You start with configuring the logic and then configure the expanded hardware configuration. If you use function elements in the logic diagram that are not supported by all devices, these devices are then no longer available in the hardware catalog of the configuration.

### Configuration

#### Main system

In Safety ES, the various devices from the hardware catalog are assigned to their relevant slot. Drag each device into the central work space and onto the slot that they really occupy in the expanded configuration.

The minimum configuration consists of a safety relay in slot 3.

An interface module for connection to a higher-level bus system can be optionally configured in slot 2.

An HMI module can be configured in slot 1.

---

#### Note

##### **3SK1 output expansions and 3RM1 Failsafe motor starters**

You can configure 3SK1 output expansions and 3RM1 Failsafe motor starters for the documentation in the properties of the 3SK2 safety relays.

---

#### Sub-system

In the subsystem, the real AS-i slaves and AS-i components are configured at their respective AS-i addresses. The hardware catalog contains all supported AS-i components from SIEMENS. Just like in the main system, they can be dragged into the work space and have their AS-i address

assigned. Using the universal modules, the profiles of standard and A/B slaves can be defined independently of manufacturer.

---

**Note**

**Configuration of simulated slaves**

Simulated slaves are allocated their AS-i addresses and the profile is selected in the properties of the safety relay. The simulated slaves are displayed in italics in the subsystem.

---

You can find more information in Chapter "Configuration (Page 106)".

## Logic

The safety logic is created in the logic diagram. The inputs and outputs of the devices of the main system and of the AS-i slaves of the subsystem, as well as signals via the fieldbus (PROFINET or PROFIBUS) are linked with function elements. Drag the required function elements onto the work space. Parameterize the individual elements in the relevant element properties that you can open by double-clicking the element. Here, you can set the various parameters and connect the inputs and outputs of the function elements with the inputs and outputs of the devices.

You will find additional information in Chapters "Logic diagram (Page 117)" and "Function elements (Page 171)."

## 7.4 Interconnecting the signals (terminals)


### Signals

There are various types of signals you can interconnect in Safety ES:

- Signals from the inputs and outputs of the terminals
- Signals via the fieldbus (PROFINET or PROFIBUS, MSS Basic only PROFIBUS)
- Signals via AS-Interface (MSS 3RK3 with AS-i interface)
- Flags from the program (3SK2 safety relay)
- Signals from the inputs and outputs of the device connector interface (3SK2 safety relay)

### Interconnecting inputs and outputs of the terminals

You interconnect the input and output terminals of the devices with the function elements in the logic diagram. To do so, open the properties dialog box by double-clicking on the relevant function element in the logic diagram.

Clicking the  button opens a selection menu in which all interconnectable signals (terminals) of the devices are displayed and can be selected:




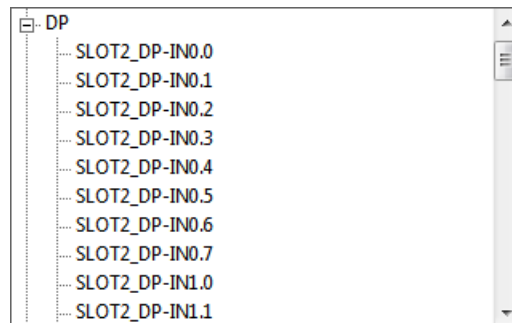


### Interconnecting PROFIBUS signals


A precondition for the interconnecting of PROFIBUS signals is the configuration of an interface module.

You interconnect the PROFIBUS signals with the input and output cells in the logic diagram. To do so, open the properties dialog box by double-clicking on the relevant function element in the logic diagram.

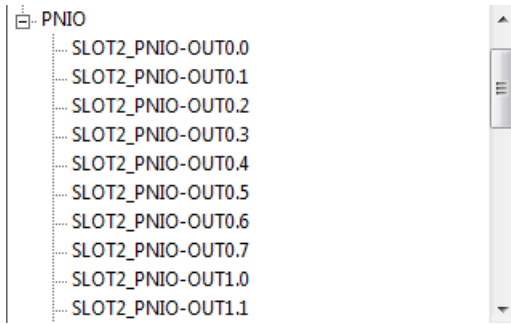
Clicking the  button opens a selection menu in which all interconnectable PROFIBUS inputs and outputs are displayed and can be selected:



### Interconnecting of PROFINET signals


A precondition for the interconnecting of PROFINET signals is the configuration of a PROFINET interface module. You interconnect the PROFINET signals with the input and output cells in the logic diagram. To do so, open the properties dialog box by double-clicking on the relevant function element in the logic diagram. Clicking the  button opens a selection menu in which all interconnectable PROFINET inputs and outputs are displayed and can be selected:

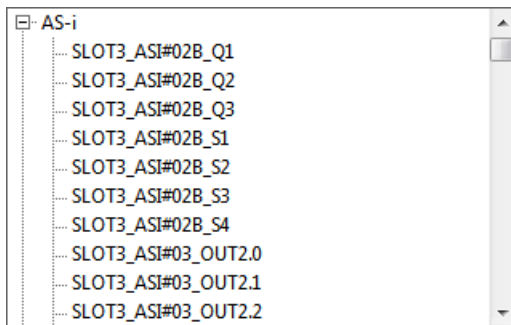
7.4 Interconnecting the signals (terminals)




Interconnecting AS-Interface signals (MSS 3RK3 with AS-i interface)

You interconnect the AS-Interface signals with the input and output cells in the logic diagram. To do so, open the properties dialog box by double-clicking on the relevant function element in the logic diagram.


Clicking the  button opens a selection menu in which all interconnectable AS-Interface signals are displayed and can be selected:

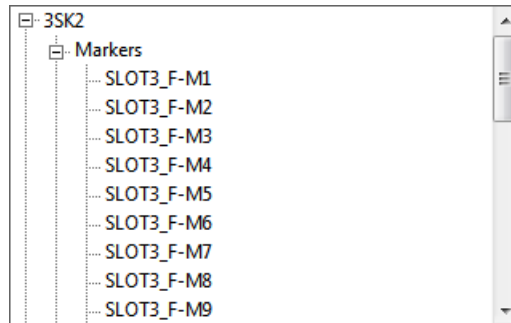


Interconnecting flags (3SK2 safety relay)

 <b>WARNING</b>
<b>Increasing of fault reaction time when using flags Can Cause Death, Serious Injury, or Property Damage.</b>
Flags are written at the end of a program cycle and can be read in again at the input by functions in the next program cycle.
Each flag that is contained in a signal path increases the fault response time.
Please note this when calculating the overall response time. You can find out how to calculate the response times in the manual of the safety relay, see Chapter "Additional documentation (Page 12)".


You interconnect the flags with the input and output cells, as well as the output functions, in the logic diagram. To do so, open the properties dialog box by double-clicking on the relevant function element in the logic diagram.

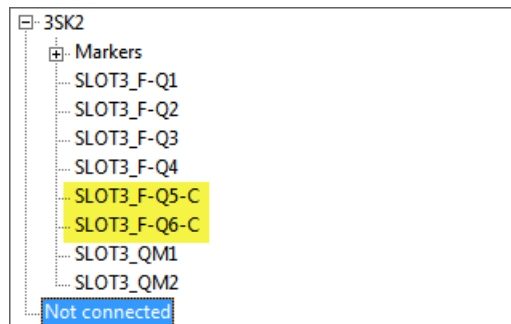
Clicking the  button opens a selection menu in which all interconnectable flags of the device are displayed and can be selected:



### Interconnecting the inputs and outputs of the device connectors (3SK2 safety relay)

You interconnect the inputs and outputs of the device connector interface with the function elements in the logic diagram. To do so, open the properties dialog box by double-clicking on the relevant function element in the logic diagram. The inputs and outputs of the device connectors are indicated with "-C" in the list.

Clicking the  button opens a selection menu in which all interconnectable terminals and signals of the device are displayed and can be selected:



## 7.5 Connection rules

Because of the hardware properties or safety regulations, there are connection rules that must be checked or monitored when function elements are edited.

### General

- Signals must not be connected recursively, i.e. "backward."
- Non-fail-safe input signals (= standard inputs) can only be added to a safety circuit if they are ANDed with a safe signal.

- Input terminals (fail-safe/non-fail-safe) can only be used once as an input (input cell or monitoring functions).
- Output terminals (fail-safe/non-fail-safe) can only be used once as an output (output cell / switching output), However, each output terminal can also be used once as an input terminal with an input cell.

## Monitoring functions

- Only fail-safe signals must be connected to a signal input (INx) of a monitoring function.
- "Mixed connection" of signals is not possible, i.e. for multi-channel function elements capable of cross-circuit detection, only channels of the same devices can be connected. (Exception: mode selector switch).

---

### Note

For cross-circuit detection, channels of individual devices are combined into "channel groups"; the number of channel groups depends on the device.

Channel group 1: IN1 / IN2

Channel group 2: IN3 / IN4

Channel group 3: IN5 / IN6

...

Channel group 10: IN19 / IN20

---

- The following rules apply for interconnecting channels to multi-channel monitoring functions with the exception of the mode selector switch:
  - If an input in a channel group is used with one channel, the assigned second input must no longer be used with two channels. It can still be used with one channel.
  - If an input of a channel group is used with two channels, the second associated input is automatically configured to the still unused input of the element (e.g. emergency stop: IN1 is configured to SLOT3\_F-IN1, IN2 is automatically assigned to SLOT3\_F-IN2).

---

### Note

An acknowledgment button must be connected to one test output.

Cross-circuit monitoring is always implemented in the case of a single-channel enabling button. This is why a single-channel acknowledgment button must also be connected via a test output.

Non-floating wiring is not possible.

---



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### Note

If a safety shutdown mat (cross-circuit principle) is connected to a slot (safety relay or expansion module), cross-circuit detection must be deactivated for the remaining inputs on this slot because otherwise the monitoring functions configured for these inputs will also signal a cross-circuit when somebody steps on the safety shutdown mat.

### Exception:

On the 3SK2 safety relay (45 mm), there are two independent test cycle pairs. You can use one test cycle pair for the safety shutdown mat (cross-circuit principle), and the other test cycle pair independently of this with monitoring functions for cross-circuit detection.

---

### Cell functions can be placed by the user

- Fail-safe and non-fail-safe input signals as well as fail-safe and non-fail-safe output signals can be connected once to an input cell function.
- Only fail-safe and non-fail-safe output signals or bit memories can be connected to an output cell function.

### Interconnecting bit memories

With the help of bit memories, you can save output signals intermediately, and read them in again and further process them at the input of one or more functions.

A bit memory cell function can be read and written via fail-safe and non-fail-safe signals.

---

#### Note

A bit memory cell function cannot serve as a signal input for a monitoring function.

A bit memory function can always be considered fail-safe irrespective of its use.

---



#### WARNING

##### **Increasing of fault reaction time when using flags Can Cause Death, Serious Injury, or Property Damage.**

Flags are written at the end of a program cycle and can be read in again at the input by functions in the next program cycle.

Each flag that is contained in a signal path increases the fault response time.

Please note this when calculating the overall response time. You can find out how to calculate the response times in the manual of the safety relay, see Chapter "Additional documentation (Page 12)".

### Interconnecting of PROFINET / PROFIBUS signals

- Non-safety-related signals can be connected optionally via PROFINET / PROFIBUS using an interface module.
- Take account of the response times of the devices plus the communication runtimes in your calculation. Updating of the process image between the safety relay and the interface module interface takes place dependent on the configured program cycle time (min. 10 ms).

## Interconnection of AS-i slaves

- Safety-related AS-i input slaves  
When safety-related AS-i input slaves are used, only the "two-channel" and "2xsingle-channel" input type parameters are permissible for monitoring functions. It is not permitted to use a safety-related AS-i input slave with one channel.  
AS-i terminals may only be used together with the "NC/NC" input type parameter for the following monitoring functions: "Monitoring Universal", "EMERGENCY STOP", "Protective door", "Protective door with tumbler", and "Safety shutdown mat (NC principle)".  
For enabling-type input functions (two-hand operation and enabling button), AS-i terminals may only be used together with the "NO/NO" input type parameter.  
The "NC/NO" input type parameter must not be used.
  - Two-hand operation  
When safety-related AS-i input slaves are used with two-hand operation, only the "2x2xsingle-channel (NO/NO/NO/NO)" and "four-channel (NO/NO/NO/NO)" input type parameters are permissible.  
The "four-channel (NO/NC/NO/NC)" input type parameter is not permitted for AS-i since the transferred value 0 is not safe.
- The two safety-related input signals of a monitoring function (F-IN1 and F-IN2) must originate from the same safety-related AS-i input slave.
- Discrepancy monitoring and sequence monitoring  
If the input signal is present at an AS-i slave and the "2xsingle-channel" input type parameter is assigned, the discrepancy and sequence monitoring parameters are automatically deactivated.  
This applies to the following function elements:
  - Monitoring Universal
  - EMERGENCY STOP
  - Safety shutdown mat with NC principle
  - Protective door
  - Protective door with tumbler
  - Enabling button
  - Two-hand operation
- Safety shutdown mat with cross-circuit principle  
There must not be any AS-i terminals connected to the "Safety shutdown mat with cross-circuit principle" function element.
- Setting/resetting of safety-related AS-i outputs using "AS-i 1..4F-DO"  
Only the terminals of one safety-related AS-i output may be connected to the outputs of the "AS-i 1..4F-DO" output function.  
Connection of other terminals and the distribution among several safety-related AS-i outputs are not permitted.  
An output cell sets/resets only the first channel Q1 of a safety-related AS-i output. Outputs Q2 ... Q4 and AUX1 and AUX2 are set/reset only using the "AS-i 1..4F-DO" output function.
- Representation of safety-related AS-i outputs  
The received Q1 ... Q4, AUX1, and AUX2 signals of another MSS 3RK3 Advanced, MSS 3RK3 ASIsafe basic or MSS 3RK3 ASIsafe extended may only be wired to input cells.

- Monitoring of safety-related input slaves  
The IN1 and IN2 receive signals may only be interconnected to input elements. Interconnecting to input cells is not permitted. Only the safety-related F-IN1&2 receive signal may be interconnected to an input cell. The monitoring function "AS-i 2F-DI" is used instead of an input cell if you want to diagnose both of the input terminal signals of the ASIsafe input slave.
- Representation of safety-related input slaves  
The send signals for a safety-related AS-i input slave may be interconnected only via an output cell.

**Interconnecting expansions via device connectors on the 3SK2 safety relay**

- "3SK1 output expansions" and "3RM1 motor starter" actuators can be connected to the 3SK2 safety relay with little wiring using 3ZY12 device connectors via the device connector interface.
- This interface provides two further safety-related outputs for control of the actuators and one feedback circuit for monitoring the two outputs. The signals of the interface can be wired in the logic diagram.
- The 3SK1 output expansion is assigned to a logical output of the 3SK2 safety relay by means of the slide switch on the front of the 3SK1 output expansion.

Slide switch	Labeling	The 3SK1 output expansion switches with output ...	
		3SK2 (22.5 mm device)	3SK2 (45 mm device)
Top	"DELAYED" switch position	F-Q4-C	F-Q6-C
Bottom	"UNDELAYED" switch position	F-Q3-C	F-Q5-C

**⚠ WARNING**

**Loss of the safety function in the event of adjustment of the slide switch on 3SK1 output expansions  
Can Cause Death, Serious Injury, or Property Damage.**

Parameterization of the logic of the 3SK2 safety relay in Safety ES must correspond to the slide switch setting on the 3SK1 output expansion in order for the safety function not to be rendered inactive.

- Make sure that the setting of the slide switch on the 3SK1 output expansion corresponds to your logic parameterized in Safety ES.
- Use a cover seal to protect the slide switch of the 3SK1 output expansion against unauthorized and unintentional adjustment.

- When used with 3ZY12 device connectors, the 3RM1 Failsafe motor starters are permanently assigned to one of the two safety-related outputs. It is not possible to change over to the other output:

22.5 mm device	45 mm device
F-Q3-C	F-Q5-C



## 7.6 Commissioning

### Safety information

#### Note

Since commissioning of the safety relay is an important, safety-related step, it must be carried out by qualified personnel.

#### WARNING

**Loss of the safety function.  
Can Cause Death, Serious Injury, or Property Damage.**

To ensure the safety of the system, a full function test of the system must be conducted and successfully completed.

A complete function test consists of the following tests:

- Configuration test (test of the configuration)
- System test (wiring test of the connected sensors and actuators)

### Methods of accessing the safety relay

The following graphic shows the various ways of accessing the safety relay.

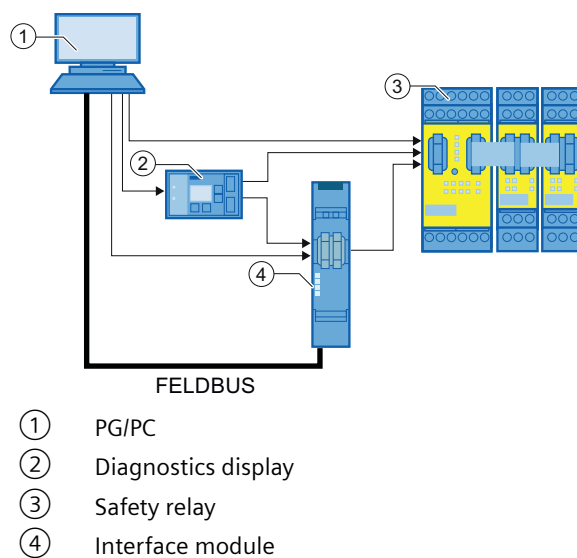


Figure 7-1 Methods of accessing the safety relay

## Requirements

The following requirements must be met for commissioning:

- The device is mounted.  
Check all the latches to ensure that they are properly engaged.
- The device is correctly wired.
- The Safety ES software is installed on your PC/PG with the correct license.
- The configuration is available in a consistent form and saved.
- The utilization of the memory module, of the internal memory, and the program cycle time were monitored.  
You will find additional information in the following chapters:
  - "Status bar (Page 39)"
  - "Settings of Safety ES - "Download options" tab (Page 94)"

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### Note

#### Number of function elements

The number of function elements that can be processed by one safety relay depends on the type of function elements. A typical value is 250.

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- The power supply unit for the safety relay is connected.
- PG/PC and safety relay are connected.



#### **WARNING**

#### **Unauthorized access to safety functions via the fieldbus Can Cause Death or Serious Injury.**

To prevent unauthorized access to the safety relay via the fieldbus, e.g. PROFINET or PROFIBUS, assign a password for accessing the device in Safety ES.

If you operate several safety relays in one fieldbus network, you must assign a separate password for each safety relay to prevent mix-ups when accessing via the fieldbus. In other words, the passwords must not be identical.

- The consistency check must not output any messages.
  - Warnings must be checked.
  - Faults must be corrected.

## Load to switching device...

---

### Note

If there is already a released configuration on the safety relay, cancel this configuration release with the "Target system" > "Cancel configuration release" menu command.

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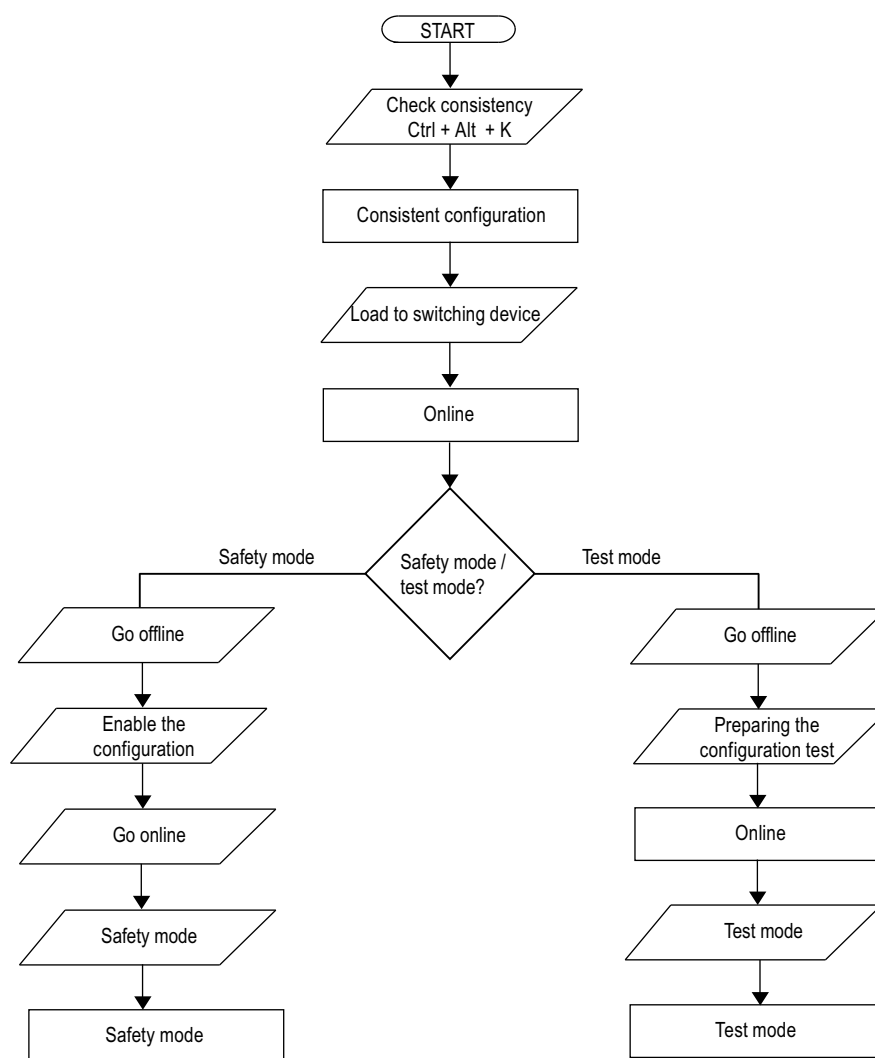


Figure 7-2 Procedure for commissioning the safety relay with factory settings

**Perform the following steps to load a configuration into the safety relay:**

Step	Action	Result
1	Switch on the power supply.	The safety relay executes a self-test.
2	Open the project in Safety ES.	-
3	Choose the "Target system" > "Load to switching device" menu command and confirm the memory dialog box with "Yes" if you have changed the configuration.	The "Load to switching device" dialog box opens.
4	Set the interface and confirm with "OK".	The configuration data is now downloaded. A message is displayed on completion of the download.
5	Confirm with "OK".	You are now online in configuring mode.

## 7.7 Testing the configuration

Before you can switch the safety relay to safety mode, you must conduct a full function test and then release the configuration.

**⚠ WARNING**

**Loss of the safety function.  
Can Cause Death, Serious Injury, or Property Damage.**

A configuration can only be released if a complete function test of the configuration has been successfully completed

A complete function test consists of the following tests:

- Check of the hardware configuration:
- Check of the parameterization of safety functions

### Project printouts for the test

Use the printouts of the project to support the test.

Step	Action	Result
1	Open the parameter file containing the configuration that you have downloaded to the safety relay.	The configuration is displayed. You are offline.
2	Activate "Target system" > "Prepare configuration test".	The "Prepare configuration test" dialog box opens.
3	Set the interface via which you have access to the device (e.g. COM1) and confirm with "OK".	The project printouts are generated as PDFs. The project switches to online mode.

- The printout contains all the configuration data stored in the safety relay.
- The configuration CRC is given on each page of the printout in the tabular footer. The printout is thus always uniquely assigned to one configuration and can later be used for the plant documentation.
- If deviations or errors occur in these checks, test the configuration and wiring and start commissioning again.

**⚠ WARNING**

**Loss of the safety function.  
Can Cause Death, Serious Injury, or Property Damage.**

Test the configuration on the safety relay.

It is not enough just to check the printout; the configuration must also be tested on the safety relay in the system.

## Switching to test mode

The safety relay can be switched to "Test mode" for the purpose of carrying out the full function test. Outputs of function elements can be forced in this operating mode.

### **WARNING**

#### **Automatic system starting in the test mode Can Cause Death, Serious Injury, or Property Damage.**

In the test mode, the safety program is executed and the outputs are controlled according to the safety program.

Take appropriate organizational measures, such as deactivating the main circuit or cordoning off parts of the system, to ensure safety for persons and the system.

#### **Note**

A consistent configuration is the requirement for switching to test mode.

#### **Note**

If you have not yet assigned a password, you must assign one now. The password for test mode must not be identical to the password for device access.

The default password is: 0000

## Execute the following steps to switch to test mode:

Step	Action	Result
1	Go online with the menu command "Switching device" > "Open online".	
2	Choose "Target system" > "Test mode" and confirm the message "Activate test mode" with "Yes".	The "Change password for test mode" dialog box opens.
3	Enter the password for test mode or assign a password.	The safety relay changes from configuring mode to test mode.

## 7.8 Forcing

Forcing means that an output of a function element can be preset to a certain value ("0" or "1"), for example, to make it easier to perform troubleshooting.

### Requirements

The following requirements must be met to activate the icons in the toolbar:

- The online view is activated.
- Test mode is activated on the safety relay.
- The logic diagram with the safety circuit is active.
- At least one connection of a function element is selected.

### Forcing





#### WARNING

**Automatic system starting in the test mode  
Can Cause Death, Serious Injury, or Property Damage.**

In the test mode, the safety program is executed and the outputs are controlled according to the safety program.


Take appropriate organizational measures, such as deactivating the main circuit or cordoning off parts of the system, to ensure safety for persons and the system.

With the "Target system" > "Diagnostics logic" > "Force" > "Force to 0" and "Target system" > "Diagnostics logic" > "Force" > "Force to 1" menu commands or the corresponding icons in the toolbar, you can set the values "0"  or "1"  for selected outputs of function elements.

If a connection is forced, an icon above the connection shows the value "0" (blue symbol) or "1" (green symbol) in the logic diagram.


### Cancel forcing

You can cancel forcing for an individual forced output as follows:

- Using the "Target system" > "Diagnostics logic" > "Force" > "Cancel forcing" menu command.
- By clicking on the icon  in the toolbar.

### Cancel forcing (all)

You can cancel forcing for all forced outputs as follows:


- Using the "Target system" > "Diagnostics logic" > "Force" > "Cancel forcing (all)" menu command.
- By clicking on the icon  in the toolbar.

## Interruption of the online connection

If the online connection is interrupted in test mode, e.g. by removing the PC cable, it can take up to 10 s before forcing of an output to "1" is canceled.

## 7.9 Configuration release

Follow these instructions:

 <b>WARNING</b>
<p><b>Loss of the safety function. Can Cause Death, Serious Injury, or Property Damage.</b></p> <p>Before the safety equipment is released for safety mode, you must ensure that all function elements are working correctly in accordance with the safety regulations. This encompasses the I/O connected to the safety relay (sensors and actuators) as well as the entire configuration of the safety relay.</p> <p>When the configuration is released, you can (as an "authorized person") confirm that the system is correctly installed and that all the safety-relevant regulations and standards for the application are observed.</p>

### Note

The release procedure described below refers only to the configuration of the safety relay and not to the system test. The system test must be documented separately and is not an integral part of this documentation.

Once the function test has been successfully carried out, you can release the configuration. To do so, proceed as follows:

Step	Action	Response
1	Select the menu command "Target system" > "Go offline". <sup>1)</sup>	The offline configuration is opened.
2	Choose "Target system" > "Approve configuration".	The "Approve configuration" dialog box is opened, thereby confirming that the system has been configured properly.
3	Set the interface via which you have access to the device (e.g., COM1) and confirm with "OK".	The "Approve configuration" dialog box opens.
4	Acknowledge the message text.	The "Approve configuration" dialog box opens.
5	Enter the name and approving company and confirm with "OK".	The "Approve configuration" dialog box opens. The configuration has been successfully approved.
6	Acknowledge the message with "OK".	The printout of the release information is created.

<sup>1)</sup> From SP2, configuration approval is also possible online. The step "Go offline" is automatically carried out by the software.

---

**Note**

If the report could not be printed when the project was released, e.g., because no printer was available, the printout must be created at the latest by the time of acceptance by selecting "Options" > "Release information."

---

**Printout of the release information**

The printout of the release information contains the following information.

- Name of the person releasing
- Name of the company of the person releasing
- Release status
- Release timestamp
- Configuration CRC

This must match the configuration CRC in the footer on the printout of the configuration. The release printout is thus always uniquely assigned to one configuration and can later be used for the plant documentation.

**Result of the release**

Once the safety relay has been released, the device is in configuring mode and can be switched to safety mode.

## 7.10 Safety mode

**Requirements**

If the safety relay contains a valid, released configuration, you can switch the safety relay from configuring mode to safety mode.

---

**Note**

Before switching the system to safety mode, ensure that the printout containing the release information is available.

---

 **WARNING**

**Automatic system startup  
Can Cause Death, Serious Injury, or Property Damage**

When the system is switched on it switches to safety mode and the safety program is executed as soon as a valid, released configuration is available.

Take appropriate measures (e.g. start button) to guarantee a defined start of the system.



## Switching to safety mode

Step	Action	Response
1	Establish an online connection with the safety relay using the "Switching device" > "Open online" menu command.	The Set interface dialog box appears.
2	Set the interface and confirm with "OK".	The project opens online.
3	Activate the menu command "Target system" > "Safety mode".	If a password has been assigned for device access, the "Enter password" dialog box appears. If a password for accessing the device has not yet been assigned, a message is displayed indicating that the switching device is not protected against unauthorized access.
4	Enter the password for device access and confirm this with "OK," or acknowledge the message with "Yes" if you have not assigned a password for device access.	The safety relay changes to safety mode.

### "Safety mode"

- When the system is switched on, it switches automatically to safety mode if a valid, released configuration already exists in the safety relay.
- After starting safety mode, the status bar in Safety ES informs you of the change to the new operating mode. The operating mode is only displayed when a project is open online.
- In safety mode, the created safety circuit is processed. Safety mode does not allow you to force function outputs.

## 7.11 Tips and Tricks

### 7.11.1 Comparison function

Menu option		Basic license	Standard license	Premium license
Edit	Compare with switching device	-	✓	✓
Edit	Compare with file	-	✓	✓

Safety ES provides a function for comparing two configurations. The configuration that is currently open in Safety ES (source configuration) is compared to a configuration to be defined by you. This can either be online in the safety relay or offline in an \*.sdp file.

You can call up the comparison function with the following menu commands:

- "Edit" > "Compare with switching device"
- "Edit" > "Compare with file"

The "Comparison of configurations" dialog box displays the results.

### Compare with switching device

Requirement: The configuration to be compared must be available in the switching device.

Carry out the comparison as follows:

1. Open the source configuration.
2. Select the "Edit" > "Compare with switching device" menu command. The "Compare with switching device" dialog box appears.
3. Select the safety relay that you would like to compare with the open configuration.
4. Click on the "OK" button.

Result: The source configuration is compared with the configuration in the safety relay.

### Compare with file

Carry out the comparison as follows:

1. Open the source configuration.
2. Select the "Edit" > "Compare with file" menu command. The "Compare with file" dialog box appears.
3. Select the file that you would like to compare with the open configuration.
4. Click on the "Open" button.

Result: The source configuration is compared with the configuration in the \*.sdp file.

### "Comparison of configurations" dialog box

The "Comparison of configurations" dialog box contains any deviating results from the comparison in tabular form:

- "Parameter name" column: Contains the names of the parameters with deviations, these are displayed in a tree structure:  
Configuration > Data structure > Element > Individual parameter
- "Source configuration" column: Contains the parameter value belonging to the parameter name in the open configuration.
- "Comparison configuration" column: Contains the parameter value belonging to the parameter name in the comparison configuration.

### "Go to" button

If you click on the "Go to" button in the "Comparison of configurations" dialog box, the respective view opens in the work space in which the object belonging to the selected parameter can be edited.

The prerequisite is that an element be selected in the tree structure in the table of differences.

Example: A function element is selected in the "Comparison of configurations" dialog box. "Go to" takes you to the relevant function element in the logic diagram.

**"Print" button:**

Using the "Print" button in the "Comparison of configurations" dialog box, open a print preview of the results of the comparison. Define whether you want to print out the results of the comparison or to save them in PDF format.

**7.11.2 Cross references**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Cross referen- ces	-	-	✓	✓

**Requirements**

This menu command can only be selected if a configuration is open in Safety ES.

**Actions**

The "Options" > "Cross references" menu command shows the cross references in tabular form in the output window.

**Structure of the cross reference list**

Operand	Kind	Type	Usage loca- tion	Diagram	Page
Device Channel Terminal identifier Device status function	Access: WR = write RO = read	Type of operand	Element type and element number of the function ele- ment.	Name of the dia- gram in which the function element is located.	Page on which the function block that is connected to the function element is lo- cated.

**Note**

The cross reference list only displays the operands used in the safety circuit.

**Edit cross references**

With the context menu (right mouse button) or by double-clicking on the item, you can go to the position where the cross reference is used in order to edit it.

### 7.11.3 Symbol list

Menu option		Symbol	Basic license	Standard license	Premium license
Options	Symbol list	-	-	✓	✓

#### Requirements

This menu command can only be selected if a configuration is open in Safety ES.

#### Actions

The "Options" > "Symbol list" menu command shows the plant identifier you assigned in the form of a table in the output window.

To improve the legibility of the configuration, you can assign identifiers for parts of your configuration data within the context of the system documentation. The symbol list gives an overview of the identifiers assigned by you, their assignments, and the type.

#### Example of a symbol list

Identifier	Assignment	Type
Switching device 1	SLOT5	Equipment identifier (BMK)
Terminal_1	SLOT3_F-IN1	Terminal identifier
Terminal_2	SLOT4_Q6	Terminal identifier
Press	-	Plant identifier
Hall 1	-	Location identifier
EMERGENCY STOP_1	EMERGENCY STOP [35]	Name

#### Editing entries in the symbol list

You can perform the following actions in the context menu (right mouse button):

- Delete: The selected identifier is deleted.
- Editing: The selected identifier can be changed (can also be activated if the identifier is selected and you click on it again or press F2).  
If you change or delete identifiers, then the display in the respective view is immediately updated.
- Go to: You jump to the corresponding icon, which is then selected (can also be activated by double-clicking).

Sorting:

- If you click on the column header in the columns "Identifier" and "Assignment," the items will be sorted alphabetically by this column.
- Clicking on the "Type" column header sorts the column as follows: Equipment identifier, Name, Comment, Terminal identifier, Location identifier, Plant identifier.

**Note****Editing rules**

You cannot assign the same identifier twice.

**7.11.4 Terminal list**

Menu option		Symbol	Basic license	Standard li- cense	Premium li- cense
Options	Terminal list	-	-	✓	✓

**Requirements**

This menu command can only be selected if a configuration is open in Safety ES.

**Actions**

The "Options" > "Terminal list" menu command lists all available terminals of the slot and subslot (AS-i) modules, as well as bit memories, in the output window with the relevant terminal identifier (right-hand column) and the interconnection status in the logic diagram (left-hand column).

The terminals are also shown for which no identifier has been assigned and also those terminals that are not yet interconnected.

**Example of a terminal list**

Terminal	Terminal marking
ASi#02_IN1	Pushbutton_1
SLOT3_F-IN1	Terminal_1
SLOT3_F-M1	Bit_memory_1

**Editing entries in the terminal list**

You can perform the following actions in the context menu (right mouse button):

- Delete: The selected terminal identifier is deleted.
- Editing: The selected terminal identifier can be changed (can even be activated if the identifier is selected and you click on it again or press F2).  
If you change or delete identifiers, then the display in the respective view is immediately updated.
- Go to: Interconnecting terminal is in the logic will take you to the corresponding function element and select it (can also be activated by double-clicking).

Sorting:

- Clicking on the column header of the first column sorts the items of this column by their interconnection status.
- Clicking on the relevant column header sorts the items of the "Terminal" and "Terminal identifier" columns alphabetically.

---

**Note**

**Editing rules**

You cannot assign the same terminal identifier twice.

---


### 7.11.5 Flags (3SK2 safety relay)

#### Function

As well as logic inputs and outputs implemented in the hardware, the 3SK2 safety relay also has a certain number of "virtual" safety-related outputs called "flags".

With the help of these flags, you can buffer output signals and read them in again and further process them via an input cell. If the signal of several functions is to be processed, this signal can be linked with the relevant functions via multiple connection of the output of the input cell.

If, for example, a fault occurs at an output element, you can read in the output signal of the "FAULT output" in the user program again, and further process it.

 <b>WARNING</b>
<b>Increasing fault response time when using flags Can Cause Death, Serious Injury, or Property Damage.</b>
Flags are written at the end of a program cycle and can be read in again at the input by functions in the next program cycle.
Each flag that is contained in a signal path increases the fault response time.
Please note this when calculating the overall response time.

The flags are interconnected in the properties of the function elements in the same way as all other inputs and outputs. You can assign a terminal name in the terminal list ("Options" > "Terminal list").

### 7.11.6 Creation, modification, and release of the configuration without the actual system

A configuration can be created, modified, and released without the actual system. Transfer of the configuration into the memory module and release of the configuration do not have to be performed on the actual system. All that is required is a safety relay of the same type, and a link to the PC / PG with Safety ES. For example, configurations for series machines can be duplicated preliminarily.

---

#### Note

The procedure does not apply to 3SK2 safety relays with width 22.5 mm since these have no memory module. Here it is possible to duplicate the configurations with the 3SK26 diagnostics display. See the manual for 3SK2 safety relays for information about this.

---

### Creation, modification, and release of the configuration without the actual system

With the following steps, you can modify the configuration remotely away from the system:


- Open the current configuration with "Load to PC" or by opening the configuring file or creating a new configuration.
- Modification of the configuration
- Save
  - Confirm cancellation of the configuration release
  - Consistency is checked
- "Target system" > "Load to switching device"
  - Choose an access path and confirm
  - Confirm cancellation of the configuration release
  - Confirm the message "Loading successfully completed"
- "Target system" > "Go offline" (may not be necessary depending on settings in Safety ES)
- "Target system" > "Prepare configuration test"
  - Choose an access path and confirm
  - Save and print out the PDF file
- "Target system" > "Go offline"
- "Target system" > "Approve configuration"
  - Choose an access path and confirm
  - Confirm release
  - Enter the name and name of the company of the person releasing and confirm
  - Confirm configuring released message
  - Save and print the release information

- Switch off safety relay
- Remove the memory module


### Apply the configuration to the actual system

The following steps must be performed on the system:

- Switch off safety relay on the system
- Replace / insert the memory module
- Switching on

 <b>WARNING</b>
<b>Automatic system startup Can Cause Death, Serious Injury, or Property Damage</b>
After switching on, the safety relay changes to safety mode if all requirements are met. In safety mode, the safety program is executed and the outputs are controlled according to the safety program. Take appropriate organizational measures, such as deactivating the main circuit or cordoning off parts of the system, to ensure safety for persons and the system.

- The safety relay performs a target / actual comparison of the hardware configuration.
- The safety relay checks whether there is a released project on the memory module.
- If this is the case, the safety relay will load the project into its main memory and switch to safety mode.
- A function test must be conducted.

 <b>WARNING</b>
<b>Loss of the safety function. Can Cause Death, Serious Injury, or Property Damage.</b>
To ensure the safety of the system, a full function test of the system must be conducted and successfully completed. A complete function test consists of the following tests: <ul style="list-style-type: none"><li>• Configuration test (test of the configuration)</li><li>• System test (wiring test of the connected sensors and actuators)</li></ul>

- Normal operation of the system is now possible.

## 7.11.7 Converting projects from MSS 3RK3 to 3SK2

### How can I use MSS 3RK3 projects for 3SK2 safety relays?

With the help of macros, you can buffer logic diagrams created with an MSS 3RK3. You can re-use these macros when creating a configuration with a 3SK2 safety relay.



You will find additional information in Chapters "Export macros... (Page 99)" and "Import macros... (Page 100)."



## Function elements

### 8.1 Notes on parameter assignment

#### 8.1.1 Compatibility lists

Which safety relay is compatible with which accessories?

Safety relay	Diagnostics display			Interface modules	
	3RK3 V1.0	3RK3 V1.1	3SK2 V1.0	3RK3 PRO-FIBUS DP	3SK2 PRO-FINET
3RK3 Basic	Yes	Yes	Yes	Yes	No
MSS 3RK3 Advanced / MSS 3RK3 ASIsafe	No	Yes	Yes	Yes	Yes
3SK2 safety relay	No	No	Yes	Yes	Yes

Which function element is compatible with which safety relay?

Function element		Safety relay		
		3RK3 Basic	MSS 3RK3 Advanced / MSS 3RK3 ASIsafe	3SK2 safety relay
Cell functions	Input cell	Yes	Yes	Yes
	Output cell	Yes	Yes	Yes

8.1 Notes on parameter assignment

Function element		Safety relay		
		3RK3 Basic	MSS 3RK3 Advanced / MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	Monitoring Universal	No	Yes	Yes
	EMERGENCY STOP	Yes	Yes	Yes
	ESPE (electro-sensitive protective equipment)	Yes	Yes	Yes
	Safety shut-down mat (NC principle)	Yes	Yes	Yes
	Safety shut-down mat (cross-circuit principle)	Yes	Yes	Yes
	Protective door	Yes	Yes	Yes
	Protective door with tumbler	No	Yes	Yes
	Enabling button	Yes	Yes	Yes
	Two-hand operation	Yes	Yes	Yes
	Mode selector switch	Yes	Yes	Yes
	AS-i 2F-DI	No	Yes	No
	Muting functions	Muting (2-sensor-parallel)	No	Yes
Muting (4-sensor-parallel)		No	Yes	Yes
Muting (4-sensor-sequential)		No	Yes	Yes
Status functions	Device status	Yes	Yes	Yes
	Element status	No	Yes	Yes
Control functions	Device command	Yes	Yes	Yes
Logic functions	AND	Yes	Yes	Yes
	OR	Yes	Yes	Yes
	XOR	Yes	Yes	Yes
	NAND	Yes	Yes	Yes
	NOR	Yes	Yes	Yes
	NEGATION (NEG)	Yes	Yes	Yes
Flip-flop	FF-SR	Yes	Yes	Yes

Function element		Safety relay		
		3RK3 Basic	MSS 3RK3 Advanced / MSS 3RK3 ASIsafe	3SK2 safety relay
Counter functions	Counter (0 -> 1)	Yes	Yes	Yes
	Counter (1 -> 0)	Yes	Yes	Yes
	Counter (0 -> 1 / 1 -> 0)	Yes	Yes	Yes
Timer functions	With ON delay	Yes	Yes	Yes
	With ON delay (trigger)	Yes	Yes	Yes
	Passing make contact	Yes	Yes	Yes
	Passing make contact (trigger)	Yes	Yes	Yes
	With OFF delay	Yes	Yes	Yes
	With OFF delay (trigger)	Yes	Yes	Yes
	Clocking	Yes	Yes	Yes
Start functions	Monitored start	Yes	Yes	Yes
	Manual start	Yes	Yes	Yes
Output functions	Standard output	Yes	Yes	Yes
	F output	Yes	Yes	Yes
	Standard output delayed	No	No	Yes
	F output delayed	No	No	Yes
	AS-i 1..4F-DO	No	Yes	No

## 8.1.2 Parameterization of times

### WARNING

**Loss of the safety function.  
Can Cause Death, Serious Injury, or Property Damage.**

The value of each time setting must always be selected at the lowest possible value that the application requires (permits). The selection of the times must comply with the requirements resulting from the risk evaluation for the respective hazardous situation. Otherwise additional measures have to be taken to avoid circumventing the safety application.

## Input delay

The input delay is required for bouncing contacts (protective door) to stabilize the signals before they can be processed further by the function elements.

The input delay can be set to anywhere between 0 to 150 ms for all function elements.

When the inputs of the fieldbus process image are used, no input delay times can be set.

If safety-related AS-Interface inputs are used, the input delay time can be deactivated (= 0 s) or set to a value between 50 ...150 ms.

For master calls on the AS-i bus, an input delay time cannot be set.

For logic-driven signals that are read back, it is also not possible to set an input delay time; this pertains to all terminal types.



### **WARNING**

**Increase of fault response time  
Can Cause Death, Serious Injury, or Property Damage**

If the input delay increases, the overall response time of the safety program increases.

## 8.1.3 Parameterization of start conditions

### Start conditions

The following start conditions must be fulfilled before the output of a function element is set:

- When the startup test is active, the sensor that is being monitored must be actuated once. Faults must not occur here.
- If any faults do occur, they must be rectified and acknowledged.

### Monitored / manual start

During a monitored start, the start pulse of the safety equipment must be between 150 and 2000 ms.

A monitored start can be carried out with the following function elements:

- Monitoring Universal
- EMERGENCY STOP
- ESPE (electro-sensitive protective equipment)
- Safety shutdown mat (NC principle)
- Safety shutdown mat (cross-circuit principle)
- Protective door
- Protective door with tumbler
- Standard output

- Start functions
- Output functions

In the case of a manual start, a rising edge 0->1 is required as the start condition at the START input.

### 8.1.4 Discrepancy monitoring

The discrepancy monitoring tolerates, within a defined time window, that associated signals are not available at the same time. If this time is exceeded, an enable signal is not output. The discrepancy monitoring can be set in the properties of the monitoring function. The following table provides an overview of discrepancy monitoring for the monitoring functions when they are connected to two-channel sensors:

Monitoring function	Discrepancy monitoring	Discrepancy time	Can be set in function element
Monitoring Universal	can be set to on / off	$\infty$ or can be set from/to: 0 ... 60000 ms,	Yes, with parameter - Input > Type "two-channel".
EMERGENCY STOP	on	5000 ms	No
ESPE (electro-sensitive protective equipment)	on	$\infty$	No
Safety shutdown mat (NC principle)	on	5000 ms	No
Safety shutdown mat (cross-circuit principle)	off	-	No
Protective door	can be set to on / off	$\infty$ or can be set from/to: 0 ... 60000 ms,	Yes, with parameter - Input > Type "two-channel".
Protective door with tumbler	can be set to on / off	$\infty$ or can be set from/to: 0 ... 60000 ms,	Yes, with parameter - Input > Type "two-channel".
Enabling button	on	$\infty$	No
Two-hand operation	on	5000 ms	Yes
Mode selector switch	off	-	Yes
AS-i 2F-DI	off	-	Yes

#### Note

The configured discrepancy time of the "protective door" and "Protective door with tumbler" monitoring functions must be greater than the configured input delay because otherwise a discrepancy time violation may occur with bouncing contacts, e.g. when the protective door is closed.

#### Note

The combination of "Discrepancy time monitoring on" and "Discrepancy time  $\infty$ " means that no discrepancy time violation exists and, as such, no fault is triggered. The system cannot be switched on, however, until after the discrepancy condition violation has been rectified.

### 8.1.5 Cross-circuit detection

A cross-circuit, which is a short-circuit between channels, can only occur with redundant device controllers. Cross-circuit detection is only possible when the sensor is operated on T1 / T2 of the relevant device, see also "Connection rules (Page 147)". The cross-section detection can be activated in the properties of the monitoring function.

Since a cross-circuit is an error requiring acknowledgment, a cross-circuit that has been rectified must be acknowledged by means of a reset.

#### Note

##### AS-i slaves

If AS-i slaves are used, activation of cross-circuit detection is not possible.

If a cross-circuit occurs at the sensor inputs of a safety-related AS-i input slave, this slave generates a code sequence error that results in shutdown of the associated function element. For further information, please refer to the documentation of the respective AS-i slave.

The following table provides an overview of cross-circuit detection for the monitoring functions:

Monitoring function	Cross-circuit detection	Instructions	Can be set in function element
Monitoring Universal	can be set to on / off	-	Yes
EMERGENCY STOP	can be set to on / off	-	Yes
ESPE (electro-sensitive protective equipment)	can be set to on / off	<ul style="list-style-type: none"> <li>If the ESPE is equipped with solid-state outputs, cross-circuit detection must be deactivated.</li> <li>If the ESPE has floating contacts, only the sensor line between the safety relay and the ESPE is tested when cross-circuit detection is activated. The light array is not tested.</li> </ul>	Yes
Safety shutdown mat (NC principle)	can be set to on / off	-	Yes
Safety shutdown mat (cross-circuit principle)	on	<p>In the case of this monitoring function, a cross-circuit is not a fault, but corresponds to the safety requirement. Therefore, a cross-circuit is not evaluated as a fault and need not be acknowledged.</p> <p>To be able to ensure absence of interaction of the safety shutdown mat with the cross-circuit detection of other sensors, only the safety shutdown mat is connected to the test outputs T1 / T2.</p>	No
Protective door	can be set to on / off	-	Yes
Protective door with tumbler	can be set to on / off	-	Yes



Monitoring function	Cross-circuit detection	Instructions	Can be set in function element
Enabling button	on	Cross-circuit monitoring is always implemented in the case of a single-channel enabling button. This is why a single-channel enabling button must also be connected via a test output. Non-floating wiring is not possible.	No
Two-hand operation	can be set to on / off	A two-hand control of type III C (Cat. 4) can only be implemented if cross-circuit detection is activated.	Yes
Mode selector switch	off	-	No
AS-i 2F-DI	off	-	No

### 8.1.6 Parameter - input type

The "2xsingle-channel (NC/NC)" and "2x2xsingle-channel (NO/NO/NO/NO)" types of the "Input" parameter are only available for AS-i terminals.

#### Note

#### Parameter "Type" 2xsingle-channel


With this input circuit type, the discrepancy monitoring, sequence monitoring, and cross-circuit detection are deactivated.

### 8.1.7 Fault signaling output (FAULT)

The fault signaling output (FAULT) is activated for all monitoring and output functions and does not need to be wired. The fault signaling output indicates wiring and logic errors.

## 8.2 Cell function

### 8.2.1 Input cell

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Cell functions	Input cell		✓	✓	✓

## Description


The input cell provides signal states for further processing in the safety logic. The signal states can be read in, for example, from the terminals of the input modules or also through a bus system.

The signal of an input cell can be used multiple times in the safety logic.

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	Terminal - Input	Select the input to be processed by the function element.
	Input delay [ms]	Select here when the function elements further process the signals: <ul style="list-style-type: none"> <li>Input delay = "0" The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>Input delay not "0" This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.

### 8.2.2 Output cell

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Cell functions	Output cell		✓	✓	✓

## Description

The output cell forwards the signal states from the safety logic to an output. The signal states can be output, for example, at the terminal of an output module or also through a bus system.

### Note

#### Setting/resetting of a safety-related AS-i output


For interconnection of multiple outputs of a safety-related AS-i output or auxiliary signals (AUX), you can use the output function "AS-i 1..4F-DO."

## Parameters

Parameter name		Description/parameter value
General	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
Parameter	Terminal - Output	Select the output to be processed by the function element.

## 8.3 Monitoring functions

### 8.3.1 Monitoring Universal

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	Monitoring Universal		-	✓	✓

## Description

With the "Monitoring Universal" function element, you evaluate signals of any sensors using contacts with a positive opening operation, normally-open contacts, or a normally-closed/ normally-open combination.

When the sensor is actuated, function output Q is deactivated, i.e., set to "0."



### WARNING

#### **Automatic system startup following transmission error at fieldbus inputs. Can Cause Death, Serious Injury or Property Damage**

Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored." This is necessary to achieve SILCL 3 as per EN 61508 and PL e/ Cat. 4 as per EN ISO 13849-1.


## Parameters

Parameter name	Description parameter value	
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number. This number ensures a unique reference to the function element during diagnostics.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameter</b>	Discrepancy monitoring	This parameter is only available with parameter - Input > Type "two-channel." You can choose whether this function will be deactivated or whether the discrepancy time between the inputs will be monitored.
	Discrepancy time infinite	You can select the discrepancy time infinite setting.
	Discrepancy time [ms]	You can select the discrepancy time between 0 and 60000 ms. Please note that the discrepancy time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.
	Sequence monitoring	You can deactivate the sequence monitoring of the inputs or define whether they will be monitored in ascending (IN1 > IN2) or descending (IN2 > IN1) order.

Parameter name	Description parameter value	
Parameter - Input	Type	<p>Use these parameters to determine the input type of the function element:</p> <ul style="list-style-type: none"> <li>single-channel (NC) IN1 is monitored for "1", i.e. function output Q is deactivated when there is a "0" signal.</li> <li>single-channel (NO) IN1 is monitored for "0," i.e., function output Q is deactivated when there is a "1" signal.</li> <li>two-channel (NC/NC) IN1 and IN2 are monitored for "1", i.e. function output Q is deactivated when there is at least one "0" signal.</li> <li>two-channel (NO/NO) IN1 and IN2 are monitored for "0," i.e., function output Q is deactivated when there is at least one "1" signal.</li> <li>two-channel (NC/NO) IN1 (NC) is monitored for "1" and IN2 (NO) is monitored for "0" (antivalent), i.e., function output Q is deactivated when there is a signal change at IN1 or IN2.</li> <li>2xsingle-channel (NC/NC) IN1 and IN2 are monitored for "1," i.e., function output Q is deactivated when there is at least one "0" signal. There are no further dependencies between the two signals.</li> </ul>
	IN1	Select the input to be processed by the function element.
	IN2	<p>This parameter is only available if the following selection is made under parameter - Input &gt; Type:</p> <ul style="list-style-type: none"> <li>two-channel</li> <li>2xsingle-channel</li> </ul> <p>IN2 is automatically assigned depending on the selected input IN1.</p>
	Input delay [ms]	<p>Select here when the function elements further process the signals:</p> <ul style="list-style-type: none"> <li>Input delay = "0" The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>Input delay not "0" This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	Cross-circuit detection	<p>When this parameter is activated, cross-circuits are detected with the aid of test outputs at the inputs.</p> <p>If AS-i slaves are used, cross-circuit detection is not possible.</p>

Parameter name		Description parameter value
Parameter - Start	Startup test	<ul style="list-style-type: none"> <li>Activated: After the switch from substitute value to real value or after the switch to safety or test mode, a start test must be conducted. For this purpose, the sensor to be monitored must be actuated once. Only then can function output Q be activated depending on the type of start.</li> <li>Deactivated: A start test is generally not required.</li> </ul>
	Start type	<ul style="list-style-type: none"> <li>Automatic: The function output Q is set as soon as all start conditions are fulfilled.</li> <li>Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal has changed from "0 → 1 → 0."</li> <li>Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1".</li> </ul>

### 8.3.2 EMERGENCY STOP

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	EMERGENCY STOP		✓	✓	✓

#### Description

With the "EMERGENCY STOP" function element, signals from the EMERGENCY STOP control devices with forcibly guided contacts are evaluated.

After the EMERGENCY STOP control device has been operated, function output Q is deactivated, i.e., set to "0."

#### WARNING

##### **Automatic system startup following transmission error at fieldbus inputs. Can Cause Death, Serious Injury or Property Damage**

Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored." This is necessary to achieve SILCL 3 as per EN 61508 and PL e/ Cat. 4 as per EN ISO 13849-1.


## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameter - Input</b>	Type	This parameter defines the input type of the function element. <ul style="list-style-type: none"> <li>single-channel (NC): IN1 is monitored for "1", i.e. function output Q is deactivated when there is a "0" signal.</li> <li>two-channel (NC/NC): IN1 and IN2 are monitored for "1", i.e. function output Q is deactivated when there is at least one "0" signal.</li> <li>2xsingle-channel (NC/NC) IN1 and IN2 are monitored for "1," i.e., function output Q is deactivated when there is at least one "0" signal. There are no further dependencies between the two signals.</li> </ul>
	IN1	Select the input to be processed by the function element.
	IN2	Only available with the parameter - Input > Type two-channel (NC/NC) and 2xsingle-channel (NC/NC). IN2 is automatically assigned depending on the selected input IN1.
	Input delay [ms]	Select here when the function elements further process the signals: <ul style="list-style-type: none"> <li>Input delay = "0": The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>Input delay not "0": This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	Cross-circuit detection	When this parameter is activated, cross-circuits are detected with the aid of test outputs at the inputs. If AS-i slaves are used, cross-circuit detection is not possible.

8.3 Monitoring functions

Parameter name		Description/parameter value
Parameter - Start	Startup test	<ul style="list-style-type: none"> <li>Activated: After the switch from substitute value to real value or after the switch to safety or test mode, a start test must be conducted. For this purpose, the sensor to be monitored must be actuated once. Only then can function output Q be activated depending on the type of start.</li> <li>Deactivated: A start test is generally not required.</li> </ul>
	Start type	<ul style="list-style-type: none"> <li>Automatic: The function output Q is set as soon as all start conditions are fulfilled.</li> <li>Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal has changed from "0 → 1 → 0."</li> <li>Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1".</li> </ul>

8.3.3 ESPE (electro-sensitive protective equipment)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	ESPE		✓	✓	✓


Description

With the function element "ESPE" (electro-sensitive protective equipment) signals from, for example, light curtains and laser scanners are evaluated.

The following ESPE types are supported by the safety relay:

- ESPE type 4 (self-monitoring) for applications up to SILCL 3 as per EN 62061
- ESPE type 2 with **integrated automatic testing** for applications up to SILCL 1 and SILCL 2 as per EN 62061  
(ESPE type 2 with manual or parameterizable testing are **not** supported.)

When something enters the protective field of the ESPE, the function output Q is deactivated, i.e., set to "0".

<p> <b>WARNING</b></p> <p><b>Automatic system startup following transmission error at fieldbus inputs. Can Cause Death, Serious Injury or Property Damage</b></p> <p>Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored." This is necessary to achieve SILCL 3 as per EN 61508 and PL e/ Cat. 4 as per EN ISO 13849-1.</p>
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## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameter - Input</b>	Type	Use these parameters to determine the input type of the function element. <ul style="list-style-type: none"> <li>single-channel (NC): IN1 is monitored for "1", i.e. function output Q is deactivated when there is a "0" signal.</li> <li>two-channel (NC/NC): IN1 and IN2 are monitored for "1", i.e. function output Q is deactivated when there is at least one "0" signal.</li> <li>2xsingle-channel (NC/NC) IN1 and IN2 are monitored for "1," i.e., function output Q is deactivated when there is at least one "0" signal. On restart, the other channel must not have passed through zero.</li> </ul>
	IN1	Select the input to be processed by the function element.
	IN2	This parameter is available with parameter - Input > Type two-channel (NC/NC) and with 2xsingle-channel (NC/NC). IN2 is automatically assigned depending on the selected input IN1.
	Input delay [ms]	Select here when the function elements further process the signals: <ul style="list-style-type: none"> <li>Input delay = "0": The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>Input delay not "0": This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	Cross-circuit detection	When this parameter is activated, cross-circuits are detected with the aid of test outputs at the inputs. If you use ESPE with electronic outputs you must deactivate cross-circuit detection. If AS-i slaves are used, cross-circuit detection is not possible.

8.3 Monitoring functions

Parameter name		Description/parameter value
Parameter - Start	Startup test	<ul style="list-style-type: none"> <li>Activated: After the switch from substitute value to real value or after the switch to safety or test mode, a start test must be conducted. For this purpose, the sensor to be monitored must be actuated once. Only then can function output Q be activated depending on the type of start.</li> <li>Deactivated: A start test is generally not required.</li> </ul>
	Start type	<ul style="list-style-type: none"> <li>Automatic: The function output Q is set as soon as all start conditions are fulfilled.</li> <li>Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal has changed from "0 → 1 → 0."</li> <li>Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1".</li> </ul>

8.3.4 Safety shutdown mat (NC principle)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	Safety shutdown mat (NC principle)		✓	✓	✓

Description

With the "Safety shutdown mat (NC principle)" function element, the signals from the safety shutdown mats with NC contacts are evaluated.

When the safety shutdown mat is actuated, function output Q is deactivated, i.e., set to "0."

<p><b>⚠ WARNING</b></p> <p><b>Automatic system startup following transmission error at fieldbus inputs. Can Cause Death, Serious Injury or Property Damage</b></p> <p>Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored." This is necessary to achieve SILCL 3 as per EN 61508 and PL e/ Cat. 4 as per EN ISO 13849-1.</p>
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## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameter - Input</b>	Type	Use these parameters to determine the input type of the function element: <ul style="list-style-type: none"> <li>• single-channel (NC): IN1 is monitored for "1", i.e. function output Q is deactivated when there is a "0" signal.</li> <li>• two-channel (NC/NC): IN1 and IN2 are monitored for "1", i.e. function output Q is deactivated when there is at least one "0" signal.</li> <li>• 2xsingle-channel (NC/NC) IN1 and IN2 are monitored for "1," i.e., function output Q is deactivated when there is at least one "0" signal. There are no further dependencies between the two signals.</li> </ul>
	IN1	Select the input to be processed by the function element.
	IN2	This parameter is available with parameter - Input > Type two-channel (NC/NC) and with 2xsingle-channel (NC/NC). IN2 is automatically assigned depending on the selected input IN1.
	Input delay [ms]	Select here when the function elements further process the signals: <ul style="list-style-type: none"> <li>• Input delay = "0": The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>• Input delay not "0": This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	Cross-circuit detection	When this parameter is activated, cross-circuits are detected with the aid of test outputs at the inputs. If AS-i slaves are used, cross-circuit detection is not possible.

8.3 Monitoring functions

Parameter name		Description/parameter value
Parameter - Start	Startup test	<ul style="list-style-type: none"> <li>Activated: After the switch from substitute value to real value or after the switch to safety or test mode, a start test must be conducted. For this purpose, the sensor to be monitored must be actuated once. Only then can function output Q be activated depending on the type of start.</li> <li>Deactivated: A start test is generally not required.</li> </ul>
	Start type	<ul style="list-style-type: none"> <li>Automatic: The function output Q is set as soon as all start conditions are fulfilled.</li> <li>Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal has changed from "0 → 1 → 0."</li> <li>Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1".</li> </ul>


8.3.5 Safety shutdown mat (cross-circuit principle)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	Safety shutdown mat (cross-circuit principle)		✓	✓	✓

Description

With the "Safety shutdown mat (cross-circuit principle)" function element, the signals from the safety shutdown mats with cross-circuit detection are evaluated.

When the safety shutdown mat is actuated, function output Q is deactivated, i.e., set to "0."

 <b>WARNING</b>
<p><b>Automatic system startup following transmission error at fieldbus inputs. Can Cause Death, Serious Injury or Property Damage</b></p> <p>Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored." This is necessary to achieve SILCL 3 as per EN 61508 and PL e/ Cat. 4 as per EN ISO 13849-1.</p>

**Note**

If a safety shutdown mat (cross-circuit principle) is connected to a slot (safety relay or expansion module), cross-circuit detection must be deactivated for the remaining inputs on this slot because otherwise the monitoring functions configured for these inputs will also signal a cross-circuit when somebody steps on the safety shutdown mat.

**Exception:**

On the 3SK2 safety relay (45 mm), there are two independent test cycle pairs. You can use one test cycle pair for the safety shutdown mat (cross-circuit principle), and the other test cycle pair independently of this with monitoring functions for cross-circuit detection.


**Parameters**

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameter - Input</b>	Type	The input type of the function element is defined: <ul style="list-style-type: none"> <li>two-channel (NC/NC): IN1 and IN2 are monitored for "1", i.e. shutdown on operation of the safety shutdown mat.</li> </ul>
	IN1	Select the input to be processed by the function element.
	IN2	IN2 is automatically assigned depending on the selected input IN1.
	Input delay [ms]	Select here when the function elements further process the signals: <ul style="list-style-type: none"> <li>Input delay = "0": The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>Input delay not "0": This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>

8.3 Monitoring functions

Parameter name		Description/parameter value
Parameter - Start	Startup test	<ul style="list-style-type: none"> <li>Activated: After the switch from substitute value to real value or after the switch to safety or test mode, a start test must be conducted. For this purpose, the sensor to be monitored must be actuated once. Only then can function output Q be activated depending on the type of start.</li> <li>Deactivated: A start test is generally not required.</li> </ul>
	Start type	<ul style="list-style-type: none"> <li>Automatic: The function output Q is set as soon as all start conditions are fulfilled.</li> <li>Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal has changed from "0 → 1 → 0."</li> <li>Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1".</li> </ul>


8.3.6 Protective door

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	Protective door		✓	✓	✓

Description

With the "Protective door" function element, the signals from the protective doors or safety flaps are evaluated by means of positive opening contacts or an NC/NO combination.

When the protective door is actuated, function output Q is deactivated, i.e., set to "0."

<p> <b>WARNING</b></p> <p><b>Automatic system startup following transmission error at fieldbus inputs. Can Cause Death, Serious Injury or Property Damage</b></p> <p>Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored." This is necessary to achieve SILCL 3 as per EN 61508 and PL e/ Cat. 4 as per EN ISO 13849-1.</p>
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## Parameters

Parameter name		Description parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameter</b>	Discrepancy monitoring	This parameter is only available with parameter - Input > Type "two-channel." You can choose whether this function will be deactivated or whether the discrepancy time between the inputs will be monitored.
	Discrepancy time infinite	You can set the discrepancy time to infinite.
	Discrepancy time [ms]	You can set the discrepancy time between 0 and 60000 ms. Please note that the discrepancy time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.
	Sequence monitoring	You can deactivate the sequence monitoring of the inputs or define whether they will be monitored in ascending (IN1 > IN2) or descending (IN2 > IN1) order.

Parameter name	Description parameter value	
<b>Parameter - Input</b>	Type	Use these parameters to determine the input type of the function element: <ul style="list-style-type: none"> <li>• single-channel (NC) IN1 is monitored for "1", i.e. function output Q is deactivated when there is a "0" signal.</li> <li>• two-channel (NC/NC) IN1 and IN2 are monitored for "1", i.e. function output Q is deactivated when there is at least one "0" signal.</li> <li>• two-channel (NC/NO) IN1 (NC) is monitored for "1" and IN2 (NO) is monitored for "0" (antivalent), i.e., function output Q is deactivated when there is a signal change at IN1 or IN2.</li> <li>• 2xsingle-channel (NC/NC) IN1 and IN2 are monitored for "1", i.e. function output Q is deactivated when there is at least one "0" signal. There are no further dependencies between the two signals.</li> </ul>
	IN1	Select the input to be processed by the function element.
	IN2	This parameter is only available if the following selection is made under parameter - Input > Type: <ul style="list-style-type: none"> <li>• two-channel</li> <li>• 2xsingle-channel</li> </ul> IN2 is automatically assigned depending on the selected input IN1.
	Input delay [ms]	Select here when the function elements further process the signals: <ul style="list-style-type: none"> <li>• Input delay = "0" The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>• Input delay not "0" This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.
	Cross-circuit detection	When this parameter is activated, cross-circuits are detected with the aid of test outputs at the inputs. If AS-i slaves are used, cross-circuit detection is not possible.




Parameter name		Description parameter value
Parameter - Start	Startup test	<ul style="list-style-type: none"> <li>Activated: After the switch from substitute value to real value or after the switch to safety or test mode, a start test must be conducted. For this purpose, the sensor to be monitored must be actuated once. Only then can function output Q be activated depending on the type of start.</li> <li>Deactivated: A start test is generally not required.</li> </ul>
	Start type	<ul style="list-style-type: none"> <li>Automatic: The function output Q is set as soon as all start conditions are fulfilled.</li> <li>Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal has changed from "0 → 1 → 0."</li> <li>Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1".</li> </ul>

**Note**

The configured discrepancy time of the "protective door" monitoring function must be greater than the configured input delay because otherwise a discrepancy time violation may occur with bouncing contacts, e.g., when the protective door is closed.

### 8.3.7 Protective door with tumbler

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	Protective door with tumbler		-	✓	✓

**Note**

The function element is not available in Safety ES for all devices. If a device that does not support this function element is configured in the configuration, the function element is hidden in the catalog window.

**Description**

With the "Protective door with tumbler" function element, you evaluate signals from protective doors. You can control the door lock and monitor its status.

For this purpose, the element has the following inputs:

- two function inputs IN1 and IN2 for position detection of the protective door.
- a "FEEDBACK\_LOCK" function input for acquiring the locking status of the lock.
- an "IN\_LOCK" function input for controlling the lock.

The element provides the following signals as the result:

- The switch-off signal for the system is output through function output "Q."
- The control signal for the lock is output through function output "LOCK."
- Error messages are output through function output "FAULT."

### Functional principle

Function output Q of this element is only set to the value "1" if the protective door is closed and locked.

When an unlocking command (= value "1") is applied to function input "IN\_LOCK," function output Q is immediately set to "0" and the tumbler is unlocked after a settable unlocking time through function output LOCK.

If the unlocking command is applied to function input "IN\_LOCK" before the unlocking time has elapsed, the tumbler will remain closed and the system can restart.

To lock a disengaged lock again, it is not necessary for the protective door to have been opened in the meantime. It can remain closed and be relocked immediately.

Time values are not saved. At the start of safety or test mode, all time values begin with their initial values.

### Start override

The start override enables function output Q to be set to the value "1" although an unlocking command is pending. This function can be used if the locking or unlocking command comes from a standstill monitor. (The standstill monitor only transmits the locking command when standstill is no longer detected.)

You can define the length of the start time in the "Start time" parameter if the start type "manual" or "monitored" has been selected.

This setting has the following properties:

- When the START command is applied to function input START, the tumbler of the element is automatically engaged if the unlocking command is pending at function input IN\_LOCK and the protective door is closed. Function output Q is set to "1." Concurrently with this, the start time is started and the "Start override active" message is set.  
If the protective door is open, locking is only performed if this is permitted in the "Tumbler with open protective door" parameter.
- You can adapt the length of the start time to the application using the "Start time" parameter. At the latest after the start time has elapsed, the "Start override active" message will be reset. The locking command must then be pending at function input IN\_LOCK. If no locking command is pending, function output Q will be set to value "0" again and the lock will be disengaged after the unlocking time has elapsed. If the locking command is detected before the start time has elapsed, the start time will be interrupted. The tumbler remains locked and the function output retains the value "1."
- If another starting command is detected at function input "START" while the startup time is running, the startup time is started from the beginning without the signal state of function outputs Q and LOCK being changed.
- This function is deactivated if the "start time" parameter is parameterized to value "0." A value not equal to "0" activates the function.

## Interlock types

The "Protective door with tumbler" function element can be used for spring-locked or solenoid-locked position switches.

- Spring-locked according to closed-circuit current principle  
The tumbler is locked passively and unlocked actively, i.e., spring tension keeps the tumbler engaged. On a power failure, the tumbler remains engaged.
- Solenoid-locked according to open-circuit current principle  
The tumbler has to be locked actively, i.e., magnetic force (solenoid energized) keeps the tumbler engaged. On a power failure, the tumbler is automatically unlocked and thus allows the service personnel to enter the system while it is de-energized.

### **WARNING**

**Protective door unlocking following power failure.  
Can Cause Death, Serious Injury, or Property Damage.**

Note that this variant of the locking on power failure takes no account of possible run-down times of the system. If this can result in a hazard for persons, the tumbler must not be implemented in this way.

**⚠ WARNING**

**Unlocked safety door after switching on with unlock command pending.  
Can cause death, serious injury, or property damage.**

After the supply voltage is applied, the safety door is unlocked immediately if an unlock command is pending, without the unlock time continuing or running again.

Plan appropriate actions to avoid any danger.

**⚠ WARNING**

**Automatic system startup following transmission error at fieldbus inputs.  
Can Cause Death, Serious Injury or Property Damage**

Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored." This is necessary to achieve SILCL 3 as per EN 61508 and PL e/ Cat. 4 as per EN ISO 13849-1.

**Note**

The configured discrepancy time of the "Protective door with tumbler" monitoring function must be greater than the configured input delay because otherwise a discrepancy time violation may occur with bouncing contacts, e.g., when the protective door is closed.

**Note**

On a signal change at the FEEDBACK\_LOCK function input, an error is generated immediately, if the signal at function output LOCK has not changed.

**Parameters**

Parameter name	Description parameter value	
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. If this parameter is deactivated, the set substitute value is made available at outputs Q and LOCK.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
	Substitute value LOCK	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output LOCK = 0 substitute value "1" means output LOCK = 1

Parameter name	Description parameter value	
<b>Parameter</b>	Discrepancy monitoring	This parameter is only available with parameter - Input > Type "two-channel." You can choose whether this function will be deactivated or whether the discrepancy time between the inputs will be monitored.
	Discrepancy time infinite	You can set the discrepancy time to infinite.
	Discrepancy time [ms]	You can set the discrepancy time between 0 and 60000 ms. Please note that the discrepancy time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.
	Sequence monitoring	You can deactivate the sequence monitoring of the inputs or define whether they will be monitored in ascending (IN1 > IN2) or descending (IN2 > IN1) order.


8.3 Monitoring functions

Parameter name	Type	Description parameter value
<b>Parameter - Input</b>	Type	Use these parameters to determine the input type of the function element: <ul style="list-style-type: none"> <li>• single-channel (NC) IN1 is monitored for "1", i.e. function output Q is deactivated when there is a "0" signal.</li> <li>• two-channel (NC/NC) IN1 and IN2 are monitored for "1", i.e. function output Q is deactivated when there is at least one "0" signal.</li> <li>• two-channel (NC/NO) IN1 (NC) is monitored for "1" and IN2 (NO) is monitored for "0" (antivalent), i.e., function output Q is deactivated when there is a signal change at IN1 or IN2.</li> <li>• 2xsingle-channel (NC/NC) IN1 and IN2 are monitored for "1", i.e. function output Q is deactivated when there is at least one "0" signal. There are no further dependencies between the two signals.</li> </ul>
	IN1	Select the input to be processed by the function element.
	IN2	This parameter is only available if the following selection is made under parameter - Input > Type: <ul style="list-style-type: none"> <li>• two-channel</li> <li>• 2xsingle-channel</li> </ul> IN2 is automatically assigned depending on the selected input IN1.
	Input delay [ms]	Select here when the function elements further process the signals: <ul style="list-style-type: none"> <li>• Input delay = "0" The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>• Input delay not "0" This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.
	Cross-circuit detection	When this parameter is activated, cross-circuits are detected with the aid of test outputs at the inputs. If AS-i slaves are used, cross-circuit detection is not possible.
	Tumbler with the open protective door	The tumbler can only be engaged while the protective door is closed or open, depending on the "tumbler with open protective door" parameter. You can set the following parameters: <ul style="list-style-type: none"> <li>• not lockable The tumbler cannot be engaged while the protective door is open.</li> <li>• lockable</li> </ul>

Parameter name	Description parameter value	
		<p>The tumbler can be locked or unlocked irrespective of the position of the protective door.</p> <p><b>Note:</b> When position switches whose door and lock contacts act on the same slave are used with AS-Interface, "lockable" must always be chosen in order to enable proper operation.</p>
	Interlock type	<p>Define the type of lock here:</p> <ul style="list-style-type: none"> <li>• Spring locking</li> <li>• Solenoid locking</li> </ul>
	Unlocking time [s]	<p>Here, you can define the unlocking time from 0 to 655 seconds. This parameter permits time-delayed unlocking of the protective door after the system has been shut down.</p>
<b>Parameters - Feedback circuit</b>	Feedback circuit monitoring	<p>The feedback circuit permits monitoring of the lock connected to the LOCK function output for correct locking. You can set the following parameters:</p> <ul style="list-style-type: none"> <li>• Deactivated</li> <li>• Enabled</li> </ul> <p>While the feedback circuit monitoring is activated, the following values are expected at the feedback input FEEDBACK_LOCK:</p> <ul style="list-style-type: none"> <li>• Protective door unlocked: expected feedback circuit signal = "1"</li> <li>• Protective door locked: expected feedback circuit signal = "0"</li> </ul>
	Feedback circuit switching time [s]	<p>Parameter only available if parameter - Feedback circuit - Monitoring is active.</p> <p>If the feedback circuit signal FEEDBACK_LOCK does not match the output signal LOCK no later than after the switching time has elapsed, function output "Q" will be switched off.</p> <p>Please note that the entered feedback circuit switching time is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>

Parameter name		Description parameter value
Parameter - Start	Startup test	<p>You can set the following parameters:</p> <ul style="list-style-type: none"> <li>Activated: After the switch from substitute value to real value or after the switch to safety or test mode, a start test must be conducted. For this purpose, the sensor to be monitored must be actuated once. Only then can function output Q be activated depending on the type of start.</li> <li>Deactivated: A start test is generally not required.</li> </ul>
	Startup time [s]	Here you can define a time between 0 and 60000 ms, during which the "IN_LOCK" locking command is to be overridden.
	Start type	<ul style="list-style-type: none"> <li>Automatic: The function output Q is set as soon as all start conditions are fulfilled.</li> <li>Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal has changed from "0 → 1 → 0."</li> <li>Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1".</li> </ul>

### 8.3.8 Enabling button

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	Enabling button		✓	✓	✓

#### Description

With the "Enabling button" function element, the signals from the enabling buttons are evaluated by means of an NO contact.

#### Note

##### Wiring of enabling button

An enabling button is always monitored for cross-circuit. This is achieved using test cycle outputs T1 and T2.

Cross-circuit monitoring is always implemented in the case of a single-channel enabling button too. This is why a single-channel enabling button must also be connected via a test output. Non-floating wiring is not possible.


When the enabling button is actuated, function output Q is activated, i.e. set to "1."



## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameter - Input</b>	Type	Use these parameters to determine the input type of the function element: <ul style="list-style-type: none"> <li>• single-channel (NO) IN1 is monitored for "1," i.e. function output Q is activated when there is a "1" signal.</li> <li>• two-channel (NO/NO) IN1 and IN2 are monitored for "1," i.e. function output Q is activated when there are two "1" signals.</li> <li>• 2xsingle-channel (NO/NO) IN1 and IN2 are monitored for "1," i.e. function output Q is activated when there are two "1" signals. There are no further dependencies between the two signals.</li> </ul>
	IN1	Select the input to be processed by the function element.
	IN2	Only available with the parameter - Input > Type two-channel (NO/NO) or 2xsingle-channel (NO/NO). IN2 is automatically assigned depending on the selected input IN1.
	Input delay [ms]	Select here when the function elements further process the signals: <ul style="list-style-type: none"> <li>• Input delay = "0" The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>• Input delay not "0" This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>

### 8.3.9 Two-hand operation

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	Two-hand operation		✓	✓	✓

#### Description

With the "Two-hand operation" function element, the signals from the two-hand control unit are evaluated.

When both buttons of the two-hand operated panel are operated within 500 ms (synchronous operation time), the function output Q is activated, i.e. set to "1".

The following table shows the type as defined by EN 574 or EN ISO 13851 that is achieved for the various requirements.


Input type	Input	Cross-circuit	Achievable type according to EN 574 or EN ISO 13851	
			MSS 3RK3	3SK2 safety relay
NO/NO	Fail-safe input terminal	X	III a	III c
NO/NO	Fail-safe AS-i input slave	-	III a	-
NO/NC/NO/NC	Fail-safe input terminal	X	III c	III c
NO/NC/NO/NC	Fail-safe input terminal	-	III c	III c
NO/NO/NO/NO	Fail-safe input terminal	X	III c	III c
NO/NO/NO/NO	Fail-safe input terminal	-	III a	III a
NO/NO/NO/NO	Fail-safe AS-i input slave	-	III c	-

X: enabled

#### Note

##### Two-hand control of type III C (Cat. 4)

A two-hand control of type III C (Cat. 4) can only be implemented if cross-circuit detection is activated.


 <b>WARNING</b>
<p><b>Loss of safety function with two-hand operation type IIIc with 3SK2 safety relay</b></p> <p><b>Can cause death, serious injury, or property damage.</b></p> <p>With cycle times of &gt; 30 ms, the synchronous actuation time can increase to up to 0.6 s for two-hand operation type IIIc.</p> <p>Set the cycle time to a maximum of 30 ms for two-hand operation type IIIc. This is the only way to guarantee the synchronous actuation time of 0.5 s required by the standard.</p>

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1

Parameter name	Description/parameter value	
<b>Parameter - Input</b>	Type	<p>Use these parameters to determine the input type of the function element:</p> <ul style="list-style-type: none"> <li>two-channel (NO/NO) IN1 and IN2 are monitored for "1," i.e. function output Q is activated when there are two "1" signals.</li> <li>four-channel (NO/NO/NO/NO) IN1 / IN2 and IN3 / IN4 are monitored for "1," i.e. function output Q is activated when there are four "1" signals.</li> <li>four-channel (NO/NC/NO/NC) IN1 / IN3 (NC) are monitored for "1", and IN2 / IN4 (NO) are monitored for "0" (antivalent), i.e. function output Q is activated when there is a signal change at IN1 / IN2 and IN3 / IN4.</li> <li>2xsingle-channel (NO/NO/NO/NO) IN1 / IN2 and IN3 / IN4 are monitored for "1," i.e. function output Q is activated when all four signals are "1." There are no further dependencies between the two signals.</li> </ul>
	IN1	Select the input to be processed by the function element.
	IN2	IN2 is automatically assigned depending on the selected input IN1.
	IN3	<p>This parameter is only available if the following selection is made under parameter - Input &gt; Type:</p> <ul style="list-style-type: none"> <li>four-channel</li> <li>2x2xsingle-channel</li> </ul> <p>Select the input to be processed by the function element.</p>
	IN4	<p>This parameter is only available if the following selection is made under parameter - Input &gt; Type:</p> <ul style="list-style-type: none"> <li>four-channel</li> <li>2x2xsingle-channel</li> </ul> <p>IN4 is automatically assigned depending on the selected input IN3.</p>
	Cross-circuit detection	<p>When this parameter is activated, cross-circuits are detected with the aid of test outputs at the inputs.</p> <p>A two-hand control of type III C (Cat. 4) can only be implemented if cross-circuit detection is activated.</p> <p>If AS-i slaves are used, cross-circuit detection is not possible.</p>
	Input delay [ms]	<p>Select here when the function elements further process the signals:</p> <ul style="list-style-type: none"> <li>Input delay = "0" The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>Input delay not "0" This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>

### 8.3.10 Mode selector switch

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	Mode selector switch		✓	✓	✓

#### Description

With the "Mode selector switch" function element, the signals from the mode selector switch are evaluated by means of NO contacts. Up to 5 operating modes can be defined. In the downstream logic, you can parameterize the operating mode to be implemented as required.

The outputs Q1 to Q5 are assigned to the inputs IN1 to IN5. When the input IN1 is activated, the function output Q1 is activated, i.e. set to "1." Further input and output pairs respond analogously.

If a start function is required for releasing an operating mode, this can be implemented with the "Start functions".

The contact switchover time is 1000 ms, that is, a switch must be made between the operating modes within this time.


#### Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	The substitute value "1" can only be assigned to one output at a time. "0" is automatically assigned to all others.
<b>Parameter</b>	Type of switch	Select the required step switch: 1 out of 2, 1 out of 3, 1 out of 4, 1 out of 5

8.3 Monitoring functions

Parameter name		Description/parameter value
Parameter - Input	Type	The input type of the function element is defined: <ul style="list-style-type: none"> <li>single-channel (NO) INx is monitored for "1," i.e. the function output Qx is deactivated when there is a "0" signal.</li> </ul>
	IN1	Select the input to be processed by the function element.
	IN2	Select the input to be processed by the function element.
	IN3	This parameter is available for switch type 1 out of 3; 1 out of 4, or 1 out of 5. Select the input that is to be processed by the function element.
	IN4	This parameter is available for switch type 1 of 4 or 1 of 5. Select the input to be processed by the function element.
	IN5	This parameter is available for switch type 1 of 5. Select the input to be processed by the function element.
	Input delay [ms]	Select here when the function elements further process the signals: <ul style="list-style-type: none"> <li>Input delay = "0" The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>Input delay not "0" This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.

8.3.11 AS-i 2F-DI

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Monitoring functions	AS-i 2F-DI		-	✓	-

**Note**

The function element is not available in Safety ES for all devices. If a device that does not support this function element is configured in the configuration, the function element is hidden in the catalog window.

**Description**

The monitoring function "AS-i 2F-DI" is used instead of an input cell if you want to diagnose both of the input terminal signals of the ASIsafe input slave.

The ANDed signal from both input terminal signals is provided at function output Q, which can be further connected in the user program.

Output Q = "1", when all inputs have the status "1".

## Background

The ASIsafe transmission protocol specifies that both the safety-related inputs of an AS-i slave must have the status "1" (valid code sequence) for the transmitted signal to be considered safe. In this way, the two inputs of the slave cannot be used individually for safety-related purposes. Any deviation from the valid code sequence, either through an error or a signal change to "0" on at least one input, must result in shutdown.

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	Enter a name for the element.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the substitute value is used.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated.
<b>Parameter - Input</b>	IN1	IN1 and IN2 are monitored for "1," i.e. function output Q is deactivated when there is at least one "0" signal.
	IN2	IN2 is automatically assigned depending on the selected input IN1.
	Input delay [ms]	Select here when the function element will further process the signals: <ul style="list-style-type: none"> <li>Input delay = "0": The input signals are further processed by the function element without time delay when there is a signal change.</li> <li>Input delay not "0": This parameter can be used to suppress signal interference. The signal state that was pending for most of the duration of the input delay is further processed.</li> </ul> Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.

## 8.4 Muting functions

### 8.4.1 Muting safety circuit

#### Application

If materials have to be conveyed into or out of a hazardous zone for further processing, the openings of the access paths can be large enough to enable a person to reach into or enter the hazardous zone. The requirement is to protect persons who may attempt to enter the hazardous zone from harm while allowing the materials to pass automatically unhindered. This is achieved with a special safety circuit that monitors the opening to the hazardous zone with electro-sensitive protective equipment (ESPE) and deactivates or "overrides" the protective equipment briefly when the material is conveyed. This safety circuit is known as "muting" and is described in the standard EN 61496-1-A.7.

#### Properties

The function element has the following inputs:

- Function input "FREE" for acquiring the signal of the protection equipment (e.g. ESPE)
- 2 or 4 function inputs "MS1" ... "MS4" for acquiring the signals of the muting sensors
- a "STOP" function input for acquiring the system status
- a function input "RESTART" for clearing the muting section

The function element provides the following signals as the result:

- The switch-on/off signal for the system is output through function output "Q."
- The "Muting active" or "Muting restart possible" status (0.5-Hz flashing) is output through function output "MUT."
- Error messages are output through function output "FAULT"

---

#### Note

The sensors for starting and ending muting operation must be mutually independent and permanently wired.

---

#### Description

The "Muting" function element permits temporary suppression (muting) of a protective field safety function for a specific purpose, e.g. for conveying materials through the protective field.

This muting mode has the following properties:

- Muting cannot be disabled from the application.
- Muting is time-monitored and is possible for no longer than the parameterized "max. muting time."
- The signal of the protective field safety function is read in by the function element at function input FREE.



- If the value "1" is applied to function input FREE (protective field free), function output Q is set to the value "1" (system running), provided that the "Muting" function element has not detected an error.
- If muting operation has been started, the value at function input FREE will be suppressed, i.e. the value "1" is still output at function output Q despite the protective field violation. The safety function is suppressed and the system continues to run.
- After muting has ended, the value at function input FREE is evaluated again. The overridden safety function is activated again.

## Muting operation

The following figure shows a typical muting arrangement

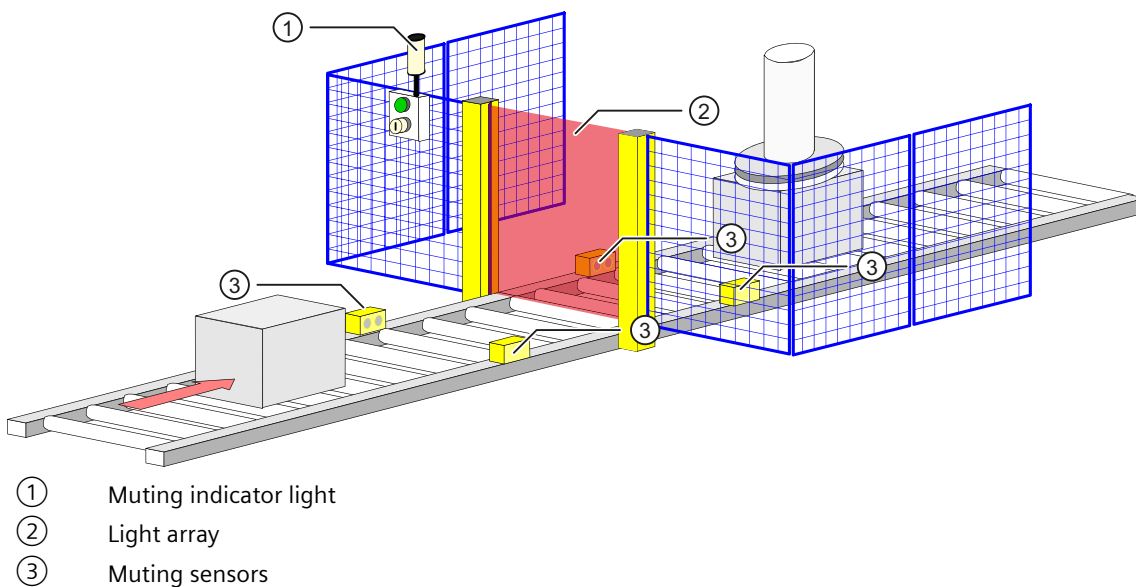


Figure 8-1 Typical muting equipment

Muting can be divided into five "muting phases":

- Phase 1 (= muting off)
  - The muting section is free
  - The material is in front of the opening or still in front of the muting sensors.
  - The protective equipment is still active and the muting indicator light is off.
- Phase 2 (= start muting)
  - The material is moving into the muting section and the material triggers the muting sensors for starting muting.
  - The protective equipment is now overridden and the muting indicator light is on.

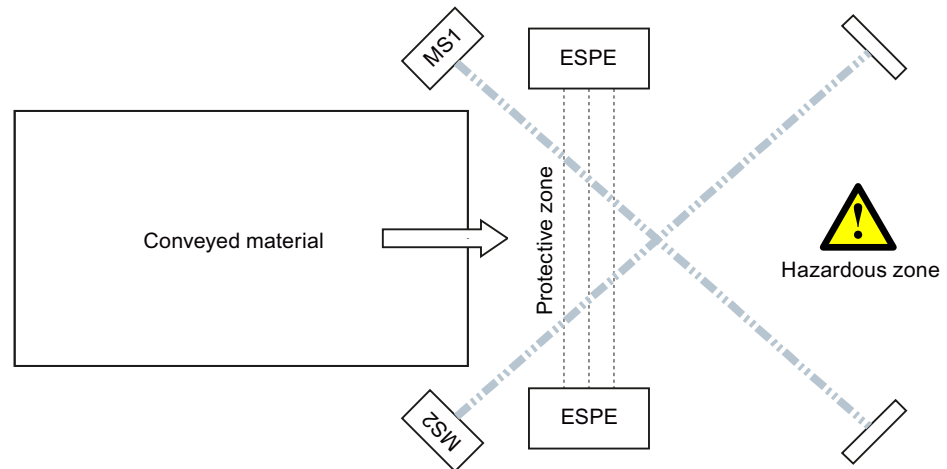
## 8.4 Muting functions

- Phase 3 (= in muting)
  - The material moves from the input to the output area of the muting section and the material triggers both the muting sensors for starting muting and the muting sensors for ending muting.
  - The protective equipment is overridden and the muting indicator light is on.
- Phase 4 (= stop muting)
  - The material moves out of the muting section.
  - The material has passed the muting sensor for starting muting. Now only the muting sensors for stopping muting are triggered.
  - The protective equipment is still overridden and the muting indicator light is still on.
- Phase 5 (= end muting)
  - The material exits the muting section.
  - The material has passed the muting sensors for ending muting.
  - The protective equipment is active again and the muting indicator light is off.

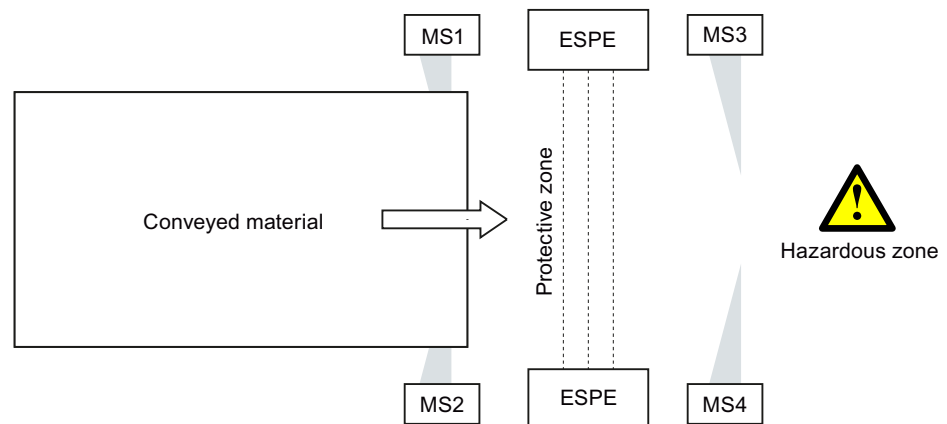
## Muting modes

Two mode groups are used for the "muting" function element with up to four muting sensors (= two pairs of sensors) at function inputs MS1 to 4:

- Parallel muting
  - 2-sensor parallel muting is possible if the dimensions of the conveyed material are not constant or too little space is available. This muting type must be operated with two muting sensors whose beams cross behind the protective field in the hazardous zone. To prevent tampering, the point where the muting sensor light barriers cross must be far enough inside the hazardous zone. No direction monitoring is possible because it is not possible to detect from which side the conveyed material is coming.

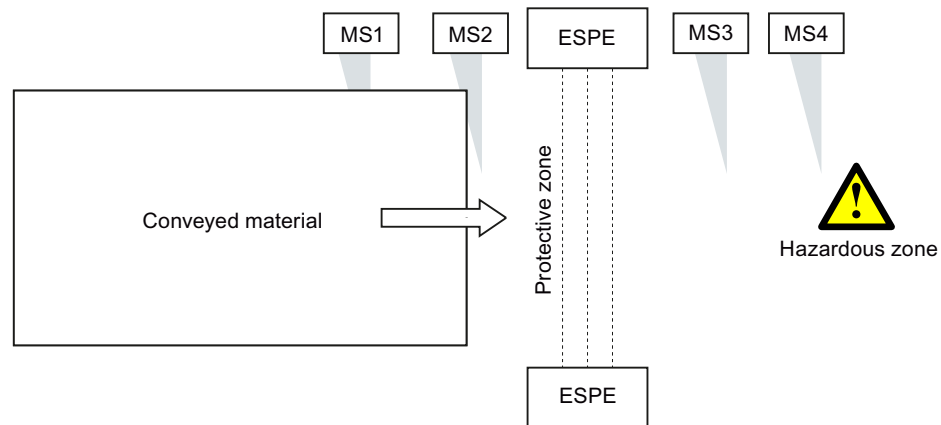


- 4-sensor parallel muting is used for very small conveyed materials. This type of muting is the functional equivalent to 2-sensor parallel muting but the activation and deactivation signal is obtained from two pairs of sensors each. Material conveying is possible in both directions.



- Sequential (= serial) muting

- 4-sensor sequential muting is used, above all, if the material to be conveyed into the hazardous zone always has the same dimensions and there is no lack of space. Material conveying is possible in both directions.



### 8.4.2 Description of the "muting" function

The signals of the muting sensors are monitored for signal discrepancy and signal sequence, depending on the muting mode.

#### Discrepancy monitoring

##### Signal discrepancy

For the duration of the discrepancy time, different signal states are accepted at the two muting sensors forming a sensor pair without an error being signaled. On a signal discrepancy, only the signals of the muting sensor belonging to a muting sensor pair are monitored. In the case of muting sensor pair 1, these are the muting sensors MS1 and MS2; for muting sensor pair 2, muting sensor MS3 and MS4. For a definable max. time (= "Discrepancy time" parameter), the signal states of the associated muting sensors must be different. On violation of the signal discrepancy condition, muting is ended and a discrepancy error (= logic error) is signaled. This error is automatically acknowledged as soon as the corresponding muting sensors have the value "0," i.e. they are no longer being triggered. While a discrepancy error is pending, the muting section can be cleared using the RESTART function. This is indicated, e.g. by the flashing muting indicator light.

Discrepancy monitoring is not performed in "4-sensor sequential" muting mode.

##### Signal dropout

The discrepancy time also allows signal dropouts of muting sensors, e.g. due to "gaps in conveyed materials", to be overridden for a period of time. Signal dropouts that are shorter than the assigned discrepancy time do not terminate muting.

The signal dropout suppression action of the "Discrepancy time" parameter affects all muting sensors, even in "4-sensor sequential" muting mode.

## Sequence monitoring

Signal sequence monitoring is only possible in muting modes with more than 2 muting sensors. In the case of 4-sensor sequential muting, the signals of all four muting sensors and, in the case of 4-sensor parallel muting, the signals of the muting sensor pairs are monitored for their sequence. On violation of the sequence condition, muting is ended and a sequence error (= logic error) is signaled. This error is automatically acknowledged as soon as all muting sensors have the value "0," i.e. they are no longer being triggered. While a sequence error is pending, the muting section can be cleared using the RESTART function. This is indicated, e.g. by the flashing muting indicator light.

## Muting time limit

Correctly started muting is only possible for a defined maximum duration. Muting is ended no later than when the max. muting time has elapsed. Muting can only be restarted after a valid muting sensor sequence has been detected or, if the muting section is still occupied, after the RESTART command has been detected.

The muting time limit has no effect in the following cases:

- During clearance of the muting section with the RESTART command.
- If function input STOP is providing the information "System stopped."

---

### Note

If it is possible that the conveyed material may remain in the muting section for a long time, for example, because the conveyor belt has been stopped, the answer is not to set the muting time limit to a very large value or to deactivate it. Instead, function input STOP should be linked with the "belt drive signal."

---

- If the time limit has been deactivated by parameter assignment.

 <b>WARNING</b>
--

<b>Unsecured hazardous locations. Can Cause Death, Serious Injury, or Property Damage.</b>
--

The muting time limit must only be shut down in justified cases, e.g. if the flow of materials is not normally interrupted in the muting section and if this does not pose a hazard to any person. If the muting time limit is deactivated, access to the hazardous locations must be prevented by suitable means.
--

## System status "STOP"

If the system is operationally shut down while muting is active, this results in a (muting) error, e.g. because of a discrepancy error of the muting sensor signals or because the max. muting time has elapsed. To avoid this (muting) error, the system status must be acquired and evaluated.

## 8.4 Muting functions

The "muting" element acquires the state of the system using function input STOP:

- STOP = 0: System running. All monitoring functions of the "muting" element are processed according to their parameter assignment.
- STOP = 1: System stopped. While muting operation is active, the time monitoring functions "muting time limit" and "discrepancy time monitoring of the muting sensors" are deactivated automatically. This prevents muting error messages due to elapsed times resulting from system shutdown.

The signal sequence and signal discrepancy evaluation (but without discrepancy time monitoring) of the muting sensor signals remains active. The value of function output Q is not changed. When the system is started again, the timers of the time monitoring function are reset or restarted. The signal sequence and signal discrepancy monitoring of the muting sensors is continued normally.

If the STOP function input is not connected, the system status will not be evaluated, i.e. the time monitoring functions are not affected.

### Muting - RESTART function

A valid muting sequence can be interrupted operationally, e.g. on a power failure, while materials are being conveyed through the muting section. On power recovery, muting is not automatically resumed because the expected muting sensor sequence is not provided by the muting sensors already triggered. It may also be necessary to clear the muting section, for example, if the load of a pallet is unfavorably distributed so that only one muting sensor was triggered. To be able to remove conveyed material from the muting section without danger, the "muting" element provides the RESTART function for clearing the muting section.

### Function input FEEDBACK\_MUT

See "Muting indicator light" section

### Function output MUT

The "muting active" state is output via a dedicated function output MUT to which, for example, a muting indicator light or a logical output terminal (e.g. PROFINET) can be connected.

## Muting indicator light

- The muting indicator light signals the following states:
  - Steady light: muting has been correctly started and the protective equipment for monitoring the protective field is overridden.
  - Flashing: clearance of the muting section is possible.
- Properties:
  - To be able to control a muting indicator light, the "muting" element sets function output MUT to the value "1" if muting is active. This function output can be interconnected to a hardware or logical output terminal (e.g. PROFINET).
  - It is optionally possible to monitor a muting indicator light connected to function output MUT using function input FEEDBACK\_MUT. Depending on the available information about the status of the indicator light, e.g. directly from the indicator light itself or from a higher-level PLC, the evaluation logic of the signal can be selected at function input FEEDBACK\_MUT using parameter "Monitoring - Muting indicator light". This parameter also enables deactivation of the monitoring function.
- Parameter "Monitoring - Muting indicator light"
  - Deactivated: The muting indicator light is not monitored.
  - statically for "1" = OK:  
With this parameter assignment, for example, the feedback signals of a "self-monitoring muting indicator light" can be monitored.  
FEEDBACK\_MUT value "0": => Muting indicator light defective  
FEEDBACK\_MUT value "1": => Muting indicator light OK
  - dynamically for MUT:  
Signal evaluation at the FEEDBACK\_MUT function input is performed by comparison with the output signal of function output MUT. On a signal change at function output MUT, the inverted signal from function output MUT is expected no later than after the parameterized "switching time muting indicator light" has elapsed.  
When the 0.5-Hz flashing signal is output, the feedback signal is not monitored, i.e. the signal at function input FEEDBACK\_MUT, can have any value. On deactivation of the flashing signal, however, the feedback signal corresponds to the inverted value of function output MUT no later than after the "switching time" has elapsed. Otherwise, an error will be generated.
- If a indicator light is defective, function output Q is set to the value "0" and the "muting indicator light defective" error message is set. This error message must be acknowledged with reset after the error has been corrected.


### 8.4.3 Clearing the muting section

#### Requirements

Clearance of the muting section can only be started if all the following conditions have been fulfilled:

- At least one muting sensor is being triggered.
- Function input RESTART is connected.  
If function input RESTART is not connected, the protective equipment cannot be cleared.
- The "muting restart possible" message is set.
- A 0.5-Hz flashing signal is output at function output MUT. The muting indicator light flashes.

#### Starting clearance

 <b>WARNING</b>
<b>Unsecured hazardous location. Can Cause Death, Serious Injury, or Property Damage.</b>
The clearance operation must be observed. It must be possible to respond to a hazardous situation by releasing the RESTART button at any time. The button must be installed in a location from which the entire hazardous area can be seen.

To start clearance of the muting section, the following steps (1 to 3) must be completed within 4 s.

- Press the RESTART button connected to the function input for at least 0.15 s.
- Then release the RESTART button for at least 0.15 s.
- Press the RESTART button again and hold it down.
- The following messages will then appear:
  - The "muting restart possible" message is reset.
  - The "muting active" message is set.
  - Function output MUT outputs a 1 signal.


#### Duration of muting with the RESTART button

Muting remains active if one of the following conditions applies:

- As long as the button remains pressed with an invalid muting sensor signal combination.
- Until the muting sensors end muting while the button is pressed.
- If a valid muting sensor signal combination is detected when the button is released the second time, assuming there are no other errors such as a signal discrepancy.



## 8.4.4 Muting (2-sensor-parallel)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Muting functions	Muting (2-sensor-parallel)		-	✓	✓

### Note

The function element is not available in Safety ES for all devices. If a device that does not support this function element is configured in the configuration, the function element is hidden in the catalog window.

### Description

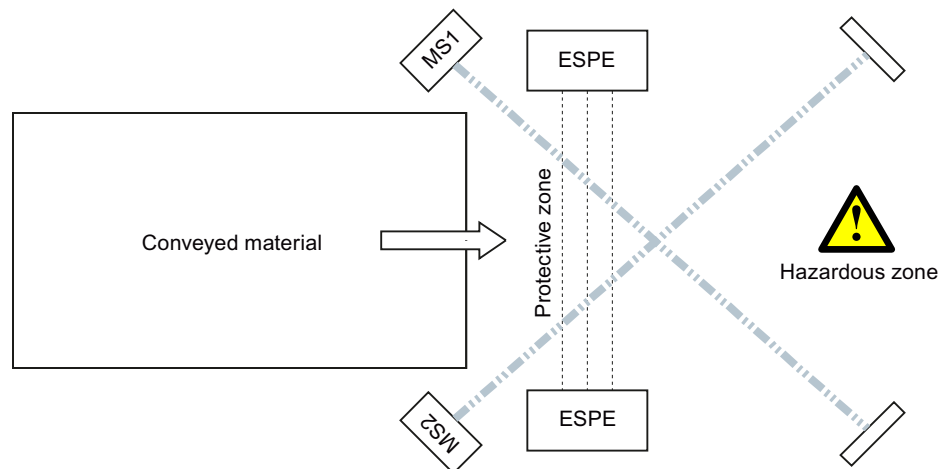


Figure 8-2 Muting 2-sensor parallel scheme

With the "Muting (2 sensor-parallel)" function element, you monitor an override circuit (= muting) with the following properties using signals from a pair of sensors:

- Muting can be performed at very short intervals without incurring a muting error.
- When a gap is detected between two conveyed items, muting is ended correctly and started again immediately when the next conveyed item is detected.
- If no gap is detected, muting is not ended. Only the maximum permissible muting time ends muting.
- The muting sensors are monitored for signal discrepancy.

**⚠ WARNING**

**Danger from tampering.  
Can Cause Death, Serious Injury, or Property Damage.**

To prevent tampering, the beams of the two muting sensors must cross far enough behind protective field. If possible, the beams should point downward at different heights.

**Note**


On a signal change at the FEEDBACK\_MUT function input, an error is generated immediately, if the signal at function output MUT has not changed.

**Parameters**

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	If this parameter is active, the function element is processed in the safety logic. If the parameter is deactivated, the set substitute values are made available at outputs Q and MUT.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
	Substitute value for function output MUT	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output MUT = 0 substitute value "1" means output MUT = 1

Parameter name	Description/parameter value	
Parameters	Muting time infinite	You can set the muting time to infinite. Please note the safety instructions (Page 212).
	Max. muting time [s]	Enter the time after which operational muting will have ended at the latest. You can set the max. muting time between 1 and 10800 s [3 h] in steps of 1 ms. The muting time is started when muting is correctly started by the muting sensors.
	Discrepancy time [ms]	You can set the discrepancy time between 0 and 60000 ms. <ul style="list-style-type: none"> <li>For the duration of the discrepancy time, different signal states are accepted at the two muting sensors forming a sensor pair without an error being signaled.</li> <li>During active muting, signal dropouts of muting sensors are accepted for the duration of the discrepancy time without ending muting.</li> </ul> Please note that the discrepancy time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay. While a discrepancy error is pending, you can clear the muting section using the RESTART function. This is indicated (e.g. flashing muting indicator light).
	Monitoring of the muting indicator light	You can activate the monitoring function for the muting indicator light and choose the desired evaluation logic of the feedback signal at function input FEEDBACK_MUT: <ul style="list-style-type: none"> <li>Deactivated</li> <li>statically for "1" = OK</li> <li>dynamically for MUT</li> </ul>
	switching time muting indicator light [s]	You can adapt the monitoring function for the indicator light to the switching time depending on the indicator light. You can set the switching time between 0.01 and 30 s. in steps of 1 ms.

### 8.4.5 Muting (4-sensor-parallel)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Muting functions	Muting (4-sensor-parallel)		-	✓	✓

#### Note

The function element is not available in Safety ES for all devices. If a device that does not support this function element is configured in the configuration, the function element is hidden in the catalog window.

#### Description

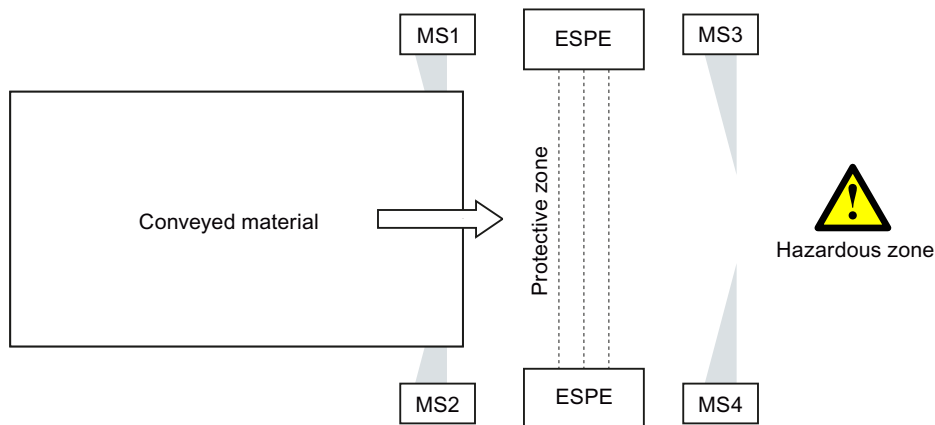


Figure 8-3 4-sensor-parallel scheme

With the "Muting (4 sensor-parallel)" function element, you monitor an override circuit (= muting) with the following properties using signals from two pairs of sensors (MS1 & MS2 and MS3 & MS4):

- This muting mode is used where there is little space.
- The muting sensors are time-monitored in pairs for signal discrepancy.
- The muting is triggered if either sensors MS1 and MS2 (= sensor pair 1) or MS3 and MS4 (= sensor pair 2) are activated within a certain discrepancy time.
- The muting sensors are monitored for sequence. The following are possible as a sequence:
  - activation of "MS1 & MS2 → MS3 & MS4" and then deactivation of "MS1 & MS2 → MS3 & MS4"
  - activation of "MS3 & MS4 → MS1 & MS2" and then deactivation of "MS3 & MS4 → MS1 & MS2"
- For the sequence conditions to be fulfilled, the conveyed material must be as long as the distance between MS1 & MS2 and MS3 & S4.

- On deviation from the permissible sequence, muting is ended and a sequence error is output.
- Muting is not specific to a direction.

---

**Note**

On a signal change at the FEEDBACK\_MUT function input, an error is generated immediately, if the signal at function output MUT has not changed.

---


**Parameters**

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	If this parameter is active, the function element is processed in the safety logic. If the parameter is deactivated, the set substitute values are made available at outputs Q and MUT.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
	Substitute value for function output MUT	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output MUT = 0 substitute value "1" means output MUT = 1

## 8.4 Muting functions

Parameter name	Description/parameter value	
<b>Parameters</b>	Muting time infinite	You can set the muting time to infinite. Please note the safety instructions (Page 212).
	Max. muting time [s]	Specify the time after which operational muting will have ended at the latest. You can set the max. muting time between 1 and 10800 s [3 h] in steps of 1 ms. The muting time is started when muting is correctly started by the muting sensors.
	Discrepancy time [ms]	You can set the discrepancy time between 0 and 60000 ms. <ul style="list-style-type: none"> <li>For the duration of the discrepancy time, different signal states are accepted at the two muting sensors forming a sensor pair without an error being signaled.</li> <li>During active muting, muting sensor signal dropouts are accepted for the duration of the discrepancy time without ending muting.</li> </ul> Please note that the discrepancy time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay. While a discrepancy error is pending, you can clear the muting section using the RESTART function. This is indicated (e.g. flashing muting indicator light).
	Monitoring of the muting indicator light	You can activate the monitoring function for the muting indicator light and choose the desired evaluation logic of the feedback signal at function input FEEDBACK_MUT: <ul style="list-style-type: none"> <li>Deactivated</li> <li>statically for "1" = OK</li> <li>dynamically for MUT</li> </ul>
	switching time muting indicator light [s]	You can adapt the monitoring function for the indicator light to the switching time depending on the indicator light. You can set the switching time between 0.01 and 30 s. in steps of 1 ms.

## 8.4.6 Muting (4-sensor-sequential)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Muting functions	Muting (4-sensor-sequential)		-	✓	✓

### Note

The function element is not available in Safety ES for all devices. If a device that does not support this function element is configured in the configuration, the function element is hidden in the catalog window.

### Description

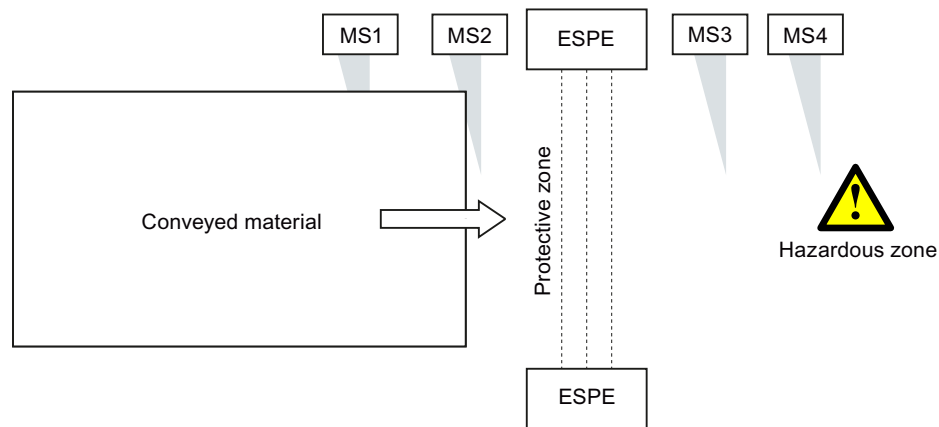


Figure 8-4 Muting 4-sensor-sequential scheme

With the "Muting (4 sensor-sequential)" function element, you monitor an override circuit (= muting) with the following properties using signals from four independent sensors (MS1 to MS4):

- This muting mode is used if there is sufficient space for entry into and exit from the hazardous zone and the conveyed material always has the same dimensions.
- The muting sensors are only monitored for sequence of triggering and non-triggering. The following are possible as a sequence:
  - triggering of "MS1 -> MS2 -> MS3 -> MS4" and ending triggering of "MS1 -> MS2 -> MS3 -> MS4"
  - triggering of "MS4 -> MS3 -> MS2 -> MS1" and ending triggering of "MS4 -> MS3 -> MS2 -> MS1"
- For the sequence conditions to be fulfilled, the conveyed material must be as long as the distance between MS1 and MS4. On deviation from the permissible sequence, muting is ended and a sequence error is output.
- The time interval between the sensor signals is not relevant.
- Muting is not specific to a direction.

**Note****STOP function**

When STOP is activated, the interference suppression is deactivated automatically. This results in limited usability of the STOP function for conveyed material with gaps. In this case, 4-sensor parallel muting must be used.

**WARNING**

**Danger from temporary deactivation of muting.  
Can cause Death, Serious Injury, or Property Damage**

If the conveyed material feed is stopped in muting phase 2 (see chapter "Muting safety circuit (Page 208)") and the conveyed material is moved again in the opposite direction, muting remains active initially. After ending triggering of the last muting sensor and expiration of the assigned discrepancy time in which signal dropouts are accepted, muting is deactivated. Monitoring of the protective field is resumed only afterwards. For this reason, the shortest possible discrepancy time must be chosen.

**Note**

On a signal change at the FEEDBACK\_MUT function input, an error is generated immediately, if the signal at function output MUT has not changed.

**Parameters**


Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	If this parameter is active, the function element is processed in the safety logic. If the parameter is deactivated, the set substitute values are made available at outputs Q and MUT.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
	Substitute value for function output MUT	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output MUT = 0 substitute value "1" means output MUT = 1



Parameter name		Description/parameter value
Parameters	Muting time infinite	You can set the muting time to infinite. Please note the safety instructions (Page 212).
	Max. muting time [s]	Enter the time after which operational muting will have ended at the latest. You can set the max. muting time between 1 and 10800 s [3 h] in steps of 1 ms. The muting time is started when muting is correctly started by the muting sensors.
	Discrepancy time [ms]	You can set the discrepancy time between 0 and 60000 ms. <ul style="list-style-type: none"> <li>During active muting, signal dropouts of muting sensors are accepted for the duration of the discrepancy time without ending muting.</li> </ul> Please note that the discrepancy time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.
	Monitoring of the muting indicator light	You can activate the monitoring function for the muting indicator light and choose the desired evaluation logic of the feedback signal at function input FEEDBACK_MUT: <ul style="list-style-type: none"> <li>Deactivated</li> <li>statically for "1" = OK</li> <li>dynamically for MUT</li> </ul>
	switching time muting indicator light [s]	You can adapt the monitoring function for the indicator light to the switching time depending on the indicator light. You can set the switching time between 0.01 and 30 s. in steps of 1 ms.

## 8.5 Status functions

### 8.5.1 Device status

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Status functions	Device status		✓	✓	✓

#### Description


The "Device status" function element provides status information about the safety relay. When the status activated in the parameter "Status type" exists, the function output Q is set to "1".

With the "Device status" function element, defined responses can be implemented in the downstream logic by connecting the function output Q in the logic diagram.

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameter</b>	Status type	Select the status message to be displayed at the function output Q. Your options are: <ul style="list-style-type: none"> <li>No status information</li> <li>Group error</li> <li>Group warning (not in the case of MSS 3RK3 Basic)</li> <li>Group prewarning (not in the case of MSS 3RK3 Basic)</li> <li>Logic error</li> <li>Test mode active</li> <li>Safety mode active</li> </ul> You can find further information on the status message in the manual of the safety relay under "Data set 92".

## 8.5.2 Element status

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Status functions	Element status		-	✓	✓

**Note**

The function element is not available in Safety ES for all devices. If a device that does not support this function element is configured in the configuration, the function element is hidden in the catalog window.

## Description


The "Element status" function element allows you to connect certain messages of a function element in the safety circuit. For example, a specific error can be displayed on the system by means of a signal lamp.

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	Status element no.	The parameter specifies the function element from which the element status will be provided. Only numbers that exist in the configuration may be entered.
	Status type	You can select a status information item for a particular function element, which will then be output at the function output: <ul style="list-style-type: none"> <li>No status information This parameter setting enables, for example, use of this element as a space holder. The function output outputs the value "0."</li> <li>Timer is active</li> <li>Function waiting for startup test</li> <li>Logic error</li> <li>Wiring error</li> <li>Substitute input value active</li> </ul>

## 8.6 Control functions

### 8.6.1 Device command

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Control functions	Device command		✓	✓	✓

### Description

With the "Device command" function element, commands can be integrated into the safety relay and connected device-specifically. For example, a reset can be triggered using an external pushbutton or via the fieldbus (e.g. PROFINET).

When there is a positive edge "0 → 1" at the input IN, the command is executed.

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	If this parameter is active, the function element is processed in the safety logic. If the parameter is deactivated, the command is not executed.
<b>Parameter</b>	Command type	<ul style="list-style-type: none"> <li>Execute no command</li> <li>Reset</li> <li>Apply code tables (MSS 3RK3 Advanced, MSS 3RK3 ASIsafe basic and MSS 3RK3 ASI-safe extended)</li> </ul>

## 8.7 Logic functions

### 8.7.1 AND

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Logic functions	AND	&	✓	✓	✓

## Description


The logic function "AND" has 1 to 5 function inputs IN and one function output Q.

Function output Q = "1", when all function inputs IN have the status "1".

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	Number of logic inputs	1 to 5 elements can be parameterized for the element.

## 8.7.2 OR

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Logic functions	OR		✓	✓	✓

### Description


The logic function "OR" has 1 to 5 function inputs IN and one function output Q.

Function output Q = "1", when at least one function input has the status "1".

### Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	Number of logic inputs	1 to 5 elements can be parameterized for the element.

## 8.7.3 XOR

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Logic functions	XOR		✓	✓	✓

### Description


The logic function "XOR" has 1 to 5 function inputs IN and one function output Q.

Function output Q = "1", when only one logic input has the status "1" at the same time.

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	Number of logic inputs	1 to 5 elements can be parameterized for the element.

## 8.7.4 NAND

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Logic functions	NAND		✓	✓	✓

## Description


The logic function "NAND" has 1 to 5 function inputs IN and one function output Q.

Function output Q = "0", when all function inputs have the status "1".

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	Number of logic inputs	1 to 5 elements can be parameterized for the element.

### 8.7.5 NOR

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Logic functions	NOR		✓	✓	✓

#### Description


The logic function "NOR" has 1 to 5 function inputs and one function output Q.

Function output Q = "0", when at least one function input has the status "1".

#### Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	Number of logic inputs	1 to 5 elements can be parameterized for the element.

### 8.7.6 NEGATION (NEG)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Logic functions	NEGATION		✓	✓	✓

#### Description

The logic function "NEGATION" has one function input IN and one function output Q.

The input signal IN is output inverted at the function output Q.


Function output Q = "1", when the input IN has the status "0".

## Parameters

Parameter name		Description/parameter value
General	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1

## 8.8 Flip-flop

### 8.8.1 FF-SR

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Flip-flop	FF-SR		✓	✓	✓

## Description

The safety relay supports the reset-dominant function "FF-SR".

"Reset-dominant" means the function output Q cannot be set to "1" when the reset input R is "1".

The function element has:

- 2 inputs: Input for setting S, input for resetting R
- One function output Q

The function output Q is formed in accordance with the following truth table:

Input for setting S	Input for resetting R	Function output Q
0	0	-
0	1	0
1	0	1
1	1	0

0 = low level

1 = high level

- no change in the output status

Q = 1, when the input for setting S = "1" and the input for resetting R = "0".



Q = 0, when the input for resetting R = "1".

**Note**

**Simultaneity of signals**

The inputs are detected once during each cycle time. Depending on when in the cycle the signal change takes place, the signal change will be detected in the same cycle time or not until the subsequent cycle time. It is thus possible that apparently simultaneous signal changes at two different inputs are not detected simultaneously by the logic.

To be able to detect a reset signal with certainty, the reset signal must be active longer than the set signal.


Take account of this behavior when creating your configuration.

**Parameters**

Parameter name		Description/parameter value
General	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1

**8.9 Counter functions**

**8.9.1 Counter (0 -> 1)**

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Counter functions	Counter (0 → 1)		✓	✓	✓

**Description**

**Note**

The count value is not stored. At the start of safety or test mode, all counters begin with their initial values.

The safety relay supports the counter function "Counter (0 → 1)". The counter value is only changed when there is a positive edge at the counter inputs. The current counter value can be counted up or down via one proprietary counter input each. When a parameterizable counter limit value is achieved or overshoot, the function output Q is set.

The counter function has:

- 3 inputs: CU - Counter input up, CD - Counter input down, R - Reset (parameterizable)
- One function output Q


### Functional principle

- The counter value is increased by 1 with every positive edge at the "Counter input up", except when the counter value reaches the maximum value 65535.
- The count value is decreased by 1 with every positive edge at the "Count input down", except when the count value reaches the value 0.
- The counter value remains unchanged when there is a positive edge simultaneously at both counter inputs.

### Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	Counter limit value (CV)	Set a counter limit value which is to be monitored (between 0 and 65535): <ul style="list-style-type: none"> <li>• Function output Q = "1" when the current counter value reaches this limit value.</li> <li>• Function output Q = "0" when the current counter value falls below this limit value.</li> </ul>
	Reset	You can select whether the counter value is set to "0" automatically or manually: <ul style="list-style-type: none"> <li>• Automatic When the function output Q = "1", the counter value and function output Q are set to "0" after one program cycle of the safety relay.</li> <li>• Manual The counter value is set to "0", irrespective of the state of the function output Q. If the counter value is not deleted after the limit value is exceeded, counting will continue.</li> <li>• Automatic with manual reset When the function output Q = "1", the counter value and function output Q are set to "0" after one program cycle of the safety relay. The counter value can be reset to "0" when the function output Q = "0".</li> </ul>

## 8.9.2 Counter (1 → 0)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Counter functions	Counter (1 → 0)		✓	✓	✓

### Description

#### Note

The count value is not stored. At the start of safety or test mode, all counters begin with their initial values.

The safety relay supports the counter function "Counter (1 → 0)". The counter value is only changed when there is a negative edge. The current counter value can be counted up or down via one proprietary counter input each. When a parameterizable counter limit value is achieved or overshoot, the function output Q is set.

The counter function has:

- 3 inputs: CU - Counter input up, CD - Counter input down, R - Reset (parameterizable)
- One function output Q

### Functional principle


- The counter value is increased by 1 with every negative edge at the "Counter input up", except when the counter value reaches the maximum value 65535.
- The counter value is decreased by 1 with every negative edge at the "Counter input down", except when the counter value reaches the value 0.
- The counter value remains unchanged when there is a positive edge simultaneously at both counter inputs.

### Parameters

Parameter name		Description/parameter value
General	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1

Parameter name		Description/parameter value
Parameters	Counter limit value (CV)	Set a counter limit value which is to be monitored (between 0 and 65535): <ul style="list-style-type: none"> <li>Function output Q = "1" when the current counter value reaches this limit value.</li> <li>Function output Q = "0" when the current counter value falls below this limit value.</li> </ul>
	Reset	You can select whether the counter value is set to "0" automatically or manually: <ul style="list-style-type: none"> <li>Automatic When the function output Q = "1", the counter value and function output Q are set to "0" after one program cycle of the safety relay.</li> <li>Manual The counter value is set to "0," irrespective of the state of function output Q. If the counter value is not deleted after the limit value is exceeded, counting will continue.</li> <li>Automatic with manual reset When the function output Q = "1", the counter value and function output Q are set to "0" after one program cycle of the safety relay. The counter value can be reset to "0" when the function output Q = "0".</li> </ul>

### 8.9.3 Counter (0 → 1 / 1 → 0)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Counter functions	Counter (0 → 1 / 1 → 0)		✓	✓	✓

#### Description

##### Note

The count value is not stored. At the start of safety or test mode, all counters begin with their initial values.

The safety relay supports the counter function "Counter (0 → 1 / 1 → 0)". The counter value is only changed when there is a positive and negative edge. The current counter value can be counted up or down via one proprietary counter input each. When a parameterizable counter limit value is achieved or overshoot, the function output Q is set.

The counter function has:

- 3 inputs: CU - Counter input up, CD - Counter input down, R - Reset (parameterizable)
- One function output Q

## Functional principle


- The counter value is increased by 1 with every positive and negative edge at the "Counter input up", except when the counter value reaches the maximum value 65535.
- The counter value is decreased by 1 with every positive and negative edge at the "Counter input down", except when the counter value reaches the value 0.
- The counter value remains unchanged when there is a positive edge simultaneously at both counter inputs.

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	Counter limit value (CV)	Set a counter limit value which is to be monitored (between 0 and 65535): <ul style="list-style-type: none"> <li>• Function output Q = "1" when the current counter value reaches this limit value.</li> <li>• Function output Q = "0" when the current counter value falls below this limit value.</li> </ul>
	Reset	You can select whether the counter value is set to "0" automatically or manually: <ul style="list-style-type: none"> <li>• Automatic When the function output Q = "1", the counter value and output Q are set to "0" after one program cycle of the safety relay.</li> <li>• Manual The counter value is set to "0", irrespective of the state of the function output Q. If the counter value is not deleted after the limit value is exceeded, counting will continue.</li> <li>• Automatic with manual reset When the function output Q = "1", the counter value and function output Q are set to "0" after one program cycle of the safety relay. The counter value can be reset to "0" when the function output Q = "0".</li> </ul>

## 8.10 Timer functions

### 8.10.1 With ON delay

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Timer functions	With ON delay		✓	✓	✓

#### Description

---

##### Note

The time value is not stored. At the start of safety or test mode, all time values begin with their initial values.

---

The safety relay supports the timer function "With ON delay". The function output Q is activated after the input (with a parameterizable delay time).

The timer function has:

- 2 inputs: IN, R - Reset
- One function output Q

---

##### Note

##### MSS 3RK3 Basic limitation

MSS 3RK3 Basic does not support a reset input for this function element.

The MSS 3RK3 Basic responds as if the "Reset" parameter has "deactivated" the value.

---

#### Functional principle

- If a "1" is detected at input IN and no reset is active, the delay time "t1" starts.
- After the delay time, function output Q is activated, i.e. set to "1", as long as there is a "1" at input IN.
- When there is an edge change at input IN before the the end of delay time "t1", the delay time continues. The function output Q remains deactivated, i.e. "0", if there is a "0" at input IN after the end of the delay time.

### "Reset" = "deactivated" and "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "deactivated". It also applies for "Reset" = "with positive edge" or "with negative edge", if there is no edge change at input R.

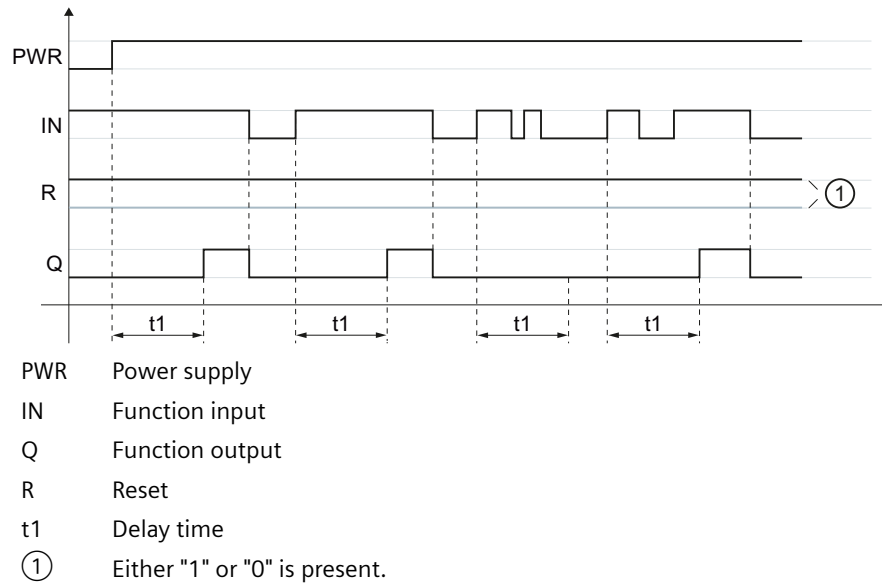


Figure 8-5 Timer function "With ON delay" when "Reset" = "deactivated", "with negative edge", or "with positive edge".

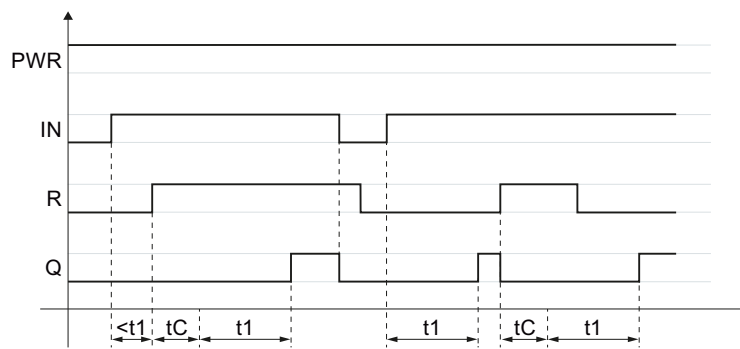
### "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "with positive edge".

#### Note

#### "Reset" = "with negative edge"

The behavior of the function element when "Reset" = "with negative edge" is exactly the same as when "Reset" = "with positive edge", except that the signal from R is inverted. Negative edge "1" > "0" is evaluated here.



PWR Power supply  
 IN Function input  
 Q Function output  
 R Reset  
 $t_1$  Delay time  
 $t_C$  Program cycle time

Figure 8-6 Timer function "With ON delay" when "Reset" = "with positive edge"

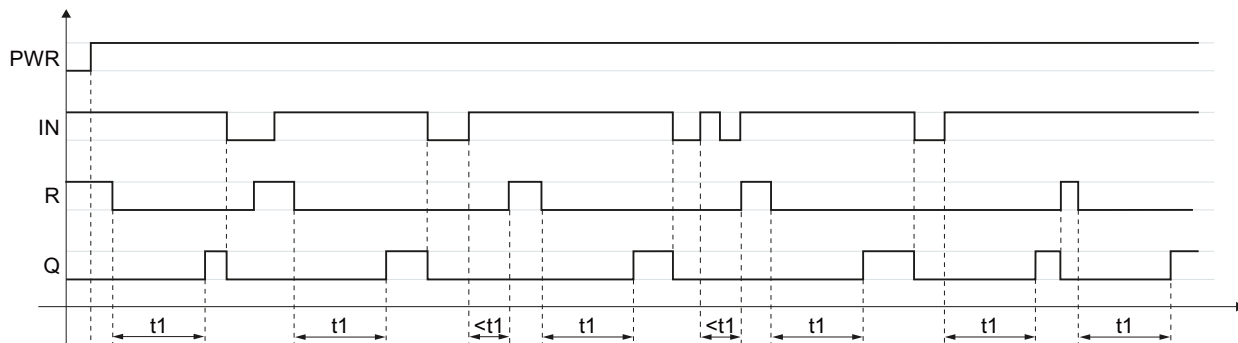
### "Reset" = "with level 1"

The following diagram shows the behavior of the function element when "Reset" = "with level 1".

#### Note

#### Value "0" is present at function input R

If the value "0" is present at function input R, the behavior of the function element is the same as for the edge evaluation shown in the first diagram.



PWR Power supply  
 IN Function input  
 Q Function output  
 R Reset  
 $t_1$  Delay time

Figure 8-7 Timer function "With ON delay" when "Reset" = "with level 1"




## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	t1 [s]	<ul style="list-style-type: none"> <li>You enter the delay time here.</li> <li>The maximum value is 655 s, increment: 5 ms</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	Reset (not in the case of MSS 3RK3 Basic)	<ul style="list-style-type: none"> <li>deactivated The timer cannot be reset selectively to the "initial position". The output Q is set/reset according to the input signal and the timer function.</li> <li>with positive edge When a positive edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a positive edge is detected again.</li> <li>with negative edge When a negative edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a negative edge is detected again.</li> <li>with level 1 When the value "1" is detected at the reset input, all timers and the output Q are reset to the value "0" as long as the value "1" is present. The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. The element starts over with its functionality only when the value "0" is detected again at the reset input.<sup>1)</sup></li> </ul>

<sup>1)</sup> "Starts over" applies to timer functions that are started by level 1 at the timer trigger input: The timers are started if the value "1" is present at the timer trigger input.

### 8.10.2 With ON delay (trigger)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Timer functions	With ON delay (trigger)		✓	✓	✓

#### Description

---

##### Note

The time value is not stored. At the start of safety or test mode, all time values begin with their initial values.

---

The safety relay supports the timer function "With ON delay (trigger)". The function output Q is activated after the input (with a parameterizable delay time).

The timer function has:

- 2 inputs: IN, R - Reset
- One function output Q

---

##### Note

##### MSS 3RK3 Basic limitation

MSS 3RK3 Basic does not support a reset input for this function element.

The MSS 3RK3 Basic responds as if the "Reset" parameter has "deactivated" the value.

---

#### Functional principle

- If a "1" is detected at input IN and no reset is active, the delay time "t1" starts.
- After the delay time, function output Q is activated, i.e. set to "1", as long as there is a "1" at input IN.
- The delay time is stopped on a 1 → 0 edge change at input IN. On another 0 → 1 edge change, the delay time will restart. The function output Q remains deactivated, i.e. "0", if there is a "0" at input IN after the end of the delay time.

### "Reset" = "deactivated" and "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "deactivated". It also applies for "Reset" = "with positive edge" or "with negative edge", if there is no edge change at input R.

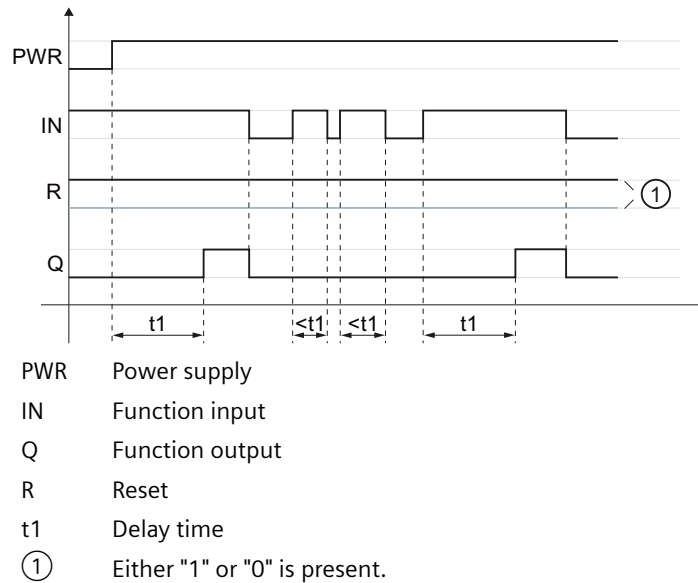


Figure 8-8 Timer function "With ON delay (trigger)" when "Reset" = "deactivated", "with negative edge", or "with positive edge".

### "Reset" = "with positive edge" or "with negative edge"

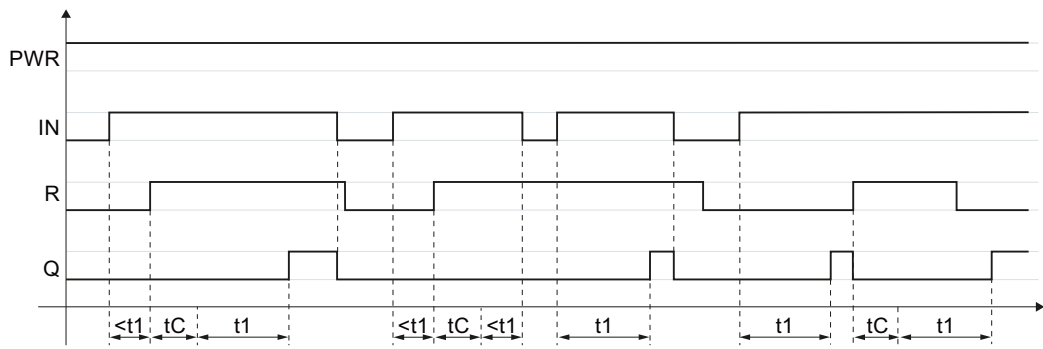
The following diagram shows the behavior of the function element when "Reset" = "with positive edge".

#### Note

#### "Reset" = "with negative edge"

The behavior of the function element when "Reset" = "with negative edge" is exactly the same as when "Reset" = "with positive edge", except that the signal from R is inverted. Negative edge "1" > "0" is evaluated here.

8.10 Timer functions



- PWR Power supply
- IN Function input
- Q Function output
- R Reset
- $t_1$  Delay time
- $t_C$  Program cycle time

Figure 8-9 Timer function "With ON delay (trigger)" when "Reset" = "with positive edge"

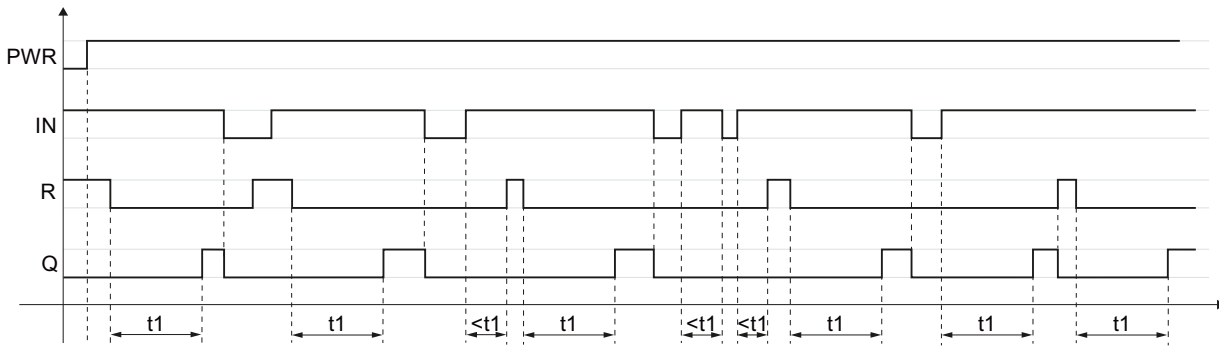
**"Reset" = "with level 1"**

The following diagram shows the behavior of the function element when "Reset" = "with level 1".

**Note**

**Value "0" is present at function input R**

If the value "0" is present at function input "R", the behavior of the function element is the same as for the edge evaluation shown in the first diagram.



- PWR Power supply
- IN Function input
- Q Function output
- R Reset
- $t_1$  Delay time


Figure 8-10 Timer function "With ON delay (trigger)" when "Reset" = "with level 1"

## Parameters

Parameter name		Description/parameter value
General	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
Parameters	t1 [s]	<ul style="list-style-type: none"> <li>You enter the delay time here.</li> <li>The maximum value is 655 s, increment: 5 ms</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	Reset (not in the case of MSS 3RK3 Basic)	<ul style="list-style-type: none"> <li>deactivated The timer cannot be reset selectively to the "initial position". The output Q is set/reset according to the input signal and the timer function.</li> <li>with positive edge When a positive edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a positive edge is detected again.</li> <li>with negative edge When a negative edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a negative edge is detected again.</li> <li>with level 1 When the value "1" is detected at the reset input, all timers and the output Q are reset to the value "0" as long as the value "1" is present. The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. The element starts over with its functionality only when the value "0" is detected again at the reset input.<sup>1)</sup></li> </ul>

<sup>1)</sup> "Starts over" applies to timer functions that are started by level 1 at the timer trigger input: The timers are started if the value "1" is present at the timer trigger input.

### 8.10.3 Passing make contact

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Timer functions	Passing make contact		✓	✓	✓

#### Description

---

##### Note

The time value is not stored. At the start of safety or test mode, all time values begin with their initial values.

---

The safety relay supports the timer function "Passing make contact". An input signal generates a signal with parameterizable duration at function output Q.

The timer function has:

- 2 inputs: IN, R - Reset
- One function output Q

---

##### Note

##### MSS 3RK3 Basic limitation

MSS 3RK3 Basic does not support a reset input for this function element.

The MSS 3RK3 Basic responds as if the "Reset" parameter has "deactivated" the value.

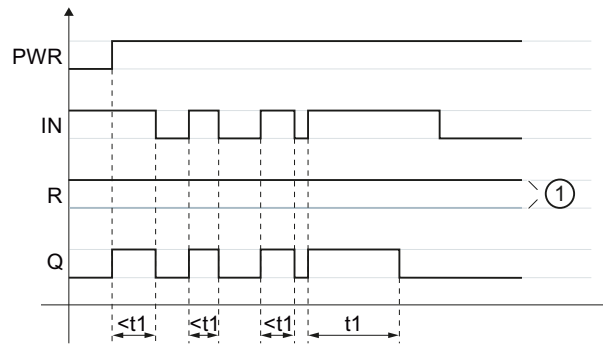
---

#### Functional principle

- If a "1" is detected at input IN and no reset is active, the make time "t1" starts and function output Q is switched to "1".
- When there is a negative edge "1 → 0" at input IN before the the end of the time "t1", the time is reset. Function output Q is deactivated, i.e. set to "0".
- After the time period "t1", function output Q is deactivated, i.e. set to "0".

### "Reset" = "deactivated" and "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "deactivated". It also applies for "Reset" = "with positive edge" or "with negative edge", if there is no edge change at input R.



PWR Power supply  
IN Function input  
Q Function output  
R Reset  
t1 Make time

① Either "1" or "0" is present.

Figure 8-11 Timer function "Passing make contact" when "Reset" = "deactivated", "with negative edge", or "with positive edge".

### "Reset" = "with positive edge" or "with negative edge"

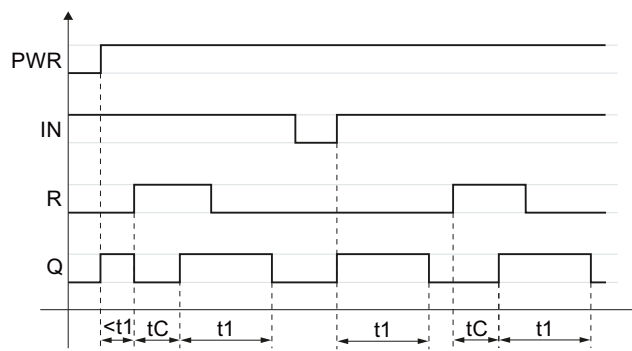
The following diagram shows the behavior of the function element when "Reset" = "with positive edge".

#### Note

#### "Reset" = "with negative edge"

The behavior of the function element when "Reset" = "with negative edge" is exactly the same as when "Reset" = "with positive edge", except that the signal from R is inverted. Negative edge "1" > "0" is evaluated here.

8.10 Timer functions



PWR Power supply  
 IN Function input  
 Q Function output  
 R Reset  
 $t_1$  Make time  
 $t_C$  Program cycle time

Figure 8-12 Timer function "Passing make contact" when "Reset" = "with positive edge"

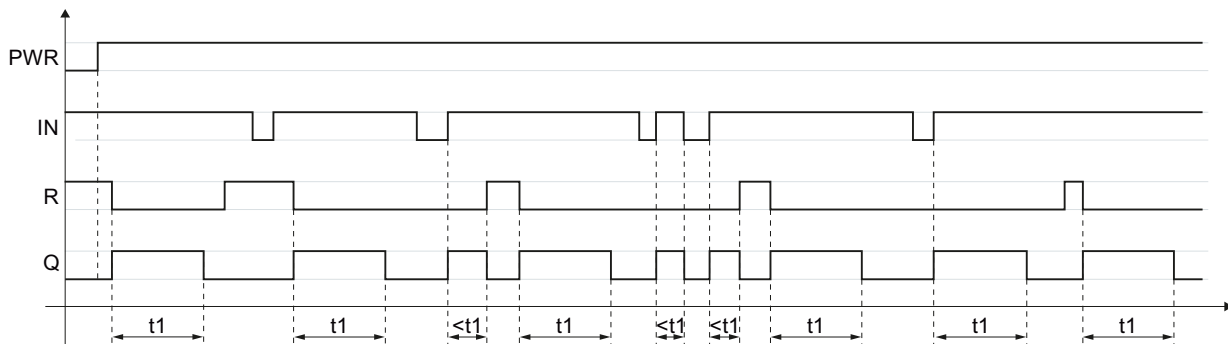
"Reset" = "with level 1"

The following diagram shows the behavior of the function element when "Reset" = "with level 1".

Note

Value "0" is present at function input R

If the value "0" is present at function input R, the behavior of the function element is the same as for the edge evaluation shown in the first diagram.



PWR Power supply  
 IN Function input  
 Q Function output  
 R Reset  
 $t_1$  Make time

Figure 8-13 Timer function "Passing make contact" when "Reset" = "with level 1"




## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameter</b>	t1 [s]	<ul style="list-style-type: none"> <li>You enter the make time here.</li> <li>The maximum value is 655 s, increment: 5 ms</li> </ul> <p>Please note that the delay time specified by you can be a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	Reset (not in the case of MSS 3RK3 Basic)	<ul style="list-style-type: none"> <li>deactivated The timer cannot be reset selectively to the "initial position". The output Q is set/reset according to the input signal and the timer function.</li> <li>with positive edge When a positive edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a positive edge is detected again.</li> <li>with negative edge When a negative edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a negative edge is detected again.</li> <li>with level 1 When the value "1" is detected at the reset input, all timers and the output Q are reset to the value "0" as long as the value "1" is present. The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. The element starts over with its functionality only when the value "0" is detected again at the reset input.<sup>1)</sup></li> </ul>

<sup>1)</sup> "Starts over" applies to timer functions that are started by level 1 at the timer trigger input: The timers are started if the value "1" is present at the timer trigger input.

### 8.10.4 Passing make contact (trigger)

Function element		Icons	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Timer functions	Passing make contact (trigger)		✓	✓	✓

#### Description

##### Note

The time value is not stored. At the start of safety or test mode, all time values begin with their initial values.

The safety relay supports the timer function "Passing make contact (trigger)". An input signal generates a signal with parameterizable delay time at function output Q.

The timer function has:

- 2 inputs: IN, R - Reset
- One function output Q

##### Note

##### MSS 3RK3 Basic limitation

MSS 3RK3 Basic does not support a reset input for this function element.

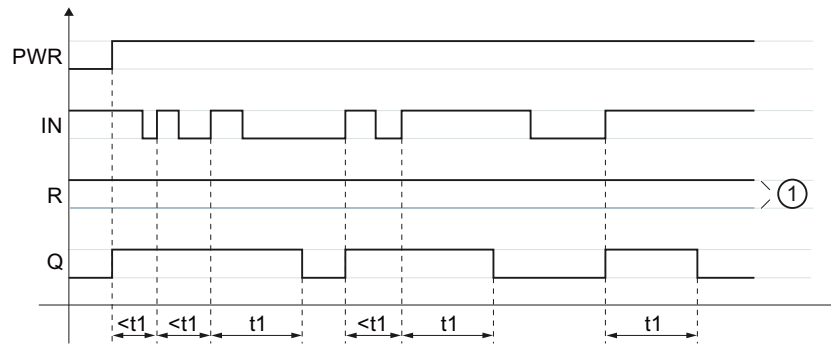
The MSS 3RK3 Basic responds as if the "Reset" parameter has "deactivated" the value.

#### Functional principle

- If a "1" is detected at input IN and no reset is active, the make time "t1" starts and function output Q is switched to "1".
- When there is a negative edge "1 → 0" at input IN before the the end of the time "t1", the time continues to elapse. Function output Q remains active, i.e. set to "1", during the time period "t1". When there is another positive edge "0 → 1" at input IN, time "t1" begins again.
- After the time period, function output Q is deactivated, i.e. set to "0".

### "Reset" = "deactivated" and "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "deactivated". It also applies for "Reset" = "with positive edge" or "with negative edge", if there is no edge change at input R.



- PWR Power supply
- IN Function input
- Q Function output
- R Reset
- $t_1$  Make time
- ① Either "1" or "0" is present.

Figure 8-14 Timer function "Passing make contact (trigger)" when "Reset" = "deactivated", "with negative edge", or "with positive edge".

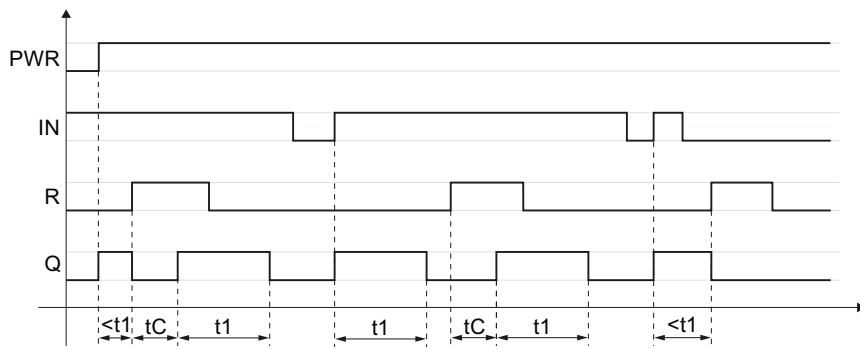
### "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "with positive edge".

#### Note

#### "Reset" = "with negative edge"

The behavior of the function element when "Reset" = "with negative edge" is exactly the same as when "Reset" = "with positive edge", except that the signal from R is inverted. Negative edge "1" > "0" is evaluated here.



PWR Power supply  
 IN Function input  
 Q Function output  
 R Reset  
 $t_1$  Make time  
 $t_C$  Program cycle time

Figure 8-15 Timer function "Passing make contact (trigger)" when "Reset" = "with positive edge"

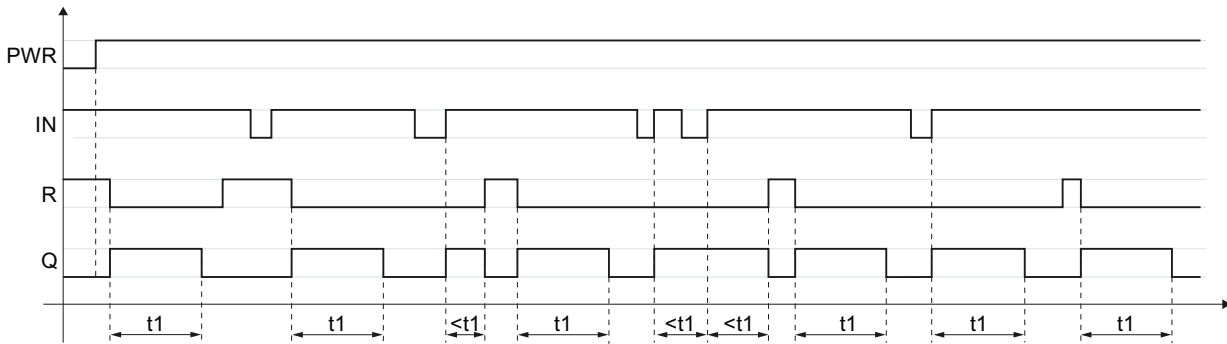
**"Reset" = "with level 1"**

The following diagram shows the behavior of the function element when "Reset" = "with level 1".

**Note**

**Value "0" is present at function input R**

If the value "0" is present at function input R, the behavior of the function element is the same as for the edge evaluation shown in the first diagram.



PWR Power supply  
 IN Function input  
 Q Function output  
 R Reset  
 $t_1$  Make time


Figure 8-16 Timer function "Passing make contact (trigger)" when "Reset" = "with level 1"

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameter</b>	t1 [s]	<ul style="list-style-type: none"> <li>You enter the make time here.</li> <li>The maximum value is 655 s, increment: 5 ms</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	Reset (not in the case of MSS 3RK3 Basic)	<ul style="list-style-type: none"> <li>deactivated The timer cannot be reset selectively to the "initial position". The output Q is set/reset according to the input signal and the timer function.</li> <li>with positive edge When a positive edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a positive edge is detected again.</li> <li>with negative edge When a negative edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a negative edge is detected again.</li> <li>with level 1 When the value "1" is detected at the reset input, all timers and the output Q are reset to the value "0" as long as the value "1" is present. The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. The element starts over with its functionality only when the value "0" is detected again at the reset input.<sup>1)</sup></li> </ul>

<sup>1)</sup> "Starts over" applies to timer functions that are started by level 1 at the timer trigger input: The timers are started if the value "1" is present at the timer trigger input.

### 8.10.5 With OFF delay

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Timer functions	With OFF delay		✓	✓	✓

#### Description

---

##### Note

The time value is not stored. At the start of safety or test mode, all time values begin with their initial values.

---

The safety relay supports the timer function "With OFF delay". The function output Q is deactivated after the input (with a parameterizable delay time).

The timer function has:

- 2 inputs: IN, R - Reset
- One function output Q

---

##### Note

##### MSS 3RK3 Basic limitation

MSS 3RK3 Basic does not support a reset input for this function element.

The MSS 3RK3 Basic responds as if the "Reset" parameter has "deactivated" the value.

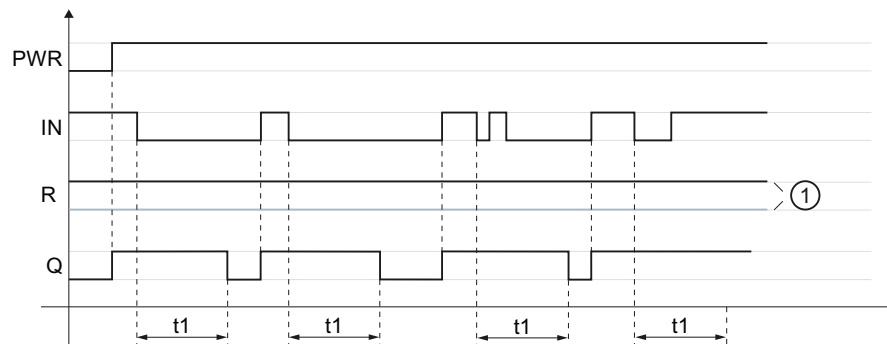
---

#### Functional principle

- If a "1" is detected at input IN and no reset is active, function output Q is set to "1".
- When there is a negative edge "1 → 0" at input IN, delay time "t1" begins.
- After the delay time, function output Q is deactivated, i.e. set to "0".
- When there is a positive edge "0 → 1" at input IN before the the end of the delay time "t1", the delay time continues. Function output Q remains active, i.e. set to "1".

### "Reset" = "deactivated" and "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "deactivated". It also applies for "Reset" = "with positive edge" or "with negative edge", if there is no edge change at input R.



- PWR Power supply
- IN Function input
- Q Function output
- R Reset
- t1 Delay time
- ① Either "1" or "0" is present.

Figure 8-17 Timer function "With OFF delay" when "Reset" = "deactivated", "with negative edge", or "with positive edge".

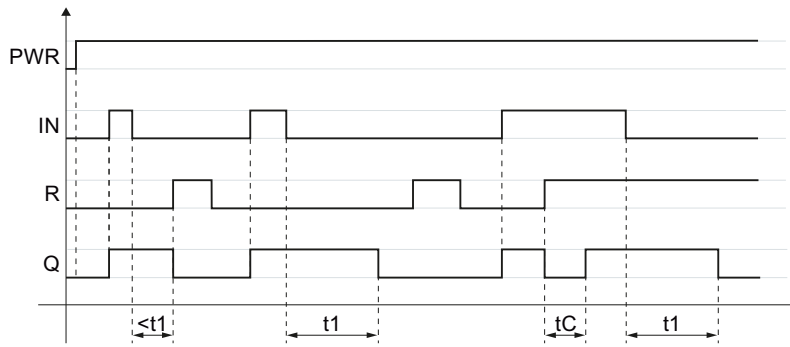
### "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "with positive edge".

#### Note

#### "Reset" = "with negative edge"

The behavior of the function element when "Reset" = "with negative edge" is exactly the same as when "Reset" = "with positive edge", except that the signal from R is inverted. Negative edge "1" > "0" is evaluated here.



PWR Power supply  
 IN Function input  
 Q Function output  
 R Reset  
 t1 Delay time  
 tC Program cycle time

Figure 8-18 Timer function "With OFF delay" when "Reset" = "with positive edge"

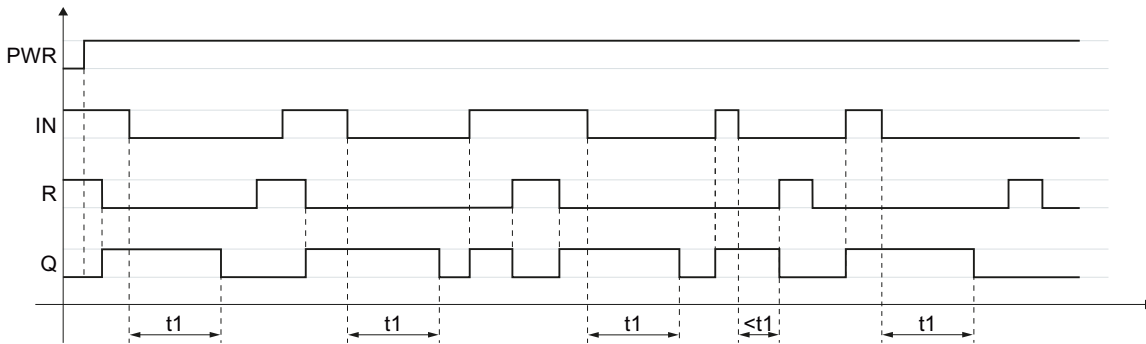
**"Reset" = "with level 1"**

The following diagram shows the behavior of the function element when "Reset" = "with level 1".

**Note**

**Value "0" is present at function input R**

If the value "0" is present at function input R, the behavior of the function element is the same as for the edge evaluation shown in the first diagram.



PWR Power supply  
 IN Function input  
 Q Function output  
 R Reset  
 t1 Delay time

Figure 8-19 Timer function "With OFF delay" when "Reset" = "with level 1"




## Parameters

Parameter name		Description/parameter value
General	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
Parameters	t1[s]	<ul style="list-style-type: none"> <li>You enter the delay time here.</li> <li>The maximum value is 655 s, increment: 5 ms</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	Reset (not in the case of MSS 3RK3 Basic)	<ul style="list-style-type: none"> <li>deactivated The timer cannot be reset selectively to the "initial position". The output Q is set/reset according to the input signal and the timer function.</li> <li>with positive edge When a positive edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a positive edge is detected again.</li> <li>with negative edge When a negative edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a negative edge is detected again.</li> <li>with level 1 When the value "1" is detected at the reset input, all timers and the output Q are reset to the value "0" as long as the value "1" is present. The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. The element starts over with its functionality only when the value "0" is detected again at the reset input.<sup>1)</sup></li> </ul>

<sup>1)</sup> "Starts over" applies to timer functions that are started by level 1 at the timer trigger input: The timers are started if the value "1" is present at the timer trigger input.

### 8.10.6 With OFF delay (trigger)

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Timer functions	With OFF delay (trigger)		✓	✓	✓

#### Description

---

##### Note

The time value is not stored. At the start of safety or test mode, all time values begin with their initial values.

---

The safety relay supports the timer function "With OFF delay (trigger)". The function output Q is deactivated after the input (with a parameterizable delay time).

The timer function has:

- 2 inputs: IN, R - Reset
- One function output Q

---

##### Note

##### MSS 3RK3 Basic limitation

MSS 3RK3 Basic does not support a reset input for this function element.

The MSS 3RK3 Basic responds as if the "Reset" parameter has "deactivated" the value.

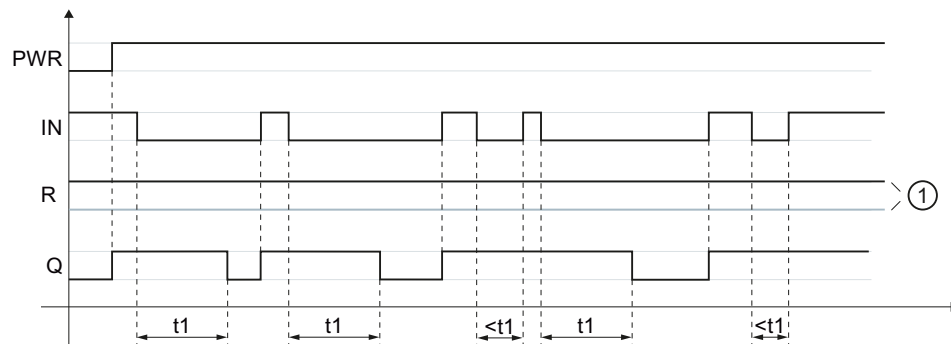
---

#### Functional principle

- If a "1" is detected at input IN and no reset is active, function output Q is set to "1".
- When there is a negative edge "1 → 0" at input IN, delay time "t1" begins.
- When there is a positive edge "0 → 1" at input IN before the the end of delay time "t1", the delay time is reset. Function output Q remains active, i.e. set to "1".
- After the delay time, function output Q is deactivated, i.e. set to "0".

### "Reset" = "deactivated" and "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "deactivated". It also applies for "Reset" = "with positive edge" or "with negative edge", if there is no edge change at input R.



PWR Power supply  
IN Function input  
Q Function output  
R Reset  
t1 Delay time

① Either "1" or "0" is present.

Figure 8-20 Timer function "With OFF delay (trigger)" when "Reset" = "deactivated", "with negative edge", or "with positive edge".

### "Reset" = "with positive edge" or "with negative edge"

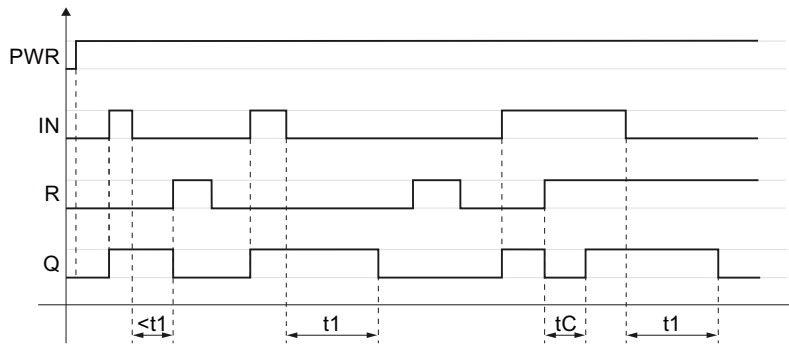
The following diagram shows the behavior of the function element when "Reset" = "with positive edge".

#### Note

#### "Reset" = "with negative edge"

The behavior of the function element when "Reset" = "with negative edge" is exactly the same as when "Reset" = "with positive edge", except that the signal from R is inverted. Negative edge "1" > "0" is evaluated here.

8.10 Timer functions



PWR Power supply  
 IN Function input  
 Q Function output  
 R Reset  
 t1 Delay time  
 tC Program cycle time

Figure 8-21 Timer function "With OFF delay (trigger)" when "Reset" = "with positive edge"

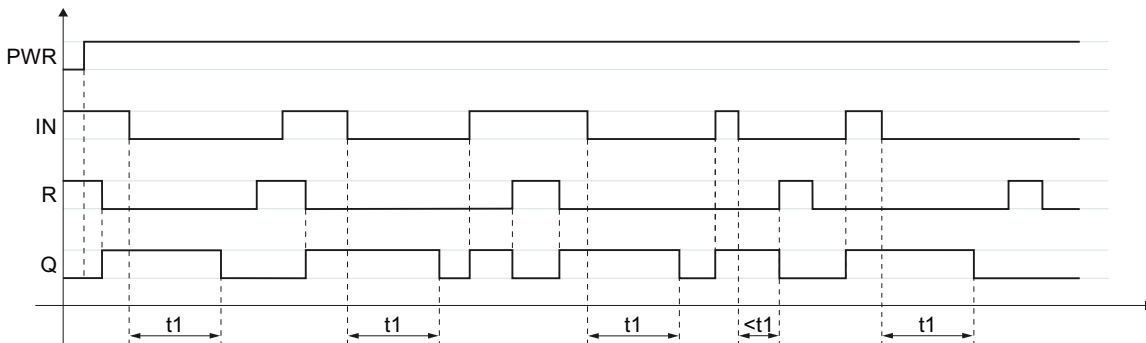
**"Reset" = "with level 1"**

The following diagram shows the behavior of the function element when "Reset" = "with level 1".

**Note**

**Value "0" is present at function input R**

If the value "0" is present at function input R, the behavior of the function element is the same as for the edge evaluation shown in the first diagram.



PWR Power supply  
 IN Function input  
 Q Function output  
 R Reset  
 t1 Delay time


Figure 8-22 Timer function "With OFF delay (trigger)" when "Reset" = "with level 1"

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	t1 [s]	<ul style="list-style-type: none"> <li>You enter the delay time here.</li> <li>The maximum value is 655 s, increment: 5 ms</li> </ul> <p>Please note that the delay time specified by you is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	Reset (not in the case of MSS 3RK3 Basic)	<ul style="list-style-type: none"> <li>deactivated The timer cannot be reset selectively to the "initial position". The output Q is set/reset according to the input signal and the timer function.</li> <li>with positive edge When a positive edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a positive edge is detected again.</li> <li>with negative edge When a negative edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a negative edge is detected again.</li> <li>with level 1 When the value "1" is detected at the reset input, all timers and the output Q are reset to the value "0" as long as the value "1" is present. The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. The element starts over with its functionality only when the value "0" is detected again at the reset input.<sup>1)</sup></li> </ul>

<sup>1)</sup> "Starts over" applies to timer functions that are started by level 1 at the timer trigger input: The timers are started if the value "1" is present at the timer trigger input.

### 8.10.7 Clocking

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Timer functions	Clocking		✓	✓	✓

#### Description

---

##### Note

The time value is not stored. At the start of safety mode, all time values begin with their initial values.

---

The safety relay supports the timer function "Clocking". The output is switched on and off periodically based on a parameterizable pulse/interval ratio.

The timer function has:

- 2 inputs: IN, R - Reset
- One function output Q

---

##### Note

##### MSS 3RK3 Basic limitation

MSS 3RK3 Basic does not support a reset input for this function element.

The MSS 3RK3 Basic responds as if the "Reset" parameter has "deactivated" the value.

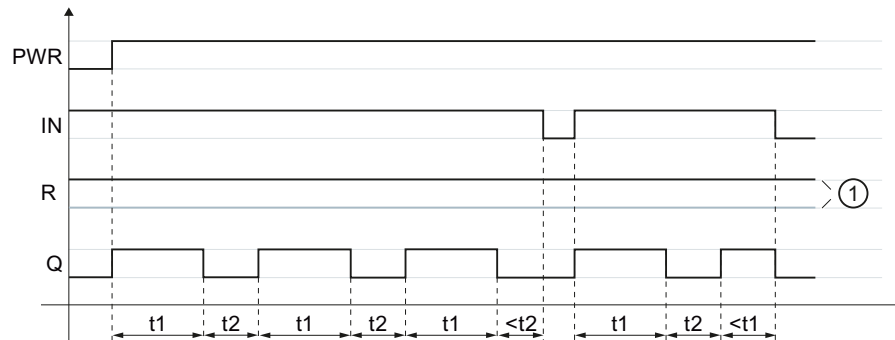
---

#### Functional principle

- If a "1" is detected at input IN and no reset is active, the clock pulse generator starts. The function output Q sends pulses as long as the input is set to "1".
- When there is a negative edge "1 → 0" at input IN, the clock pulse generator stops and sets the function output Q to "0".

### "Reset" = "deactivated" and "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "deactivated". It also applies for "Reset" = "with positive edge" or "with negative edge", if there is no edge change at input R.



- PWR Power supply
- IN Function input
- Q Function output
- R Reset
- t1 Pulse time
- t2 Pause time
- ① Either "1" or "0" is present.

Figure 8-23 Timer function "Clocking" when "Reset" = "deactivated", "with negative edge", or "with positive edge".

### "Reset" = "with positive edge" or "with negative edge"

The following diagram shows the behavior of the function element when "Reset" = "with positive edge".

#### Note

#### "Reset" = "with negative edge"

The behavior of the function element when "Reset" = "with negative edge" is exactly the same as when "Reset" = "with positive edge", except that the signal from R is inverted. Negative edge "1" > "0" is evaluated here.

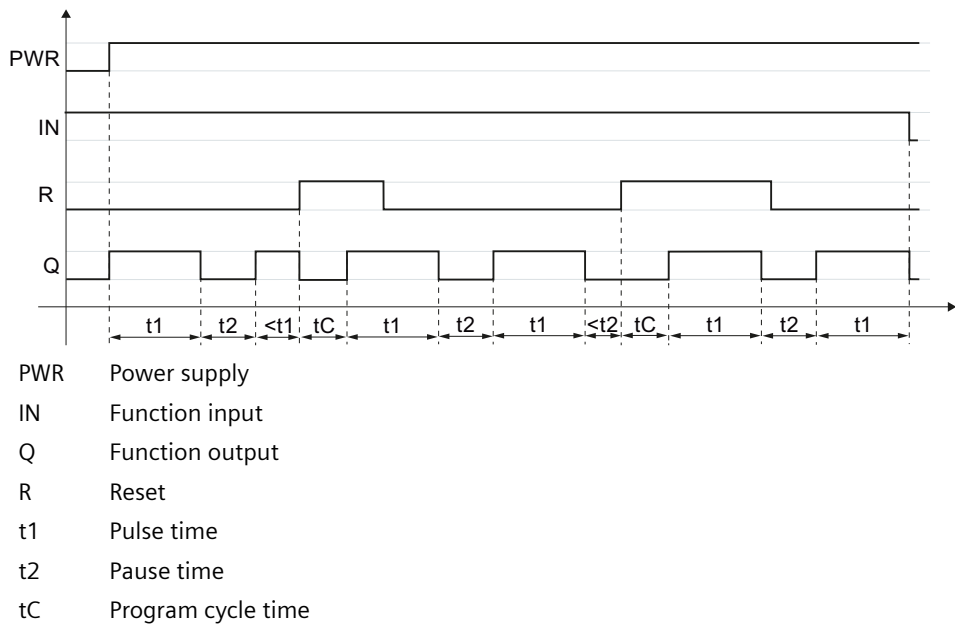


Figure 8-24 Timer function "Clocking" when "Reset" = "with positive edge"

**"Reset" = "with level 1"**

The following diagram shows the behavior of the function element when "Reset" = "with level 1".

**Note**

**Value "0" is present at function input R**

If the value "0" is present at function input R, the behavior of the function element is the same as for the edge evaluation shown in the first diagram.

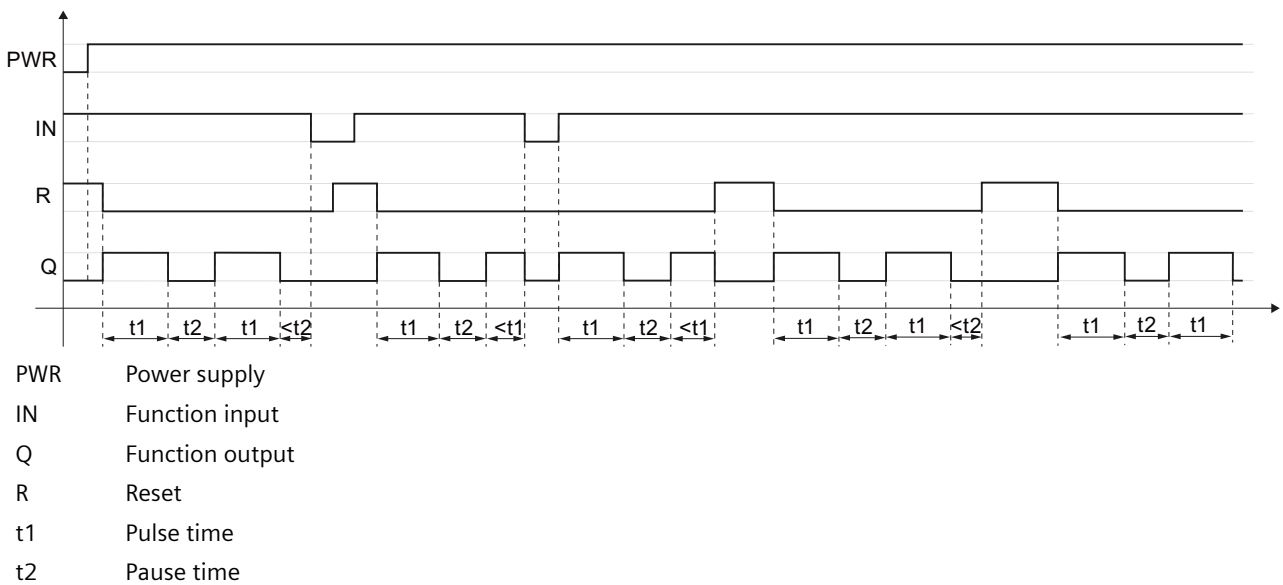


Figure 8-25 Timer function "Clocking" when "Reset" = "with level 1"



## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters</b>	t1[s]	<ul style="list-style-type: none"> <li>Enter the pulse time t1 and the pause time t2 for the clock-pulse generator.</li> <li>The maximum value is 655 s, increment: 5 ms</li> </ul> <p>Please note that the times you specified are a multiple of the program cycle time you specified in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
	t2[s]	
	Reset (not in the case of MSS 3RK3 Basic)	<ul style="list-style-type: none"> <li>deactivated The timer cannot be reset selectively to the "initial position". The output Q is set/reset according to the input signal and the timer function.</li> <li>with positive edge When a positive edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a positive edge is detected again.</li> <li>with negative edge When a negative edge is detected at the reset input, all timers and the output Q are reset once to the value "0". The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. Afterwards, the element starts over with its functionality.<sup>1)</sup> The value of the reset input only becomes irrelevant when a negative edge is detected again.</li> <li>with level 1 When the value "1" is detected at the reset input, all timers and the output Q are reset to the value "0" as long as the value "1" is present. The signal status at the timer trigger input is ignored in this process. The output Q assumes the value "0" for at least one program cycle. The element starts over with its functionality only when the value "0" is detected again at the reset input.<sup>1)</sup></li> </ul>

<sup>1)</sup> "Starts over" applies to timer functions that are started by level 1 at the timer trigger input: The timers are started if the value "1" is present at the timer trigger input.

## 8.11 Start functions

### 8.11.1 Monitored start

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Start functions	Monitored start		✓	✓	✓

#### Description

The "Monitored start" function element requires as start condition status "1" at input IN and input START. When this condition is fulfilled, the function output Q is activated, i.e. set to "1".

The start signal at the START input is only valid when the following applies:

- The time sequence of the START signal corresponds to the values "0 → 1 → 0".
- Value "1" must be present for 0.15 to 2 s.

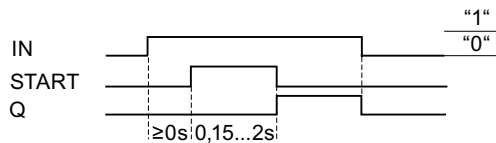



Figure 8-26 Start function "Monitored start"

#### Parameters

Parameter name		Description/parameter value
General	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1

## 8.11.2 Manual start

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Start functions	Manual start		✓	✓	✓

### Description

The "Manual start" function element requires as start condition status "1" at input IN and input START. When this condition is fulfilled, the function output Q is activated, i.e. set to "1".

The start signal at the START input is only valid when the following applies:

The time sequence of the START signal corresponds to the values "0 → 1".

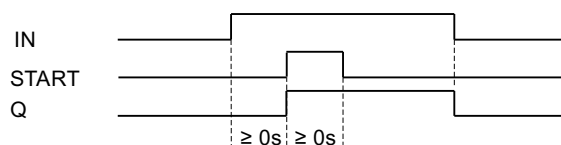



Figure 8-27 Manual start

### Parameters

Parameter name		Description/parameter value
General	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1

## 8.12 Output functions

### 8.12.1 Standard output

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Output functions	Standard output		✓	✓	✓

## Description

The "Standard output" function element is required to switch the hardware outputs of the standard output group.



### WARNING


#### **Automatic system startup following transmission error at fieldbus inputs. Can Cause Death, Serious Injury or Property Damage**

Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored."

## Parameters


Parameter name	Description/parameter value	
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When the parameter is deactivated, the set substitute value is made available at output Q.
	Substitute value – Q1	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
<b>Parameters - Output circuit</b>	Q1	Select the output for the processed signal.
	Auxiliary outputs	Select whether auxiliary outputs are to be activated: <ul style="list-style-type: none"> <li>• No</li> <li>• One auxiliary output</li> <li>• Two auxiliary outputs</li> </ul>
	AUX1	Only available when at least one auxiliary output is activated: Select the output to which the processed signal is to be output. The auxiliary output AUX1 supplies the same signal as Q. It can be interconnected with safety-related or standard outputs.
	AUX2	Only available when two auxiliary outputs are activated: Select the output for the processed signal. The auxiliary output AUX2 supplies the same signal as Q. It can be switched with safety-related or standard outputs.
<b>Parameter - Start</b> (not in the case of MSS 3RK3 Basic)	Start type	<ul style="list-style-type: none"> <li>• Automatic: The function output is set as soon as all start conditions are fulfilled.</li> <li>• Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1 → 0."</li> <li>• Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1."</li> </ul>

## 8.12.2 F output

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Output functions	F output		✓	✓	✓

### Description

The "F output" function element can be used to switch the hardware outputs of the safety-related devices on one or two channels.

 <b>WARNING</b>
<p><b>Automatic system startup following transmission error at fieldbus inputs. Can Cause Death, Serious Injury or Property Damage</b></p> <p>Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored." This is necessary to achieve SILCL 3 as per EN 61508 and PL e/ Cat. 4 as per EN ISO 13849-1.</p>

### Note


On a signal change at function input FEEDBACK, an error is generated immediately if the signal at function output Q has not changed.

### Parameters

Parameter name	Description/parameter value	
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Substitute value – Q1	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
	Substitute value – Q2	Only available with output type "Redundant F output": "0" or "1" can be assigned to the substitute value when the element is deactivated.
<b>Parameter</b>	Output type	Select the output type: <ul style="list-style-type: none"> <li>• Single F output</li> <li>• Redundant F output</li> </ul>

Parameter name	Description/parameter value	
<b>Parameter - Feedback circuit</b>	Monitoring	<p>The signal at the feedback circuit input is monitored with time delay by comparing it with the current status of the function output.</p> <p>Select the type of feedback circuit monitoring:</p> <ul style="list-style-type: none"> <li>• Deactivated</li> <li>• For OFF and ON status</li> <li>• For OFF status</li> </ul>
	Switching time [s]	<p>Parameters are only available when Parameters - Feedback circuit monitoring "For OFF and ON status" or "For OFF status" is activated.</p> <p>Select the switching time of the "auxiliary contacts" that depends on the function element.</p> <p>Please note that the entered feedback circuit switching time is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time and the response times in the manual of the safety relay.</p>
<b>Parameters - Output circuit</b>	Q1	<p>Select the output for the processed signal.</p> <p>Q1 can only be interconnected with the output of a safety-related device.</p>
	Q2	<p>Only available with output type "Redundant F output":</p> <p>Select the output for the processed signal.</p> <p>Q2 can only be interconnected with the output of a safety-related device.</p>
	Auxiliary outputs	<p>Select whether auxiliary outputs are to be activated:</p> <ul style="list-style-type: none"> <li>• No</li> <li>• One auxiliary output</li> <li>• Two auxiliary outputs</li> </ul>
	AUX1	<p>Only available when at least one auxiliary output is activated:</p> <p>Select the output to which the processed signal is to be output. The auxiliary output AUX1 supplies the same signal as Q. It can be interconnected with safety-related or standard outputs.</p>
	AUX2	<p>Only available when two auxiliary outputs are activated:</p> <p>Select the output for the processed signal. The auxiliary output AUX2 supplies the same signal as Q. It can be switched with safety-related or standard outputs.</p>
	FAULT	<p>Select the output for the processed signal.</p>
<b>Parameter - Start</b> (not in the case of MSS 3RK3 Basic)	Start type	<ul style="list-style-type: none"> <li>• Automatic: The function output is set as soon as all start conditions are fulfilled.</li> <li>• Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1 → 0".</li> <li>• Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1".</li> </ul>

### 8.12.3 Standard output delayed

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Output functions	Standard output delayed		-	-	✓

#### Note


The function element is not available in Safety ES for all devices. If a device that does not support this function element is configured in the configuration, the function element is hidden in the catalog window.

#### Description

Applications of "Stop category 1" can be implemented with the function element "Switching output delayed". This describes, for example, controlled power-down of a drive with subsequent disconnection from the main power source:

- When switching the drive off, control signal Q1 is reset first, and then control signal Q2 is reset with a time delay.
- This sequence is reversed when switching the drive on: First, control signal Q2 is set, and then control signal Q1 is set with a time delay.

The switching status of the actuators is checked (feedback circuit monitoring) via the auxiliary contacts / feedback signals of the two "actuators" (contactor and soft starter).

 <b>WARNING</b>
<p><b>Automatic system startup following transmission error at fieldbus inputs. Can Cause Death, Serious Injury or Property Damage</b></p> <p>Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored."</p>


## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Substitute value – Q1	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
	Substitute value – Q2	Only available with output type "Redundant standard output": "0" or "1" can be assigned to the substitute value when the element is deactivated.
<b>Parameters</b>	Output type	Select the output type: <ul style="list-style-type: none"> <li>Standard output</li> <li>Redundant standard output</li> </ul>
<b>Parameter - Output circuit - Delay time (t)</b>	On (Q2-t->Q1) [s]	ON-delay time When switching on function outputs Q1 and Q2, function output Q1 is switched on with a time delay in relation to output Q2. Set the length of the time delay (ON-delay time).
	Off (Q1-t->Q2) [s]	OFF-delay time When switching off function outputs Q1 and Q2, function output Q2 is switched off with a time delay in relation to output Q1. Set the length of the time delay (OFF-delay time).
	Bypass input	<ul style="list-style-type: none"> <li>No The delay time function of the element cannot be "overridden".</li> <li>Yes, with a pos. edge When a positive edge is detected at the bypass input, a currently active delay time is evaluated as "expired" on a one-off basis, and outputs Q1 and Q2 are set/reset in accordance with a properly expired delay time.</li> <li>Yes, with a neg. edge When a negative edge is detected at the bypass input, a currently active delay time is evaluated as "expired" on a one-off basis, and outputs Q1 and Q2 are set/reset in accordance with a properly expired delay time.</li> <li>Yes, with value "1" When the value "1" is detected at the bypass input, a currently active delay time is evaluated as "expired" on a one-off basis, and outputs Q1 and Q2 are set/reset in accordance with a properly expired delay time.</li> </ul>
<b>Parameter - Output circuit - Q1</b>	Q1	Select the output for the processed signal.
<b>Parameter - Output circuit - Q2</b>	Q2	Select the output for the processed signal.



Parameter name		Description/parameter value
Parameter - Output circuit - AUX1	Auxiliary output 1	Select whether auxiliary output 1 (AUX1) is to be activated: <ul style="list-style-type: none"> <li>No</li> <li>Yes</li> </ul>
	AUX1	Only available when auxiliary output 1 is activated: Select the output for the processed signal. Auxiliary output AUX1 sends the same signal as Q1.
Parameter - Output circuit - AUX2	Auxiliary output 2	Select whether auxiliary output 2 (AUX2) is to be activated: <ul style="list-style-type: none"> <li>No</li> <li>Yes</li> </ul>
	AUX2	Only available when auxiliary output 2 is activated: Select the output for the processed signal. Auxiliary output AUX2 sends the same signal as Q2.
Parameter - Start	Start type	<ul style="list-style-type: none"> <li>Automatic: The function output is set as soon as all start conditions are fulfilled.</li> <li>Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1 → 0."</li> <li>Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1."</li> </ul>

### 8.12.4 F output delayed

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Output functions	F output delayed		-	-	✓

#### Note


The function element is not available in Safety ES for all devices. If a device that does not support this function element is configured in the configuration, the function element is hidden in the catalog window.


#### Description

Safety applications of "Stop category 1" can be implemented with the function element "Switching output delayed". This describes controlled power-down of a drive with subsequent disconnection from the main power source:

- When switching the drive off, control signal Q1 is reset first, and then control signal Q2 is reset with a time delay.
- This sequence is reversed when switching the drive on: First, control signal Q2 is set, and then control signal Q1 is set with a time delay.

It is possible to check the switching state of the two actuators (feedback circuit monitoring) via the auxiliary contacts / feedback signals of the two actuators.

 <b>WARNING</b>
<p><b>Reduced diagnostic coverage due to deactivation of the light test Can Cause Death, Serious Injury, or Damage to Property</b></p> <p>The light test can be deactivated in the case of the "F output delayed" output function. Deactivating the light test has an impact on diagnostic coverage. This has an impact on the category according to EN ISO 13849. Note that Cat. 4 in compliance with EN ISO 13849 at the respective terminal is achieved only if the light test has been activated. In addition, the function test interval (shutdown test) is reduced to <math>\leq 1</math> year for solid-state actuators. You can find further information on the test intervals in the Machinery Directive 2006/42/EC.</p>

 <b>WARNING</b>
<p><b>Automatic system startup following transmission error at fieldbus inputs. Can Cause Death, Serious Injury or Property Damage</b></p> <p>Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored." This is necessary to achieve SILCL 3 as per EN 61508 and PL e/ Cat. 4 as per EN ISO 13849-1.</p>

**Note**

When a signal is changed at the function input FEEDBACK1... 2, an error is generated immediately if the signal at the function output Q1... 2 has not changed.

**Parameters**


Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Substitute value – Q1	"0" or "1" can be assigned to the substitute value when the element is deactivated. Substitute value "0" means output Q = 0 substitute value "1" means output Q = 1
	Substitute value – Q2	Only available with output type "Redundant F output": "0" or "1" can be assigned to the substitute value when the element is deactivated.
<b>Parameter</b>	Output type	Select the output type: <ul style="list-style-type: none"> <li>• Single F output</li> <li>• Redundant F output</li> </ul>

Parameter name		Description/parameter value
<b>Parameter - Feedback circuit 1</b>	Monitoring	<p>The signal at the feedback circuit input is monitored with time delay by comparing it with the current status of the function output.</p> <p>Select the type of feedback circuit monitoring:</p> <ul style="list-style-type: none"> <li>• Deactivated</li> <li>• For OFF and ON status</li> <li>• For OFF status</li> </ul> <p>Note: If the feedback contacts of the two actuators are to be monitored with one input, you must use feedback circuit 2.</p>
	Switching time [s]	<p>Parameters are only available when Parameters - Feedback circuit monitoring "For OFF and ON status" or "For OFF status" is activated.</p> <p>Select the switching time of the "auxiliary contacts" that depends on the function element.</p> <p>Please note that the entered feedback circuit switching time is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time in the manual of the safety relay.</p>
<b>Parameter - Feedback circuit 2</b>	Monitoring	<p>Only available with output type "Redundant F output":</p> <p>The signal at the feedback circuit input is monitored with time delay by comparing it with the current status of the function output.</p> <p>Select the type of feedback circuit monitoring:</p> <ul style="list-style-type: none"> <li>• deactivated</li> <li>• For OFF and ON status</li> <li>• For OFF status</li> </ul> <p>Note: If the feedback contacts of the two actuators are to be monitored with one input, you must use feedback circuit 2.</p>
	Switching time [s]	<p>Only available with output type "Redundant F output":</p> <p>Parameters are only available when Parameters - Feedback circuit monitoring "For OFF and ON status" or "For OFF status" is activated.</p> <p>Select the switching time of the "auxiliary contacts" that depends on the function element.</p> <p>Please note that the entered feedback circuit switching time is a multiple of the program cycle time specified by you in the properties of the safety relay.</p> <p>You can find more information on the program cycle time in the manual of the safety relay.</p>

Parameter name	Description/parameter value	
Parameter - Output circuit - Delay time (t)	On (Q2-t->Q1) [s]	ON-delay time When switching on function outputs Q1 and Q2, function output Q1 is switched on with a time delay in relation to output Q2. Set the length of the time delay (ON-delay time).
	Off (Q1-t->Q2) [s]	OFF-delay time When switching off function outputs Q1 and Q2, function output Q2 is switched off with a time delay in relation to output Q1. Set the length of the time delay (OFF-delay time).
	Bypass input	<ul style="list-style-type: none"> <li>• No The delay time function of the element cannot be "overridden".</li> <li>• Yes, with a pos. edge When a positive edge is detected at the bypass input, a currently active delay time is evaluated as "expired" on a one-off basis, and outputs Q1 and Q2 are set/reset in accordance with a properly expired delay time.</li> <li>• Yes, with a neg. edge When a negative edge is detected at the bypass input, a currently active delay time is evaluated as "expired" on a one-off basis, and outputs Q1 and Q2 are set/reset in accordance with a properly expired delay time.</li> <li>• Yes, with value "1" When the value "1" is detected at the bypass input, a currently active delay time is evaluated as "expired" on a one-off basis, and outputs Q1 and Q2 are set/reset in accordance with a properly expired delay time.</li> </ul>
Parameter - Output circuit - Q1	Q1	Select the output for the processed signal.
	Maximum read-back time [ms]	Set the desired maximum read-back time dependent on the connected capacitive load. For additional information on the maximum read-back time, in the "SIRIUS 3SK2 Safety Relays" manual, see the chapter "Dark test".
	Light test	Select whether the light test is to be carried out: <ul style="list-style-type: none"> <li>• activated</li> <li>• deactivated</li> </ul> For additional information on the light test, in the "SIRIUS 3SK2 Safety Relays" manual, see the chapter "Light test".
Parameter - Output circuit - Q2	Q2	Select the output for the processed signal.
	Maximum read-back time [ms]	Set the desired maximum read-back time dependent on the connected capacitive load. For additional information on the maximum read-back time, in the "SIRIUS 3SK2 Safety Relays" manual, see the chapter "Dark test".
	Light test	Select whether the light test is to be carried out: <ul style="list-style-type: none"> <li>• activated</li> <li>• deactivated</li> </ul> For additional information on the light test, in the "SIRIUS 3SK2 Safety Relays" manual, see the chapter "Light test".

Parameter name	Description/parameter value	
<b>Parameter - Output circuit - AUX1</b>	Auxiliary output 1	Select whether auxiliary output 1 (AUX1) is to be activated: <ul style="list-style-type: none"> <li>• No</li> <li>• Yes</li> </ul>
	AUX1	Only available when auxiliary output 1 is activated: Select the output for the processed signal. Auxiliary output AUX1 sends the same signal as Q1.
	Maximum read-back time [ms]	Set the desired maximum read-back time as a function of the connected capacitive load. For additional information on the maximum read-back time, in the manual "SIRIUS 3SK2 safety relays", see chapter "Dark test".
	Light test	Select whether the light test is to be carried out: <ul style="list-style-type: none"> <li>• activated</li> <li>• deactivated</li> </ul> For additional information on the light test, in the "SIRIUS 3SK2 Safety Relays" manual, see the chapter "Light test".
<b>Parameter - Output circuit - AUX2</b>	Auxiliary output 2	Select whether auxiliary output 2 (AUX2) is to be activated: <ul style="list-style-type: none"> <li>• No</li> <li>• Yes</li> </ul>
	AUX2	Only available when auxiliary output 2 is activated: Select the output for the processed signal. Auxiliary output AUX2 sends the same signal as Q2.
	Maximum read-back time [ms]	Set the desired maximum read-back time dependent on the connected capacitive load. For additional information on the maximum read-back time, in the "SIRIUS 3SK2 Safety Relays" manual, see the chapter "Dark test".
	Light test	Select whether the light test is to be carried out: <ul style="list-style-type: none"> <li>• activated</li> <li>• deactivated</li> </ul> For additional information on the light test, in the "SIRIUS 3SK2 Safety Relays" manual, see the chapter "Light test".
<b>Parameter - Output circuit</b>	FAULT	Select the output for the processed signal.
<b>Parameter - Start</b>	Start type	<ul style="list-style-type: none"> <li>• Automatic: The function output is set as soon as all start conditions are fulfilled.</li> <li>• Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1 → 0".</li> <li>• Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1".</li> </ul>

### 8.12.5 AS-i 1..4F-DO

Function element		Symbol	MSS 3RK3 Basic	MSS 3RK3 Advanced MSS 3RK3 ASIsafe	3SK2 safety relay
Output functions	AS-i 1..4F-DO		-	✓	-

#### Note

The function element is not available in Safety ES for all devices. If a device that does not support this function element is configured in the configuration, the function element is hidden in the catalog window.

#### Description

With the "AS-i 1..4F-DO" function element, safety-related AS-i outputs can be switched. A safety-related AS-i output module can contain up to four safe outputs, wherein only one fail-safe output can be active at any given time.

Up to 12 safety-related AS-i-outputs can be set/reset independently. The element can be placed multiple times for this purpose. You connect the F-OUT1 ... 4 signals from the safety-related AS-i output with the corresponding AS-i address to the "output terminals" of the individual function elements.

#### Properties

The "AS-i 1..4F-DO" function element has the following properties:

- 4 function outputs for setting/resetting the 4 safety-related F-OUT1..4 outputs of an ASIsafe output slave. The equipment identifier (BMK) in the terminal address is that of the safety relay and not that of the ASIsafe output slave.
- One function input each for setting/resetting the 4 safety-related AS-i outputs. These function inputs are monitored in such a way that only one of the function inputs can have the value "1" at any one time. If this condition is violated, all safety-related outputs of this function element will be shut down and an error message to this effect is generated.
- 2 function inputs with which you can set and reset the two non-safety-related auxiliary control signals AUX1 and AUX2.

---

**Note**

**Non-safety-related auxiliary control signals (AUX1/AUX2)**

In addition to the safety-related control signals (code sequences) of the AS-i outputs, non-safety-related auxiliary control signals (AUX1, AUX2) can also be transmitted. These are used, for example, to acknowledge a restart inhibit or to release errors at AS-i outputs. Additional information can be found in the relevant documentation of the safety-related AS-i output.

The auxiliary control signals AUX1 and AUX2 are defined as pulses. That is why these terminals must not be used for static signals. This pulse is generated as soon as an edge change from zero to one is detected at the respective AUX input (an edge change from one to zero is not taken into consideration).

If a simultaneous edge change is detected for both inputs, the pulse for AUX2 is output after the pulse for AUX1.

---

**Note**

**Forcing**

Only one of the function outputs can have the value "1" at any one time. The other outputs are automatically forced to the value "0." If forcing of an output is canceled, forcing of all other outputs will also be canceled. If multiple outputs are forced to "1," the code sequence of the output with the lowest number will be output.

---



**WARNING**

**Automatic system startup following transmission error at fieldbus inputs.  
Can Cause Death, Serious Injury or Property Damage**

Transmission errors at the fieldbus inputs can result in an erroneous start in which the system starts accidentally. To prevent this, the start type must be parameterized as "monitored." This is necessary to achieve SILCL 3 as per EN 61508 and PL e/ Cat. 4 as per EN ISO 13849-1.

---

**Note**

On a signal change at function input FEEDBACK\_1 ... 4, an error is generated immediately if the signal at function output Q1 ... 4 has not changed.

---

## Parameters

Parameter name		Description/parameter value
<b>General</b>	Name	You can enter a name for the element here.
	Comment	This text appears above the function element in the diagram. This may, for example, be information about this function element.
	Element number	Consecutive number that is automatically assigned. You can change the number.
	Element activated	When this parameter is active, the function element is processed in the safety logic. When this parameter is deactivated, the set substitute value is made available at output Q.
	Function output substitute value	The substitute value "1" can only be assigned to one output at a time. "0" is automatically assigned to all others. "0" or "1" can be assigned to the substitute value when the element is deactivated.
<b>Parameter</b>	Output type	Select the number of safety-related outputs required: <ul style="list-style-type: none"> <li>• 1F-DO</li> <li>• 2F-DO</li> <li>• 3F-DO</li> <li>• 4F-DO</li> </ul>
<b>Parameter - Feedback circuit - for outputs 1 to 4</b>	Monitoring	The signal at the feedback circuit input is monitored with time delay by comparing it with the current status of the function output. Select the type of feedback circuit monitoring: <ul style="list-style-type: none"> <li>• Deactivated</li> <li>• For OFF and ON status</li> <li>• For OFF status</li> </ul>
	Switching time [s]	Parameters are only available when Parameters - Feedback circuit monitoring "For OFF and ON status" or "For OFF status" is activated. Select the switching time of the "auxiliary contacts" that depends on the function element. Please note that the entered feedback circuit switching time is a multiple of the program cycle time specified by you in the properties of the safety relay. You can find more information on the program cycle time and the response times in the manual of the safety relay.
<b>Parameters - Output circuit</b>	Q1	Select the output for the processed signal.
	Q2-Q4	The fields are activated by the Output type parameter. The outputs are assigned automatically according to the selected output Q1. All 4 outputs must be on the same slave.
	FAULT	Select the output for the processed signal.
<b>Parameter - Start</b>	Start type	<ul style="list-style-type: none"> <li>• Automatic: The function output is set as soon as all start conditions are fulfilled.</li> <li>• Monitored: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1 → 0."</li> <li>• Manual: Function output Q is set as soon as all start conditions are fulfilled and the start signal is changed from "0 → 1."</li> </ul>



# Diagnostics

This diagnostics can be used to read the status of each system function element. Diagnostics with Safety ES is divided up into "Diagnostics configuration" and "Diagnostics logic".

The diagnostics configuration provides users with an overview of the module status and the device messages.

Diagnostics logic allows users to monitor system components. It also permits forcing.

Access to the diagnostics is possible via the fieldbus (PROFINET or PROFIBUS) and device interface depending on the existing license variant of Safety ES.

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## Note

A description of the diagnostics of older software versions of Safety ES is provided in the online help.

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## 9.1 Diagnostics configuration

### 9.1.1 Module status

#### Requirements

The "Target system" > "Diagnostics configuration" > "Module status" menu command can only be selected if the main system or the subsystem is activated in the navigation window and if an online connection is established between Safety ES and the safety relay.

#### Module status

When you choose "Target system" > "Diagnostics configuration" > "Module status", the status of the modules is shown in an additional column in the configuration table.

A red square indicates either a faulty module or a module that does not actually exist.

---

## Note

In the main system, all modules after the first defective module can no longer be addressed.

---

## Note

### Diagnostics display

The status of the diagnostics display is not displayed.

---

## 9.1.2 Dialog "Device messages" > "Overview" tab

### Requirements

The menu command "Target system" > "Diagnostics configuration" > "Device messages" > "Overview" can only be selected when Safety ES is connected online with the safety relay.

The configuration supports the following messages:

### General

Status	Symbol	Meaning
Group error	red	At least one error is present.
Bus error	red	Communication to the fieldbus master is disturbed.
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present (e.g. "Safety sensor triggered").

### Problem / Message - Possible remedial measures

In this window, problems / messages and possible remedial measures for these are shown in two columns.

### Examples:

Problem / Message	Possible remedial measures
Initialization error	<ul style="list-style-type: none"> <li>Switch off and switch on again the voltage supply of the device.</li> <li>The next time a device error is indicated, the device must be replaced.</li> </ul>
Group error	<ul style="list-style-type: none"> <li>The safety relay has detected at least one application-specific error.</li> <li>More detailed messages will give the precise cause of the error.</li> </ul>
Error in configuration	<ul style="list-style-type: none"> <li>Check the actual device configuration against the configured target configuration.</li> <li>Acknowledge after remedying the error.</li> </ul>
AS-i code sequence error	<ul style="list-style-type: none"> <li>An incorrect AS-i code sequence was received from at least one safety-related AS-i slave.</li> <li>Check the system for EMC interference and start up the system again.</li> <li>If code sequence errors occur again, replace the AS-i slave in question.</li> </ul>
Disconnect	<ul style="list-style-type: none"> <li>Restore the connection again.</li> <li>Check whether another program is using and therefore blocking the interface.</li> </ul>
Logic error	<ul style="list-style-type: none"> <li>The monitored sensor outputs an invalid signal sequence.</li> <li>Operate the monitored sensor in such a way that the start condition is fulfilled.</li> </ul>

### Legends

The meaning of the symbols used in the Problem / Message - Possible remedial measures section and the urgency level of the colors used is explained in the legends.

### 9.1.3 "Device messages" dialog box > "Status" tab

#### Requirements

The menu command "Target system" > "Diagnostics configuration" > "Device messages" > "Status" can only be selected when Safety ES is connected online to the safety relay.

The configuration supports the following messages:

#### General

Status	Symbol	Meaning
Group error	Red	At least one error is present.
Bus error	Red	Communication to the fieldbus master is disturbed.
Group warning	Yellow	At least one warning is present.
Group prewarning	Yellow	At least one prewarning is present (e.g. "Safety sensor triggered").

#### Group error

Status	Symbol	Meaning
Device fault	Red	<ul style="list-style-type: none"> <li>Faulty input or output</li> <li>Defective device</li> </ul>
Configuring error	Red	An error occurred during the configuring phase.
Configuration error	Red	TARGET slot configuration not equal ACTUAL slot configuration.
Safety protocol error	Red	<ul style="list-style-type: none"> <li>Communication with a safety-relevant communications partner is disrupted; for example, communications disrupted due to effects of EMC.</li> <li>Code sequence error (MSS 3RK3 Advanced, MSS 3RK3 ASIsafe basic and MSS 3RK3 ASIsafe extended)</li> </ul>
Group error from user program	Red	At least one error is present.
Wiring error	Red	Faulty wiring of a sensor connection or in the sensor itself.
Logic error	Red	Protection fault: Processing sequence on the sensor not coherent.
For an element number		Issues the number of the lowest element on which the group error is pending.

#### Bus error

Status	Symbol	Meaning
SC bus error	Red	Communication via the system interface is interrupted.
AS-i bus error	Red	The message is displayed for up to 30 s during startup if no AS-i bus is detected.
Fieldbus error	Red	Communication via the fieldbus interface is interrupted.

**Group warning**

Status	Symbol	Meaning
Group warning from user program	Yellow	At least one warning is present.
For an element number		Issues the number of the lowest element on which the group warning is pending.

**Group prewarning**

Status	Symbol	Meaning
Group prewarning from user program	Yellow	At least one prewarning is present.
For an element number		Issues the number of the lowest element on which the group prewarning is pending.

**Fault acknowledgment**

Status	Symbol	Meaning
Reset performed	Green	All error sources were eliminated and could be acknowledged.
Reset not possible	Yellow	At least one error cannot be acknowledged since the error cause still exists.

**Operating state**

Status	Symbol	Meaning
Configuring mode	Green	The safety relay is in configuring mode.
Test mode	Green	The safety relay is in test mode.
Safety mode	Green	The safety relay is in safety mode.
User program is running	Green	The safety relay is actively processing the safety circuit.
User program stopped	Yellow	The safety relay is not processing the safety circuit.
Operating state change rejected	Yellow	No valid password has been entered for switching to test mode. There is a configuring or device error that is preventing operating mode change.

**Access path**

Status	Symbol	Meaning
Access path closed	Green	No access path is open.
Access path of fieldbus controller is open	Green	The access path over the fieldbus interface for a control is open.
Fieldbus access path - ES tool is open	Green	The access path over the fieldbus interface for an ES tool is open.
Access path to device interface is open	Green	The access path over the device interface is open

Status	Symbol	Meaning
Connection abort	Yellow	The monitoring time has been exceeded. During monitoring time, the safety relay has not received any data set from the communication partner with write access to the safety relay.
Handshake error	Red	An error was detected during connection monitoring in test mode.

## Password protection

Status	Symbol	Meaning
Device access authorization exists	Green	Device access authorization exists.
Password protection for device access is inactive	Yellow	There is no protection against access from a higher-level controller or other users.
Incorrect password entry	Yellow	A password was received that does not match any device access password stored in the safety relay.

## Device self-test

Status	Symbol	Meaning
Self-test active	Blue	Device self-test running.
Self-test OK	Green	The device self-test was finished without an error.
Self-test error	Red	<p>The device has detected a defect during the self-test. This fault can be caused by a wiring error at the output or by an internal device fault.</p> <ul style="list-style-type: none"> <li>• Check the wiring of the outputs for short-circuit, cross-circuit and capacitive load.</li> <li>• To acknowledge the fault, switch the supply voltage of the device off and on again.</li> <li>• If the fault is reported again, replace the device with a new device.</li> </ul>

## Legends

The meaning of the symbols used in the Problem / Message - Possible remedial measures section and the urgency level of the colors used is explained in the legends.

### 9.1.4 Dialog "Device messages" > "Engineering" tab

#### Requirements

The menu command "Target system" > "Diagnostics configuration" > "Device messages" > "Configuring" can only be selected when the Safety ES is connected online to the safety relay.

The configuration supports the following messages:

**General**

Status	Symbol	Meaning
Group error	red	At least one error is present.
Bus error	red	Communication to the fieldbus master is disturbed.
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present (e.g. "Safety sensor triggered").

Status	Symbol	Meaning
Configuring error	red	An error occurred during the configuring phase.

**Configuring**

Status	Symbol	Meaning
Configuration missing	yellow	No valid configuration is stored in the safety relay.
Configuration not released	yellow	A valid configuration is stored but not released yet in the safety relay.
Release canceled	yellow	An already released configuration was canceled by means of the configuration release command.
Release canceled due to incorrect configuration release CRC	red	The configuration release CRC in the release data has a value other than "0" and deviates from the value calculated by the safety relay.
Release denied due to incorrect configuration CRC	red	The user tried to release a configuration whose configuration CRC does not match the configuration CRC to be released.
Configuration released	green	A valid and released configuration is stored in the safety relay.
Release denied, already released	yellow	The user is trying to release an already released configuration by means of the configuration release command.
Factory settings restored	green	The factory settings were successfully restored.

**Element error**

Status	Symbol	Meaning
Invalid parameter value	red	A parameter value is not within the permissible value range.
Interconnection rule violated	red	At least 1 interconnection rule is violated.
Data structure incorrect	red	While receiving new configuring data, an inconsistency was detected by the safety relay in the structure and content of at least one data structure.
For an element number		Specifies the number of the lowest element whose parameters were not accepted by the device.

## Device resources

Status	Symbol	Meaning
Max. number of elements exceeded	red	More elements than the maximum number of elements were transferred to the safety relay.
Max. size of memory exceeded	red	More element parameters were transferred to the device than can be stored in the safety relay memory .
Program cycle time exceeded	red	The program cycle time set by the user is exceeded, and the safety relay changes to configuring mode.

## Legends

The meaning of the symbols used in the Problem / Message - Possible remedial measures section and the urgency level of the colors used is explained in the legends.

### 9.1.5 "Device messages" dialog box > "Configuration" tab

#### Requirements

The menu command "Target system" > "Diagnostics configuration" > "Device messages" > "Configuration" can only be selected when the Safety ES is connected online to the safety relay.

The configuration supports the following messages:

#### General

Status	Symbol	Meaning
Group error	red	At least one error is present.
Bus error	red	Communication to the fieldbus master is disturbed.
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present (e.g. "Safety sensor triggered").

Status	Symbol	Meaning
Error in configuration	red	A problem has occurred in the memory module.

#### Device configuration

Status	Symbol	Meaning
TARGET configuration equal ACTUAL configuration	green	The specified TARGET configuration of the safety relay corresponds to the current function and device configuration.
TARGET configuration not equal ACTUAL configuration	red	The specified TARGET configuration of the safety relay does not correspond to the current function and device configuration.

Status	Symbol	Meaning
TARGET slot configuration not equal ACTUAL slot configuration	red	The specified TARGET slot configuration of the safety relay does not correspond to the ACTUAL slot configuration.
Target subslot configuration not equal to actual subslot configuration	red	The specified target subslot configuration (AS-i configuration) of the safety relay does not match the actual subslot configuration.

## Memory module

Status	Symbol	Meaning
Memory module not plugged in	red	No memory module is plugged in the safety relay.
Memory module defective	red	Memory module is defective.
Programming successful	green	Programming of the memory module was successful.
Programming error	red	Programming of the memory module was not successful.
User memory too small	red	More configuration data were transferred to the safety relay than can be stored in the user memory.
Memory module deleted	green	The memory module was deleted by command beforehand.

## Legends

The meaning of the symbols used in the Problem / Message - Possible remedial measures section and the urgency level of the colors used is explained in the legends.

### 9.1.6 Dialog "Device messages" > "PROFINET IO" tab

#### Requirements

The menu command "Target system" > "Diagnostics configuration" > "Device messages" > "PROFINET IO" can only be selected when Safety ES is connected online to the safety relay.

The "PROFINET IO" tab is only available when a PROFINET interface module is configured.

The configuration supports the following messages:

#### General

Status	Symbol	Meaning
Group error	Red	At least one error is present.
Bus error	Red	Communication with the IO controller is disturbed.
Group warning	Yellow	At least one warning is present.
Group prewarning	Yellow	At least one prewarning is present (e.g. "Safety sensor triggered").



## PN Status

Status	Symbol	Meaning
CPU/Master STOP	Yellow	<ul style="list-style-type: none"> <li>CPU STOP: The user program in the PLC is not processed any more.</li> <li>Master STOP: A disturbed communication with the fieldbus master was detected.</li> </ul>
Bus error	Red	Communication via PROFINET IO is interrupted.
Parameterization error	Red	During parameter assignment in existing communication connection a parameter assignment error occurred.
Configuration error	Red	The actual configuration of an existing communication connection does not match the target configuration. This resulted in an error.
Process data exchange stopped	Yellow	Process data exchange with the IO controller has stopped, for example, because the controller is in "STOP" state (= CPU STOP) or the user program in the safety relay is not running.
Communication OK	Green	The communication connection to the IO controller is set up. Configuration and parameter assignment of the safety relay have been executed successfully.

## Legends

The meaning of the symbols used in the Problem / Message and Possible Remedial Measures section and the urgency level of the colors used is explained in the legends.

### 9.1.7 Dialog "Device messages" > "PROFIBUS DP" tab

#### Requirements

The menu command "Target system" > "Diagnostics configuration" > "Device messages" > "PROFIBUS DP" can only be selected when Safety ES is connected online to the safety relay.

The "PROFIBUS DP" tab is only available when there is a configured DP interface module.

The configuration supports the following messages:

#### General

Status	Symbol	Meaning
Group error	red	At least one error is present.
Bus error	red	Communication to the fieldbus master is disturbed.
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present (e.g. "Safety sensor triggered").

**DP status**

Status	Symbol	Meaning
CPU/Master STOP	yellow	<ul style="list-style-type: none"> <li>CPU STOP: The user program in the PLC is not processed any more.</li> <li>Master STOP: A disturbed communication with the fieldbus master was detected.</li> </ul>
DP bus error	red	Communication via PROFIBUS DP has been interrupted.
DP parameter assignment error	red	During parameter assignment in existing communication connection a parameter assignment error occurred.
DP configuration error	red	The actual configuration of an existing communication connection does not match the target configuration. This resulted in an error.
DP process data exchange stopped	yellow	Process data exchange with the DP master has stopped, for example, because the controller is in the "STOP" state (= CPU STOP) or because the user program in the safety relay is not running.
DP communication ok	green	The communication connection to the fieldbus master is set up. Configuration and parameter assignment of the safety relay have been executed successfully.

**Legends**

The meaning of the symbols used in the Problem / Message - Possible remedial measures section and the urgency level of the colors used is explained in the legends.

**9.1.8 Dialog "Device messages" > "Device bus interface" tab****Requirements**

The menu command "Target system" > "Diagnostics configuration" > "Device messages" > "Device bus interface" can only be selected when Safety ES is connected online to the safety relay.

The configuration supports the following SC status messages (SC = system interface):

**General**

Status	Symbol	Meaning
Group error	Red	At least one error is present.
Bus error	Red	There is at least one communication fault of a bus system.
Group warning	Yellow	At least one warning is present.
Group prewarning	Yellow	At least one prewarning is present (e.g. "Safety sensor triggered").

**SC status**

Status	Symbol	Meaning
SC communication OK	Green	The internal communication link is set up.
SC bus error	Red	Communication via the system interface is interrupted.

Status	Symbol	Meaning
SC parameterization error	Red	An error occurred during parameter assignment for an existing communication connection.
SC configuration error	Red	The actual configuration of an existing communication connection does not match the target configuration. This resulted in an error. <ul style="list-style-type: none"> <li>• More than the maximum permissible expansion modules for the basic unit are connected.</li> <li>• An expansion module has been inserted/removed during operation.</li> <li>• No supply voltage is applied to at least one EM.</li> <li>• The basic unit or an expansion module is defective.</li> <li>• High electromagnetic interference in control cabinet.</li> </ul>
SC process data exchange stopped	Yellow	No more process data is exchanged.

## Legends

The meaning of the symbols used in the Problem / Message and Possible Remedial Measures section and the urgency level of the colors used is explained in the legends.

### 9.1.9 "Device messages" dialog box > "AS-Interface" tab

#### Requirements

The "AS-Interface" tab appears only if AS-Interface is configured for MSS 3RK3 Advanced, MSS 3RK3 ASIsafe basic or MSS 3RK3 ASIsafe extended.

The configuration supports the following messages:

#### General

Status	Symbol	Meaning
Group error	red	At least one error is present.
Bus error	red	Communication to the fieldbus master is disturbed.
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present (e.g. "Safety sensor triggered").

#### AS-i interface

Status	Symbol	Meaning
AS-i communication ok	green	<ul style="list-style-type: none"> <li>• The communications link to the AS-i slaves exists.</li> <li>• The AS-i slaves have been successfully configured and parameterized.</li> </ul>
AS-i configuration error	red	The actual configuration of an existing communication connection does not match the target configuration. This resulted in an error. Communication via the AS-i fieldbus interface is interrupted.

Status	Symbol	Meaning
For AS-i address		States the lowest of the affected addresses.
AS-i parameterization error	red	A simulated AS-i slave was not included in the data traffic by the AS-i master.
For AS-i address		States the lowest of the affected addresses.
AS-i bus error	red	The message is displayed for up to 30 s during startup if no AS-i bus is detected.

### AS-i slave function

Status	Symbol	Meaning
AS-i slave function active	green	The AS-i slave function is active, i.e. non-safety-related AS-i slaves are simulated by the safety relay.

### AS-i monitor function

Status	Symbol	Meaning
AS-i monitor function active	green	The AS-i monitor function is active, i.e. non-safety-related AS-i slaves are monitored.

### ASIsafe

Status	Symbol	Meaning
Safety protocol error	red	Fault in safety-related communication, for example, resulting from ASIsafe code sequence error due to effects of EMC.
ASIsafe 7x4-bit code sequence monitor active	green	At least one 7x4-bit code sequence monitor is monitoring data on the AS-i bus.
ASIsafe 7x4-bit code sequence error	red	During data transmission, an error in the 7x4-bit code sequence was detected in at least one AS-i address.
For AS-i address		States the lowest of the affected addresses.
ASIsafe 8x4-bit code sequence monitor active	green	At least one 8x4-bit code sequence monitor is active.
ASIsafe 8x4-bit code sequence error	red	During data transmission, an error in the 8x4-bit code sequence was detected in at least one AS-i address.
ASIsafe code table teaching active	blue	Monitoring of ASIsafe code sequences that have not yet been taught is active.
Code tables missing	red	The code table is missing for at least one of the configured safety-related input slaves.
Multiple code tables	red	At least two safety-related AS-i slaves with the same code table have been detected.
New codes tables	yellow	The code table of at least one configured safety-related input slave has not yet been transferred.
Code tables known	green	A valid code table has been taught and applied for all configured safety-related AS-i input slaves detected on the AS-i bus.
For AS-i address		States the lowest of the affected addresses.

Status	Symbol	Meaning
ASIsafe 7x4-bit code sequence generator active	green	At least one 7x4-bit code sequence generator is involved in the AS-i communication, i.e. it is transmitting a certain 7x4-bit code sequence for a particular parameterized AS-i address.
ASIsafe 8x4-bit code sequence generator active	green	At least one 8x4-bit code sequence generator is involved in the AS-i communication, i.e. it is transmitting a certain 8x4-bit code sequence for a particular parameterized AS-i address.

## Legends

The meaning of the symbols used in the Problem / Message - Possible remedial measures section and the urgency level of the colors used is explained in the legends.

## 9.2 Diagnostics logic

### 9.2.1 Monitoring






The "Target system" > "Diagnostics logic" > "Monitor" menu command shows the status of the inputs / outputs, of the function elements, and of the connections between the functions.



The status of the connections is determined based on the status of the respective function output Q.

### Requirements





- The safety relay is opened online.
- The logic diagram with the safety circuit is active.
- The safety relay is in safety mode / test mode

### General element status

Symbol	Color	Meaning
	gray	Function element is deactivated
	green	At least one function output is active
	green flashing	Function element is ready and is waiting for a start signal.
	yellow flashing	Function element waiting for startup test
	blue	Timer is active

Symbol	Color	Meaning
	red	Wiring error <b>Note</b> For input cells this means that the input substitute value is active.
	flashing red	Logic error, e.g. status of the feedback contact, does not match the setpoint value

### Status of the function inputs/function outputs

Symbol	Color	Meaning
	green	Function input active
	blue	Function input inactive
	green	Function output active
	blue	Function output inactive

## 9.2.2 Messages of the function elements

### 9.2.2.1 Element messages

The menu command "Target system" > "Diagnostics logic" > "Element messages" shows the messages for a function that is selected in the logic diagram. You can monitor status messages of several functions simultaneously.

The element messages can be read out from the user program.

### Requirements

- The safety relay is opened online.
- The logic diagram with the safety circuit is active.
- At least one function must be selected.

### 9.2.2.2 Messages for Monitoring Universal

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

## "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

## "Messages" tab

The view of the "Messages" tab is divided into the sections "General," "Sensor," and "Start."

### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	is set if: <ul style="list-style-type: none"> <li>• A sensor test was not executed in the case of an active startup test function</li> <li>• A discrepancy condition violation is present</li> <li>• The value "1" is not present simultaneously at all available (parameterized) function inputs (IN1, ...)</li> <li>• A signal sequence violation is present</li> <li>• A cross-circuit is present in the case of cross-circuit monitoring</li> </ul>

### Sensor

Status	Symbol	Meaning
Safety sensor triggered	yellow	The safety sensor has been actuated. This message is automatically reset if the value "1" is pending at all IN1 / 2 function inputs monitored.
Startup test required	yellow	This message is set in a parameterized startup test on each restart and each time the substitute value is changed to a real value until the user has actuated the connected sensor at least once.
Sequence condition not fulfilled	red	The sequence condition was not fulfilled in accordance with the parameter assignment.

Status	Symbol	Meaning
Discrepancy condition violated	red	is set if: <ul style="list-style-type: none"> <li>After the discrepancy time has elapsed, the signal states at the inputs monitored are different</li> <li>The signal states of the inputs monitored had not all previously been reset simultaneously to the value "0" when they are set to "1"</li> </ul>
Cross-circuit at input x	red	A cross-circuit was detected at input x.

## Start

Status	Symbol	Meaning
Start signal duration invalid	yellow	Only with start type "Monitored start": The start signal time monitoring element detected a violation.

### 9.2.2.3 EMERGENCY STOP messages

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

#### "Messages" tab

The view of the "Messages" tab is divided into the sections "General," "Sensor," and "Start."

#### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.



Status	Symbol	Meaning
Start condition not fulfilled	yellow	is set if: <ul style="list-style-type: none"> <li>• A sensor test was not executed in the case of an active startup test function</li> <li>• A discrepancy condition violation is present</li> <li>• A cross-circuit is present in the case of cross-circuit monitoring</li> <li>• The value "1" is not present simultaneously at all available (parameterized) function inputs (IN1, ...)</li> </ul>

## Sensor

Status	Symbol	Meaning
Safety sensor triggered	yellow	The safety sensor has been actuated. This message is automatically reset if the value "1" is pending at all IN1 / IN2 function inputs monitored.
Startup test required	yellow	This message is set in a parameterized startup test on each restart and each time the substitute value is changed to a real value until the connected sensor is actuated at least once.
Discrepancy condition violated	red	is set if: <ul style="list-style-type: none"> <li>• After the discrepancy time has elapsed, the signal states at the inputs monitored are different</li> <li>• The signal states of the inputs monitored had not all previously been reset simultaneously to the value "0" when they are set to "1"</li> </ul>
Cross-circuit at input x	red	A cross-circuit was detected at input x.

## Start

Status	Symbol	Meaning
Start signal duration invalid	yellow	Only with start type "Monitored start": The start signal time monitoring element detected a violation.

### 9.2.2.4 Messages for ESPE

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

**"Overview" tab**

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

**"Messages" tab**

The view of the "Messages" tab is divided into the sections "General," "Sensor," and "Start."

**General**

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	is set if: <ul style="list-style-type: none"> <li>A sensor test was not executed in the case of an active startup test function</li> <li>A discrepancy condition violation is present</li> <li>A cross-circuit is present in the case of cross-circuit monitoring</li> <li>The value "1" is not present simultaneously at all available (parameterized) function inputs (IN1, ...)</li> </ul>

**Sensor**

Status	Symbol	Meaning
Safety sensor triggered	yellow	The safety sensor has been actuated. This message is automatically reset if the value "1" is pending at all IN1 / IN2 function inputs monitored.
Discrepancy condition violated	red	is set if: <ul style="list-style-type: none"> <li>The signal states of the inputs monitored had not all previously been reset simultaneously to the value "0" when they are set to "1"</li> </ul>
Startup test required	yellow	This message is set in a parameterized startup test on each restart and each time the substitute value is changed to a real value until the connected sensor is actuated at least once.
Cross-circuit at input x	red	A cross-circuit was detected at input x.

## Start

Status	Symbol	Meaning
Start signal duration invalid	yellow	Only with start type "Monitored start": The start signal time monitoring element detected a violation.

### 9.2.2.5 Messages for safety shutdown mat (NC principle)

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

#### "Messages" tab

The view of the "Messages" tab is divided into the sections "General," "Sensor," and "Start."

#### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	is set if: <ul style="list-style-type: none"> <li>• A sensor test was not executed in the case of an active startup test function</li> <li>• A discrepancy condition violation is present</li> <li>• A cross-circuit is present in the case of cross-circuit monitoring</li> <li>• The value "1" is not present simultaneously at all available (parameterized) function inputs (IN1, ...)</li> </ul>

## Sensor

Status	Symbol	Meaning
Safety sensor triggered	yellow	The safety sensor has been actuated. This message is automatically reset if the value "1" is pending at all IN1 / IN2 function inputs monitored.
Startup test required	yellow	This message is set in a parameterized startup test on each restart and each time the substitute value is changed to a real value until the connected sensor is actuated at least once.
Discrepancy condition violated	red	is set if: <ul style="list-style-type: none"> <li>The signal states of the inputs monitored had not all previously been reset simultaneously to the value "0" when they are set to "1"</li> </ul>
Cross-circuit at input x	red	A cross-circuit was detected at input x.

## Start

Status	Symbol	Meaning
Start signal duration invalid	yellow	Only with start type "Monitored start": The start signal time monitoring element detected a violation.

### 9.2.2.6 Messages for safety shutdown mat (cross-circuit principle)

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

#### "Messages" tab

The view of the "Messages" tab is divided into the sections "General," "Sensor," and "Start."

#### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).

Status	Symbol	Meaning
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	is set if: <ul style="list-style-type: none"> <li>• A sensor test was not executed in the case of an active startup test function</li> <li>• A cross-circuit is present</li> <li>• The value "1" is not present simultaneously at all available (parameterized) function inputs (IN1, ...)</li> </ul>

## Sensor

Status	Symbol	Meaning
Safety sensor triggered	yellow	The safety sensor has been actuated. This message is automatically reset if the value "1" is pending at all IN1 / IN2 function inputs monitored.
Startup test required	yellow	This message is set in a parameterized startup test on each restart and each time the substitute value is changed to a real value until the connected sensor is actuated at least once.
Wire break at input x	red	Value "0" detected at input x.
Short circuit to P at input x	red	A short-circuit to P was detected at input x.

## Start

Status	Symbol	Meaning
Start signal duration invalid	yellow	Only with start type "Monitored start": The start signal time monitoring element detected a violation.

### 9.2.2.7 Messages for protective door

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

**"Messages" tab**

The view of the "Messages" tab is divided into the sections "General," "Sensor," and "Start."

**General**

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	<p>is set if:</p> <ul style="list-style-type: none"> <li>• A sensor test was not executed in the case of an active startup test function</li> <li>• A discrepancy condition violation is present</li> <li>• The value "1" is not present simultaneously at all available (parameterized) function inputs (IN1, ...)</li> <li>• A signal sequence violation is present</li> <li>• A cross-circuit is present in the case of cross-circuit monitoring</li> </ul>

**Sensor**

Status	Symbol	Meaning
Safety sensor triggered	yellow	The safety sensor has been actuated. This message is automatically reset if the value "1" is pending at all IN1 / IN2 function inputs monitored.
Startup test required	yellow	This message is set in a parameterized startup test on each restart and each time the substitute value is changed to a real value until the connected sensor is actuated at least once.
Sequence condition not fulfilled	red	The sequence condition was not fulfilled in accordance with the parameter assignment.
Discrepancy condition violated	red	<p>is set if:</p> <ul style="list-style-type: none"> <li>• After the discrepancy time has elapsed, the signal states at the inputs monitored are different</li> <li>• The signal states of all inputs to be monitored had not all previously been reset simultaneously to the value "0" when they are set to "1."</li> </ul>
Cross-circuit at input x	red	A cross-circuit was detected at input x.

## Start

Status	Symbol	Meaning
Start signal duration invalid	yellow	Only with start type "Monitored start": The start signal time monitoring element detected a violation.

### 9.2.2.8 Messages for protective door with lock

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

#### "Messages" tab

The view of the "Messages" tab is divided into the sections "General," "Sensor / Protective Door," "Lock," and "Start."

#### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	is set if: <ul style="list-style-type: none"> <li>• A sensor test was not executed in the case of an active startup test function</li> <li>• A discrepancy condition violation is present</li> <li>• The value "1" is not present simultaneously at all available (parameterized) function inputs (IN1, ...)</li> <li>• A signal sequence violation is present</li> <li>• A cross-circuit is present in the case of cross-circuit monitoring</li> </ul>

## Sensor

Status	Symbol	Meaning
Safety sensor triggered	yellow	The safety sensor has been actuated. This message is automatically reset if the value "1" is pending at all IN1 / IN2 function inputs monitored.
Protective door closed	green	The protective door is closed.
Startup test required	yellow	This message is set in a parameterized startup test on each restart and each time the substitute value is changed to a real value until the connected sensor is actuated at least once.
Sequence condition not fulfilled	red	The sequence condition was not fulfilled in accordance with the parameter assignment.
Discrepancy condition violated	red	is set if: <ul style="list-style-type: none"> <li>After the discrepancy time has elapsed, the signal states at the inputs monitored are different</li> <li>The signal states of the inputs monitored had not all previously been reset simultaneously to the value "0" when they are set to "1"</li> </ul>
Cross-circuit at input x	red	A cross-circuit was detected at input x.

## Lock

Status	Symbol	Meaning
Lock engaged	green	The lock is engaged.
Lock released	green	The lock is released.
Feedback circuit signal and switching status do not match	red	The feedback circuit signal does not match the interlock status.
Protective door opened when lock was active	red	The protective door opened when lock was active.
Locking not possible because the protective door is open	red	Locking not possible because the protective door is open.
Start override active	blue	The start override time is running.

## Start

Status	Symbol	Meaning
Start signal duration invalid	yellow	Only with start type "Monitored start": The start signal time monitoring element detected a violation.

### 9.2.2.9 Messages for enabling button

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.



## "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

## "Messages" tab

The view of the "Messages" tab is divided into the sections "General" and "Sensor."

### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	Is set if: <ul style="list-style-type: none"> <li>A discrepancy condition violation is present</li> <li>A cross-circuit is present</li> <li>The value "1" is not present simultaneously at all available (parameterized) function inputs (IN1, ...)</li> <li>A jammed button error is present</li> </ul>

### Sensor

Status	Symbol	Meaning
Enabling button OFF	green	The enabling button has the status OFF.
Enabling button ON	green	The enabling button has the status ON.
Pushbutton jammed	red	The pushbutton is jammed.
Discrepancy condition violated	red	Is set if: <ul style="list-style-type: none"> <li>The signal states of the inputs monitored had not all previously been reset simultaneously to the value "0" when they are set to "1"</li> </ul>
Cross-circuit at input x	red	A cross-circuit was detected at input x.

### 9.2.2.10 Messages for two-hand operation

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

#### "Messages" tab

The view of the "Messages" tab is divided into the sections "General" and "Sensor."

##### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	is set if: <ul style="list-style-type: none"> <li>• A discrepancy condition violation is present</li> <li>• A cross-circuit is present</li> <li>• If both pushbuttons were not pressed "synchronously", that is, they were pressed with a time offset greater than 0.5 s</li> <li>• The value "1" is not present simultaneously at IN1 / 3, IN2 / 4</li> <li>• The two pushbuttons were not released simultaneously</li> <li>• A jammed button error is present</li> </ul>

##### Sensor

Status	Symbol	Meaning
Pushbutton jammed	red	The pushbutton is jammed.
Do not release both pushbuttons	red	The two pushbuttons were not released simultaneously.

Status	Symbol	Meaning
Discrepancy condition violated	red	is set if: <ul style="list-style-type: none"> <li>After the discrepancy time has elapsed, the signal states at the inputs monitored are different within one or both pushbuttons</li> <li>The signal states of the inputs monitored had not all previously been reset simultaneously to the value "0" when they are set to "1"</li> </ul>
Cross-circuit at input x	red	A cross-circuit was detected at input x.

### 9.2.2.11 Messages for mode selector switch

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

#### "Messages" tab

The view of the "Messages" tab is contains the sections "General" and "Mode selector switch."

#### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

#### Mode selector switch

Status	Symbol	Meaning
Switchover time exceeded	yellow	The "1 out of 2 ... 5 selection monitoring" detected the value "0" at all inputs after the contact switchover time had elapsed.
Invalid operating mode selection	red	The "1 out of 2 ... 5 selection monitoring" detected after the contact switchover time had elapsed: The value "1" is present at more than one input.

### 9.2.2.12 Messages for the muting functions

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

#### "Messages" tab

The view of the "Messages" tab is divided into the sections "General", "Muting sensors", and "Restart."

#### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. muting indicator light fault).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start muting condition not met	yellow	Not all conditions for operational starting of muting using muting sensors are met.

#### Muting sensors

Status	Symbol	Meaning
Muting operation active	green	Muting mode is activated.
Muting operation not active	green	Muting mode is not activated.
Protective field not free	yellow	The value "0" is present at the "FREE" function input.
System not running	yellow	The value "1" is present at the "STOP" function input.
Sequence condition not fulfilled	red	The sequence condition was not observed.
Discrepancy condition sensor pair x not fulfilled	red	A discrepancy violation was detected in the signals of muting sensor pair x.

Status	Symbol	Meaning
Max. muting time elapsed	red	Muting operation terminated because "max. muting time" expired.
Muting indicator light fault	red	The muting indicator light monitoring function has detected an error.

## Restart

Status	Symbol	Meaning
Muting restart possible	green	Muting mode was not terminated correctly, i.e. at least one muting sensor is still being triggered.
Restart signal duration invalid	yellow	The "Muting restart possible" message is set and, the first time the RESTART button is pressed, the expected operating sequence does not follow.

### 9.2.2.13 Messages for counter functions

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

#### "Messages" tab

The view of the "Messages" tab is contains the sections "General" and "Counter function."

#### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

## Counter function

Status	Symbol	Meaning
Counter limit value exceeded	yellow	The parameterized counter limit value was exceeded.
Counter limit value undershot	green	The parameterized counter limit value was undershot.
Last count pulse was up	green	Last count pulse was up
Last count pulse was down	green	Last count pulse was down.

### 9.2.2.14 Messages for timer functions

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

#### "Messages" tab

The view of the "Messages" tab is contains the sections "General" and "Timer function."

#### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

#### Time function

Status	Symbol	Meaning
OFF delay active	blue	The parameterized time t1 runs "with OFF delay".
ON delay active	blue	The parameterized time t1 runs "with ON delay".
Passing make pulse contact active	blue	The parameterized time t1 runs "with ON delay."
Clock-pulse generator active	green	The parameterized times t1 and t2 run "with clocking".

### 9.2.2.15 Messages for start functions

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

#### "Overview" tab

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

#### "Messages" tab

The view of the "Messages" tab is contains the sections "General" and "Start."

#### General

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	The value "0" is present at the "Start condition input (IN)".

#### Start

Status	Symbol	Meaning
Start signal duration invalid	yellow	Only with start type "Monitored start": The start signal time monitoring element detected a violation.

### 9.2.2.16 Messages for output functions

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

**"Overview" tab**

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

**"Messages" tab**

The view of the "Messages" tab is divided into the sections "General," "Output," "Feedback circuit," and "Start."

**General**

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. cross-circuit).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	is set if: <ul style="list-style-type: none"> <li>there is a feedback circuit error when feedback circuit monitoring is activated.</li> <li>the value "0" is pending at the function input (IN).</li> </ul>

**Output**

Status	Symbol	Meaning
Output x active	green	Function output x is switched on.
Auxiliary output x active	green	Auxiliary output x is switched on.

**Feedback circuit**

Status	Symbol	Meaning
Feedback circuit signal x and switching status do not match	red	The signal at feedback circuit input x does not match the switching status of the function outputs. The output function immediately deactivates all its outputs in case of inconsistencies.



**Start**

Status	Symbol	Meaning
Start signal duration invalid	yellow	Only with start type "Monitored start": The start signal time monitoring element detected a violation.

**Delay**

Status	Symbol	Meaning
Bypass active	blue	Bypassing is active.
ON-delay time active at Q1	blue	The ON-delay time at output Q1 is active.
OFF-delay time active at Q2	blue	The OFF-delay time at output Q2 is active.

**9.2.2.17 Messages for AS-i 1..4F-DO**

The "Element Messages" dialog box contains two tabs named "Overview" and "Messages" and provides information, remedial measures, and messages about pending problems and errors.

**"Overview" tab**

The view of the "Overview" tab is divided into the following sections:

Section	Content and meaning
General	The color indicates the type of error.
Problem / Message Possible remedial measures	Defines remedial measures for the displayed problem.
Legend	Explains the meaning of the symbols used in the Problem / Message - Possible remedial measures section.

**"Messages" tab**

The view of the "Messages" tab is divided into the sections "General," "Output," "Start," and "Feedback circuit."

**General**

Status	Symbol	Meaning
Logic error	red	At least one logic error is present (e.g. discrepancy error / sequence error).
Wiring error	red	At least one wiring error is present (e.g. feedback circuit error).
Group warning	yellow	At least one warning is present.
Group prewarning	yellow	At least one prewarning is present.

Status	Symbol	Meaning
Start condition not fulfilled	yellow	is set if: <ul style="list-style-type: none"> <li>• there is a feedback circuit error when feedback circuit monitoring is active</li> <li>• the logic error "Invalid output selection" is present</li> <li>• the value "1" is present at more than one of the existing (parameterized) function inputs</li> </ul>

## Output

Status	Symbol	Meaning
Output x active	green	Function output x is switched on.
Auxiliary control signal x sent	green	The auxiliary control signal x was transmitted completely by the code sequence that is currently active.
Invalid output selection	red	The value "1" was detected on more than one input IN1 ... 4 by the "1 out of 4 - selection monitoring."

## Start

Status	Symbol	Meaning
Start signal duration invalid	yellow	Only with start type "Monitored start": The start signal time monitoring element detected a violation.

## Feedback circuit

Status	Symbol	Meaning
Feedback circuit signal x and switching status do not match	red	The signal at feedback circuit input x and the switching status of function output x do not match. In case of inconsistencies, the output function immediately switches off all its outputs.

## 9.3 Messages during the consistency check

### 9.3.1 Messages during the consistency check - Identification

The consistency check is used to check whether the configuration is correct and complete.

A consistency check is carried out for the following actions:

- With the "Edit" > "Check consistency" menu command
- When a configuration is saved
- With the "Target system" > "Prepare configuration test..." menu command

The messages are displayed in the output window. By clicking on a message in the output window, you can jump to the corresponding error location.

The following messages may appear during the consistency check:

Message	Kind	Message text	Remedy
Name of configuration engineer is missing	Error	"General configuration: Name of configuration engineer is missing."	Enter the name of the configuration engineer in the "Project" parameter assignment view
Name of the the configuration engineer's company is missing	Error	"General configuration: Name of configuration engineer's company is missing."	Enter the name of the company of the configuration engineer in the "Project" parameter assignment view
Project name is missing	Error	"General configuration: Project name is missing."	Enter the project name in the "Project" parameter assignment view
The user memory is full	Error	"General configuration: The user memory is overloaded. Reduce the system documentation (under Options > Settings of Safety ES) or optimize the logic if necessary!"	Reduce the memory requirements on the memory module You will find more information in chapter "Settings of Safety ES - "Download options" tab (Page 94)"

### 9.3.2 Messages during the consistency check - Configuration

The consistency check is used to check whether the configuration is correct and complete.

A consistency check is carried out for the following actions:

- With the "Edit" > "Check consistency" menu command
- When a configuration is saved
- With the "Target system" > "Prepare configuration test..." menu command

The messages are displayed in the output window. By clicking on a message in the output window, you can jump to the corresponding error location.

The following messages may appear during the consistency check:

Message	Kind	Message text	Remedy
The expansion modules must be configured in succession.	Error	"Configuration: There is a gap in front of an expansion module."	Correct the configuration "manually," possibly using the "Delete blank rows automatically" function from the context menu.
The safety relay must be available.	Error	"Configuration: A safety relay always needs to be configured at slot 3."	Drag the safety relay from the catalog window to slot 3 in the configuration table.

### 9.3.3 Messages during the consistency check - Logic

The consistency check is used to check whether the configuration is correct and complete.

## 9.3 Messages during the consistency check

A consistency check is carried out for the following actions:

- With the "Edit" > "Check consistency" menu command
- When a configuration is saved
- With the "Target system" > "Prepare configuration test..." menu command

The messages are displayed in the output window. By clicking on a message in the output window, you can jump to the corresponding error location.

## Logic diagram

The following messages exist for the logic diagram:

Rule	Kind	Message	Remedy
All address elements must be assigned to valid addresses. (Exception: FAULT output)	Error	Logic: Terminal not connected <[element type]> (no. [element number]).	Assign a valid address in the object properties dialog of the address element or of the associated input/output element.
Non-fail-safe input signals can only be added to a safety circuit if they are ANDed with a safe signal.	Warning	Logic: Signal flow terminal <[element type]> (no. [element number]): Non-safety-relevant signal is connected with a safety-relevant signal to a safety output without ANDing.	Change the safety circuit accordingly.
Inputs of logic elements must be connected. (Exceptions: • STOP and RESTART of the muting functions • AUX1/2 for AS-i 1 to 4F-DO)	Error	Logic: Input <[element type]> (no. [element number]) not connected.	Change the safety circuit accordingly.
Outputs of logic elements must be connected. (Exception: FAULT output)	Error	Logic: Output <[element type]> (no. [element number]) not connected.	Change the safety circuit accordingly.
A function element must not overlap a page limit.	Warning	Logic: The function element <function name> (no. [element number]) overlaps the page limit.	Move the function element or execute the "Realign graphic" command.
A function element must not overlap a connection.	Warning	Logic: The function element <1> [no. \2] overlaps a connection.	Move the function element or execute "Realign graphic."
A function element must not overlap another function element.	Warning	Logic: The function element <function name> (no. [element number]) overlaps another function element.	Move the function element or execute "Realign graphic."
A connection must not overlap another one.	Warning	Logic: A connection overlaps another connection.	Move the connection or associated function element, or execute "Realign graphic."
A comment field overlaps a page limit.	Warning	Logic: A comment field overlaps the page limit.	Move the comment.
A comment field overlaps another comment field.	Warning	Logic: A comment field overlaps another comment field.	Move the comment.
A comment field overlaps a connection.	Warning	Logic: A comment field overlaps a connection.	Move the comment/connection.

Rule	Kind	Message	Remedy
A function element overlaps a comment field.	Warning	Logic: The function element <1> [no. \2] overlaps a comment field.	Move the function element/comment field.
A reference point of an interrupted connection overlaps a connection.	Warning	Logic: A reference point of an interrupted connection overlaps another connection.	Move the connection or execute "Realign graphic".
A reference point of an interrupted connection overlaps another reference point.	Warning	Logic: A reference point of an interrupted connection overlaps with another reference point.	Change the safety circuit accordingly or execute "Realign graphic."
A function element overlaps a reference point of an interrupted connection.	Warning	Logic: The function element <1> [no. \2] overlaps a reference point of an interrupted connection.	Change the safety circuit accordingly or execute "Realign graphic."
A reference point of an interrupted connection overlaps the page limit.	Warning	Logic: A reference point of an interrupted connection overlaps the page limit.	Change the safety circuit accordingly or execute "Realign graphic."
A comment field element overlaps a reference point of an interrupted connection.	Warning	Logic: A comment field overlaps a reference point of an interrupted connection.	Change the safety circuit accordingly or execute "Realign graphic."
The set program cycle time has been exceeded	Error	Logic: The set program cycle time has been exceeded. Reduce the number of function elements.	Alter safety circuit accordingly or increase program cycle time
If the channels of a device are wired to the "Safety shutdown mat (cross-circuit principle)" monitoring function, the other channels of this device should not be used with: <ul style="list-style-type: none"> <li>another monitoring function "Safety shutdown mat (cross-circuit principle)"</li> <li>another monitoring function with activated cross-circuit.</li> </ul>	Warning	Logic: <[element type]> (no. [element number]) - cross-circuit detection activated (channels of <[BMK/slot/subslot no.]> are wired to the monitoring function <safety shutdown mat (cross-circuit principle)> <[element type]> (no. [element number])> wired).	Change the safety circuit accordingly.
The internal memory on the safety relay is full	Error	"General configuration: The internal memory of the safety relay is full. Reduce the scope of the logic"	Reduce the scope of the logic (by optimization, for example).
A function element has an interconnection level larger than 255 (parameter is only 1 byte in size)	Error	Logic: No more than 255 function elements can be connected one behind the other. The rule is violated by the function element with the number \1.	Optimize the logic in such a way that no more than 255 interconnection levels are required (e.g. by use of output and input cells in pairs).

## 9.4 Safety ES messages

### 9.4.1 Error reading a data set

**Message: "Error reading a data set"**

#### Description

Error reading a data set from the safety relay or from the parameter file.

#### Possible causes

- The connection to the safety relay is interrupted.
- The cable has not been connected to the specified COM/USB interface.
- The cable has not been connected to the safety relay.
- The cable is defective.
- The COM/USB interface has been assigned to another program.
- The parameter file is damaged.

#### Remedy

- Check the connection to the safety relay.
- Redo the configuration.

### 9.4.2 The file <file name> cannot be opened

**Message: "The file <file name> cannot be opened"**

#### Description

The specified file cannot be opened.

#### Possible causes

- Missing access rights
- The file does not exist.
- The file is already opened at a different location.

**Remedy**

- Check the access rights.
- Check whether the file exists
- Close the application where the file is opened.

**9.4.3 The file <file name> cannot be written****Message: "The file <file name> cannot be written"****Description**

The specified file cannot be written.

**Possible causes**

- Missing access rights
- The file does not exist.
- The file is already exclusively opened by another application.
- Not sufficient memory on the hard disk.
- The PC has no network access.

**Remedy**

- Check the access rights
- Check whether the file exists
- Close the application where the file is opened.
- Check whether there is sufficient storage space on the hard disk and delete any not needed data, if applicable.
- Check the network access.

**9.4.4 The file <file name> cannot be read****Message: "The file <file name> cannot be read"****Description**

The specified file cannot be read.

### Possible causes

- Missing access rights
- The file does not exist
- The file is already exclusively opened by another application
- There is no network access
- The file is damaged.

### Remedy

- Check the access rights
- Check whether the file exists
- Close the application that has opened the file
- Check the network access
- Recreate the file.

## 9.4.5 Online function not available

**Message: "Online function not available"**

### Description

An online function could not be executed.

### Remedy

- Close the application, restart it, and execute the function again.
- If this measure does not help, reinstall Safety ES.

## 9.4.6 Error while executing the action

**Message: "Error while executing the action"**

### Description

An error occurred while executing the action.



**Remedy**

- Close the application, restart it, and execute the function again.
- If this measure does not help, reinstall Safety ES.

**9.4.7 Error during download to safety relay****Message: "Error during download to safety relay"****Description**

An error occurred while loading the configuration to the connected safety relay.

**Possible causes**

- The configuration is erroneous.
- The connection to the safety relay is interrupted.
- The safety relay is defective.

**Remedy**

- Check the connection to the safety relay.
- Repeat the download.
- Read out the diagnostics (via the menu command "Target system > Device diagnostics")
- Replace the safety relay.

**9.4.8 Error during download to PC****Message: "Error during download to PC"****Description**

An error occurred while loading the configuration from the connected safety relay to the PC.

**Possible causes**

- The configuration is erroneous.
- The connection to the safety relay is interrupted.
- The safety relay is defective.

### Remedy

- Check the connection to the safety relay.
- Repeat the download to the PC.
- Read out the diagnostics (via the menu command "Target system > Device diagnostics").

## 9.4.9 Printout could not be created

**Message: "Printout could not be created"**

### Description

An error occurred while generating the printout.

### Possible causes

- No connection to the printer could be established.
- The Safety ES installation is damaged.

### Remedy

- Check the connection to the printer.
- Reinstall Safety ES.

## 9.4.10 Print preview could not be generated

**Message: "Print preview could not be generated"**

### Description

An error occurred while generating the print preview.

### Possible causes

- The Safety ES installation is damaged.

**Remedy**

- Reinstall Safety ES.

**9.4.11 Imported activation code is incorrect****Message: "Imported activation code is incorrect"****Description**

You have tried to import an incorrect code for activating the project access password.

**Possible causes**

- You have selected the wrong file.
- The file is damaged.

**Remedy**

- Repeat the action.
- If this measure does not help, contact Technical Support.

**9.4.12 The file with the activation code for resetting...****Message: "File with activation code for resetting password for project access could not be opened"****Description**

File with activation code for resetting password for project access could not be opened.

**Possible causes**

- Missing access rights.
- The file does not exist.
- The file is already exclusively opened by another application.
- There is no network access.
- The file is damaged.

## Remedy

- Check the access rights.
- Check whether the file exists
- Close the application that has opened the file.
- Check the network access.
- Repeat the action.
- If this measure does not help, contact Technical Support.

### 9.4.13 Connection to the safety relay could not be established...

**Message: No connection to safety relay could be established. The action is canceled"**

#### Description

A printout of the configuration data on a safety relay is created, for example, within the framework of the function "Prepare configuration test". For this purpose, an online connection to a safety relay needs to be established.

#### Possible causes

- No connection path is possible.
- The connection to the safety relay is interrupted.
- The cable has not been connected to the specified COM/USB interface.
- The cable has not been connected to the safety relay.
- The cable is defective.
- The COM/USB interface has been assigned to another program.

#### Remedy

- Restore the connection to the safety relay.
- Check the connection to the safety relay.
- Repeat the action.

#### 9.4.14 Connection to device cannot be opened! Please check...

**Message: "Connection to device cannot be opened!" Please check whether the cable connection is interrupted or another program is blocking the serial interface."**

##### Description

This message appears in conjunction with the commands "Open online", "Load to PC" and "Load to switching device".

##### Possible causes

- No connection path is possible.
- The connection to the safety relay is interrupted.
- The cable has not been connected to the specified COM/USB interface.
- The cable has not been connected to the safety relay.
- The cable is defective.
- The COM/USB interface has been assigned to another program.

##### Remedy

- Restore the connection to the safety relay.
- Check the connection to the safety relay.
- Repeat the action.

#### 9.4.15 The configuration on the connected safety relay...

**Message: "Configuration of connected safety relay does not match configuration shown in the editor. The action is canceled"**

##### Description

Within the framework of the function "Prepare configuration test", a printout of the configuration data on a safety relay is created. If there is no associated offline project, the circuit elements are automatically arranged in the logic diagram and it is possible that not all documentation data (e.g. equipment identifier, terminal identifiers, element identifiers) are available.

To implement the "Prepare configuration test" function, the offline configuration that matches the configuration in the safety relay must always be open.

## Remedy

Open the file with the configuration that matches the configuration in the safety relay and repeat the action.

### 9.4.16 No consistency check could be executed...

**Message: "No consistency check could be executed. The action is canceled"**

## Description

An error occurred during the consistency check.

## Remedy

- Close the application, restart it, and execute the function again.
- If this measure does not help, reinstall Safety ES.

### 9.4.17 Printout or print preview could not be created

**Message: "Printout or print preview could not be created"**

## Description

An error occurred while generating the printout or print preview.

## Possible causes

- No connection to the printer could be established.
- The Safety ES installation is damaged.

## Remedy

Implement the following measures one after another:

- Check the connection to the printer.
- Repeat the action.
- Reinstall Safety ES.

### 9.4.18 The configuration on the connected safety relay...

**Message: Configuration of connected safety relay does not match configuration shown in the editor. Release is not possible"**

#### Description

To execute the function "Release configuration", it is absolutely necessary that the offline configuration that matches the configuration on the safety relay is displayed in Safety ES.

#### Remedy

Open the file with the configuration that matches the configuration in the safety relay and repeat the action.

### 9.4.19 Data set with release data could not be read...

**Message: "Data set with release data could not be read. Release is not possible"**

#### Description

An error occurred while reading the release data set from the safety relay.

#### Possible causes

- The connection to the safety relay is interrupted.
- The cable has not been connected to the specified COM/USB interface.
- The cable has not been connected to the safety relay.
- The cable is defective.
- The COM/USB interface has been assigned to another program.

#### Remedy

- Check the connection to the safety relay.
- Repeat the action.

### 9.4.20 Data set with release data could not...

**Message: "Data set with release data could not be written. Release is not possible"**

#### Description

An error occurred while writing the release data set to the safety relay.

#### Possible causes

- The connection to the safety relay is interrupted.
- The cable has not been connected to the specified COM/USB interface.
- The cable has not been connected to the safety relay.
- The cable is defective.
- The COM/USB interface has been assigned to another program.

#### Remedy

- Check the connection to the safety relay.
- Repeat the action.

### 9.4.21 Error during download to safety relay...

**Message: "Error during download to safety relay" Maximum memory size was exceeded"**

#### Description

There are too many configuration data to be downloaded.

#### Possible cause

There is not enough storage space on the connected safety relay.

#### Remedy

- Install a larger memory in the safety relay.
- Reduce the scope of documentation data (e.g. equipment identifier, terminal identifier, element identifier) or do not download these data to the safety relay.



## 9.4.22 Safety System ES cannot read required status information...

**Message: "Safety ES cannot read required status information from the connected safety relay. The action is canceled"**

### Description

An error occurred while reading the release data set from the safety relay.

### Possible cause

- The connection to the safety relay is interrupted.
- The cable has not been connected to the specified COM/USB interface.
- The cable has not been connected to the safety relay.
- The cable is defective.
- The COM/USB interface has been assigned to another program.

### Remedy

- Check the connection to the safety relay.
- Repeat the action.

## 9.4.23 An access path to the connected safety relay cannot...

**Message: "No access path to connected safety relay can be opened. The action is canceled"**

### Description

The safety relay must first open up an access path to permit write access (e.g. commands) to a connected safety relay. This is not possible at the moment.

### Possible causes

- A connection has not been established with the safety relay.
- The cable has not been connected to the specified COM/USB interface.
- The cable has not been connected to the safety relay.
- The cable is defective.

- The COM/USB interface has been assigned to another program.
- The access path to the safety relay is already being used (e.g. by another application or a PROFIBUS/PROFINET master).

### Remedy

- Check the connection to the safety relay.
- Make an already used access path available again.

## 9.4.24 Device error. For this reason, change to test mode is...

Message: "Device error. Switching to test mode is therefore not possible"

### Description

There is an error in the connected safety relay. Switching to test mode is therefore not possible.

### Possible causes

Device error.

### Remedy

- Reset the safety relay by restoring the factory settings.
- Replace the safety relay.

## 9.4.25 Logic diagram could not be initialized. Reason: ...

Message: "Logic diagram could not be initialized. Reason: ..."

### Possible causes

An error occurred during the initialization of the graphical user interface.

### Remedy

- Close the application, restart it, and execute the function again.
- If this measure does not help, reinstall Safety ES.

### 9.4.26 Inconsistencies were detected while reading data set xxx.

**Message:** "Inconsistencies were detected while reading data set xxx"

#### Description

Inconsistencies were detected while reading a data set from the parameter file or while transferring a data set from the connected safety relay.

#### Possible causes

- The parameter file is damaged.
- The connection to the safety relay is disturbed.

#### Remedy

1. Close Safety ES and repeat the action.
2. Check the connection to the safety relay.

### 9.4.27 Do you want to activate test mode for the safety relay that contains the configuration with the...

**Message:** "Do you want to activate test mode for the safety relay that contains the configuration with the configuration CRC xxx (hex.)?"

#### Description

This command activates the test mode on the target system.

---

**Note**

For this purpose, it is important that you observe the notes in the Online Help of Safety ES or in the system manual.

---

### 9.4.28 An error occurred during transfer of configuration from safety relay...

**Message: "An error occurred during transfer of configuration from safety relay or an incorrect configuration was downloaded from safety relay. The action is canceled"**

#### Description

An error occurred during the transfer of a configuration from the connected safety relay. The configuration could not be transferred completely.

#### Possible causes

- The connection to the safety relay is disturbed.
- The configuration on the safety relay is damaged.
- The safety relay is defective.

#### Remedy

- Close Safety ES and repeat the action.
- Check the connection to the safety relay.
- Check the configuration on the safety relay or the safety relay itself.

### 9.4.29 Error reading configuration data...

**Message: "Error reading configuration data. Configuration CRC and configuration data do not match"**

#### Description

The data in the configuration file to be opened do not match the associated configuration CRC.

#### Possible causes

- The configuration data were changed outside of Safety ES.
- Error reading configuration data.

#### Remedy

- Close Safety ES and repeat the action.

### 9.4.30 Error during communication with the connected safety relay...

**Message:** "Error during communication with the connected safety relay (data set: <Data set number>)! The application is ended."

#### Description

An error occurred during communication with the safety relay (reading or writing of data sets).

#### Possible causes

- The connection to the safety relay is interrupted.
- Incorrect operating mode on the safety relay.
- Lack of resources on the safety relay.

#### Remedy

- Check the connection to the safety relay.
- Check the safety relay itself.
- Repeat the action, if required.



# Glossary

## **\*.sdp file**

File for storing parameterization data of a device (switching device parameters) on a programming device / PC. Safety ES projects are saved in files with this extension (\*.sdp).

## **7 x 4-bit code sequence generator**

A 7 x 4-bit code sequence generator is an AS-i slave simulated by a safety monitor with a dedicated AS-i address and a special 7 x 4-bit code sequence. It sets and resets AS-i actuators safely.

## **7 x 4-bit code sequence monitor**

A 7 x 4-bit code sequence monitor is a safety-related AS-i output that listens to the 7 x 4-bit code sequences of a 7 x 4-bit code sequence generator. It is not assigned to a dedicated AS-i address.

## **7 x 4-bit code sequences (safety-related signals to actuators)**

These safety-related signals are transmitted to the safety-related AS-i outputs as 7 x 4-bit code sequences. For this purpose, the safety monitor simulates a safety-related AS-i slave with an AS-i address and a special 7 x 4-bit code sequence. The safety-related output listens to this 7 x 4-bit code sequence without assigning a safe address itself, i.e. it behaves like a monitor. The safety-related output evaluates the 7 x 4-bit code sequences and switches the connected actuators accordingly.

## **8 x 4-bit code sequences (safety-related signals from sensors)**

Each safety-related AS-i input slave has its own unique 8 x 4-bit code sequence to be able to transmit safety-related signals to a safety monitor. These code sequences must be made known to the MSS 3RK3 by teaching. The integrated safety monitor listens in to the 8 x 4-bit code sequences of all safety-related AS-i input slaves as a passive participant and evaluates them safely.

## **8 x 4-bit code sequence generator**

Safety-related AS-i input slave (sensor) with its own unique 8 x 4-bit code sequence. It transmits safety-related signals to an AS-i safety monitor.

## **8 x 4-bit code sequence monitor**

An 8 x 4-bit code sequence monitor is an AS-i safety monitor that monitors safety-related AS-i input slaves (8 x 4-bit code sequence generators) and evaluates them safely. It is not assigned to a dedicated AS-i address.

### **AS-Interface (AS-i)**

AS-Interface (actuator-sensor interface) is the fieldbus communication standard.

### **ASIsafe**

Safety-related version of AS-Interface from SIEMENS AG.

### **Catalog window**

View in the Safety ES interface; tree representation of elements that can be dragged and dropped into the work space (in the configuration view: Modules; logical view: Function elements).

### **Combined Transaction Type 2 (CTT2)**

Communication protocol on AS-Interface in accordance with Specification V3.0 for the transmission of large volumes of data (analog values, strings, etc.).

### **Configuration**

Defines the configuration of a device or system and the arrangement of the components.

### **CPU**

The central processing unit (CPU) or the main processor is the main processing element of a computer system.

### **CTT (Combined Transaction Type)**

Special AS-i slave profile: In addition to the "Standard AS-i Slave" type, which transfers the process image of its inputs and outputs as a 4-bit message frame, whose bit position reflects the value of the associated input and output terminals, there are also further types of AS-i slaves. These types of slaves are named "Combined Transaction Types". In these types, the bit position of the process data bits does not correspond to the values of the input and output terminals of the AS-i slave.

### **Current-source short circuit**

In the direct voltage system of the safety relays, current-source short circuit means a short circuit between a conductor and a positive potential (+ 5 V or + 24 V).

### **Cyclic redundancy check (CRC)**

CRC is a test procedure for checking for data corruption. A generator polynomial is used to generate a checksum from the monitored data that then acts as a signature for it. There are different algorithms for calculating the polynomial generator.



**Dark period**

Dark periods occur during shutdown tests and complete bit pattern tests. Test-related 0 signals are switched from the fail-safe output module to the output bit while the output is active. This output is then briefly disabled (= dark period). A sufficiently slow actuator does not respond to this and remains switched on.

**Data set (DS)**

A data set groups together data that belong to a single unit by virtue of logic or content.

**Device name**

Before an IO device can be addressed by an IO controller, the IO device must have a device name because the IP address is permanently assigned to the device name.

In the case of PROFINET, this method was chosen because names are easier to handle than complex IP addresses. Assignment of a device name for a specific IO device can be compared to setting the PROFIBUS address on a DP slave. An IO device does not have a device name when it is delivered. It can only be addressed by an IO controller once a device name has been assigned to it, e.g. for transmission of the configuration data during startup or for exchanging useful data in cyclic operation.

**Discrepancy monitoring**

A two-channel or multi-channel sensor can be monitored for signal discrepancy (= discrepancy monitoring). Discrepancy monitoring is possible with the following monitoring criteria:

- Discrepancy monitoring monitors the values of the input signals when changing from 1->0 or 0->1 at at least one input to check that they are the same after a certain time, the "discrepancy time".
- Discrepancy monitoring monitors the values of the input signals for the simultaneous presence of the value "0".

While a discrepancy error is active, it is impossible to set the function output Q to the value "1".

**Discrepancy time**

Parameterizable time for the discrepancy analysis.

The discrepancy time monitoring tolerates associated signals not being available at the same time within a defined time window. The signal transmitters are monitored to increase the functional reliability. The signal change of the signal transmitters is checked within the defined time. If this time is exceeded, an enable signal is not output. This type of monitoring is mandatory for a number of protective safety devices.

If the discrepancy time is set too high, the error detection time and error response time will be prolonged to no useful effect. If the discrepancy time is set too low, the availability is reduced to no useful effect because a discrepancy error will be detected even if there is no real error.

### **Distributed Peripheral**

The safety relay can be connected in a distributed configuration to a higher-level controller with the help of a fieldbus (e.g. PROFINET IO or PROFIBUS DP)

The controller is the master and the safety relay is the slave.

### **DP address**

Unique address of a bus node in a PROFIBUS network. Settable values are 0 ... 126.

### **DP interface**

Communication module for connecting an MSS 3RK3 central unit to the PROFIBUS fieldbus system.

### **DP slave**

A slave that is operated on PROFIBUS with the PROFIBUS DP protocol and works according to the EN 50 170 standard, Volume 2, PROFIBUS.

### **DPV1**

PROFIBUS specification with added interrupts and acyclic services.

### **Element identifier**

Parameterizable name for a circuit element.

### **Element number**

Unique and type-independent identification numbers for switching elements that are assigned by the system and can be parameterized.

### **ESPE (electro-sensitive protective equipment)**

Unit comprising devices and/or components that are actuated non-mechanically and that work together for the purpose of detecting the approach or presence of persons. The unit contains at least a detection function, a control/monitoring function, and one or more output signal switching devices.

Examples include light barriers, capacitive, active infrared, ultrasonic, and camera systems. The safety-related control system combined with the ESPE, or the ESPE itself, can additionally contain a second shutdown device, multifunctions, standstill monitoring, start inhibit, restart inhibit, etc.

### **EUC**

Abbreviation for equipment under control

**Feedback circuit**

The feedback circuit of a safety function monitors the connected actuators with positively-driven contacts. The normally closed contacts of the actuators with positively-driven contacts are used to check whether these have assumed their safe state before being activated again.

**Fieldbus**

Industrial communication system that connects a large number of field devices such as probes (sensors), final controlling elements, and drives (actuators) to a control device.

**Forcing**

Signal state of an output is set to a fixed value irrespective of the actual signal state value.

This function overwrites a variable (e.g. flag, output) with a defined value. The variable is also write-protected so that this value cannot be changed from any source (including the user program). The value is retained even after the PG has been removed. The write protection can only be removed in error-free operation by calling the "unforce" function and assigning the value defined by the user program to the variable again. In the event of a fault (e.g. connection loss, device fault, etc.), write protection is revoked early.

The "force" function can be used, for example, to set certain outputs to the "ON" state for any length of time during the commissioning phase if the conditions of logic operations of the user program are not fulfilled (for example, because inputs have not yet been wired).

**Function / function element**

Blocks in the logic diagram of the software (e.g. EMERGENCY STOP function, ESPE, etc.)

**FW**

Abbreviation for firmware

**Group warning**

For all device diagnostic buffer entries that can result in internal tripping, a group warning is generated if the relevant message (e.g. unbalance) is set and the associated internal trip signal (e.g. unbalance trip) is not set. This warning is entered in the I/O area. The bit for group errors in the I/O area is not set.

**GSD file (device master file)**

File that describes the properties of a PROFIBUS DP slave or a PROFINET IO device. Standardized description of a DP standard slave for connection to a higher-level engineering system (e.g. STEP 7).

## **GSDML**

The GSDML language is defined by the GSDML scheme. A GSDML scheme contains validity rules that allow you to check the syntax of a GSD file, for example. Manufacturers of IO devices can obtain GSDML schemes (in the form of scheme files) from PROFIBUS International.

## **GSDML file**

The properties of a PROFINET device are described in a GSD (General Station Description or device master data) file. You can link a PROFINET device into an automation system via the GSD file. The GSD file contains all information required for configuration.

In the case of PROFINET IO, the GSD file is in XML format and will therefore be referred to as a GSDML file in this documentation. The structure of the GSDML file conforms to ISO 15734, the worldwide standard for device descriptions.

## **HW**

Abbreviation for hardware

## **I&M data**

Identification and maintenance data. Identification data (I data) is information about the module, some of which is also printed on the module housing.

I data is only read. Maintenance data (M data) is plant-specific information, such as the installation location, installation date, etc. M data is created and written to the module during commissioning. Identification and maintenance data (I&M) is information stored in a module that supports you with

- Checking the system configuration
- Locating modified system hardware
- Troubleshooting a system.

I&M data can be used to identify modules uniquely on the network.

## **IBS**

Abbreviation for commissioning

## **Input delay**

Parameter that is used to suppress interference pulses of 0 ms up to a set input delay time.

The set input delay is subject to a tolerance that can be looked up in the technical data of the module. A long input delay will suppress longer interference pulses; a short delay will suppress shorter interference pulses. The permissible input delay depends on the cable length between the transmitter and module.

## IP address

To enable a PROFINET device to be addressed as a node on Industrial Ethernet, the PROFINET device requires an IP address that is unique within the network. The IP address is made up of 4 decimal numbers with a range of values from 0 through 255. The decimal numbers are separated by a decimal point.

The IP address is made up as follows:

- Address of the (sub)net
- Address of the station (host or network node)

## LLDP

LLDP (Link Layer Discovery Protocol) is a protocol that allows the next neighbor to be detected. LLDP enables a device to send information about itself and receive information from neighboring devices.

## Lock (tumbler mechanism)

According to EN 1088, the objective of a tumbler mechanism is to maintain a guard in the closed position. It is also connected to the control so that the machine cannot operate if the guard is not closed and that the guard is kept closed until the risk of injury is no longer present.

## Logical input/output terminal

Inputs and outputs whose signals are transferred over a fieldbus system (e.g. PROFINET, AS-i) are termed "logical input and output terminals" in the manual.

## MAC address

The MAC address is a worldwide unique device identification and is assigned to each PROFINET device during production. The PROFINET device can be accessed via the MAC address via LAN.

The MAC address is 6 bytes long and has the following structure:

- 3 bytes for the manufacturer ID
- 3 bytes with a device identifier (consecutive number).

The MAC address can generally be read from the front on the device, e.g.: 08-00-06-6B-80-C0.

## Muting

Muting is the temporary deactivation or cancellation of a safety function, e.g. light array, that must be passed through.

EN 61946-1:

Override function: Temporary automatic overriding of the protection function with additional sensors to distinguish between people and objects.

### **Navigation window**

Representation in the Safety ES interface; tree structure with which the view shown in the work space can be selected ("Configuration" view, "Logic" view).

### **Offline project**

The safety circuit is provided in the form of a program file and can be opened using the software.

### **Online project**

A safety circuit is present in the safety relay and can be read out using the software.

### **Output window**

View in the software interface in which messages or similar are displayed.

### **Parameterization**

Parameterization is the definition of parameters using the parameterization software.

### **Parameters**

Parameters are values that can be used to control the behavior of the devices.

### **PELV**

Protective Extra-Low Voltage. PELV (Protective Extra-Low Voltage, formerly referred to as "protective extra low voltage with safe isolation") offers protection against electric shock. It is dealt with in EN 50178.

### **PELV power section**

Ensures a circuit with a voltage that does not exceed the PELV with safe isolation from other circuits (not PELV circuits). In addition, grounding facilities are provided for PELV circuits and/or their accessible conducting parts.

### **PII/PIQ**

Process image input/process image output

### **PLC**

Abbreviation for programmable logic controller (e.g. SIMATIC S7)

### **Process response time**

The process response time is synonymous with the process safety time.

**Process safety time**

The period of time between the failure of the EUC (equipment under control) or of the EUC higher-level control or control system with the potential to cause a dangerous incident, and the time when the response in the EUC must be completed to prevent the occurrence of the dangerous incident (definition from EN 61508-4 3.6.20).

**PROFIBUS**

Fieldbus of Profibus International (PI), open fieldbus, standardized in accordance with EN/IEC.

**PROFenergy**

Profile for power management in production plants. PROFenergy uses the PROFINET communication protocol. It controls the power consumption of automation equipment used in production via a PROFINET network.

**PROFINET**

PROFINET (Process Field Network) is the open Industrial Ethernet standard of Profibus & Profinet International (PI) for automation.

Within the framework of Totally Integrated Automation (TIA), PROFINET is a consistent continuation of:

- PROFIBUS DP, the established fieldbus
- Industrial Ethernet, the communication bus for the cell level.

Experiences from both systems have been and are being integrated in PROFINET.

**PROFINET IO controller**

Device via which the connected IO devices are addressed. The IO controller exchanges input and output signals with assigned field devices. The IO controller is often the controller on which the automation program runs.

**PROFINET IO device**

Distributed field device assigned to one of the IO controllers.

**Programmable controller (PLC)**

Controller whose functionality is defined by a user program stored in the controller. The PLC comprises a CPU, memory, input/output modules and internal bus system. The I/O and the programming language are oriented to control engineering needs.

**Programming device (PG)**

A PG is a PC that is suitable for use in industry, compact, and portable. Its distinguishing feature is the special hardware and software for programmable controllers (SIMATIC).

### Reference designation (BMK)

Inputs and outputs or terminals of different devices within a system can be addressed uniquely using the reference designation.

The current reference designations (previously known as equipment identifiers) can be found in EN 61346-2. The standard EN 61346-2 replaces DIN 40719-2 and has been valid since June 1, 2001. The 3-year transition deadline expired on June 1, 2003.

### Reset

Tripping, i.e. disconnection and prevention of reclosure of an affected output due to a fault (e.g. cross-circuit, discrepancy time violation) can be acknowledged with Reset.

### Restart

The device carries out a complete restart as with Power-ON. However, the auxiliary power for the electronics does not have to be switched off; something that is often difficult in practice in the installed state. A restart can be forced by the command "Restart", for example.

### Result of logic operation (RLO)

Binary result of a logical combining of several items of data.

### S7 routing

The term routing denotes a transition from one subnet to one or several other subnets in a SIMATIC station that possesses interfaces to the applicable subnets.

Routing makes it possible to reach S7 stations online across subnet boundaries using a PG/PC, for example to download user programs or a hardware configuration or to be able to execute testing and diagnostic functions.

You can connect a PG/PC anywhere on the network and establish an online connection to all stations reachable via network transitions.

### Safe state

The basis of the safety concept in safety-related systems is that a safe state exists for all process variables that can also be specified by the user. (Substitute value for failed inputs; initial state in the event of a "safety-related incident"). Generally, the safe state signifies signal level = 0 in the case of inputs and deactivation of the output in the case of outputs.

### Safety circuit

A safety circuit encompasses the section of a safety system that is located before a safe output and sets this output.



**Safety systems**

Safety systems are intended to play their role in keeping potential hazards for both people and the environment as low as possible by using suitable technical equipment, without restricting, more than absolutely necessary, industrial production and the use of machines. The protection of man and environment has to be put on an equal footing in all countries by applying rules/regulations that have been internationally harmonized. These regulations are also intended to avoid the distortion of competition due to differing safety requirements in international trade.

**Safety-related slave**

Slave for connecting safety-related sensors, actuators, and other devices.

**SC**

Abbreviation used for semiconductor. Used in conjunction with inputs and outputs (e.g. "SC outputs").

**Sequence monitoring**

If at least two function inputs are parameterized on an input element, sequence monitoring is possible. Sequence monitoring monitors the sequence of the remaining input signals in the case of a signal change from 0 -> 1 at an input. The simultaneous response of input signals constitutes a sequence violation. While a sequence error is active, it is impossible to set the function output Q to the value "1".

**Short circuit to ground**

Short circuit to ground: A short circuit between a conductor and ground in a DC voltage system.

**Simple Network Management Protocol (SNMP)**

Network protocol for monitoring and controlling network elements (e.g. switches).

**Slave**

Some fieldbuses (e.g. PROFIBUS DP) are based on a master-slave architecture. Message frames are sent by the master to the addressed station (slave) and responded to by the slave.

**Startup test**

Manually or automatically conducted test of the safety-related evaluation device after the supply voltage has been applied to the safety-related evaluation device.

One example of such a test is manually opening and closing a guard after the supply voltage has been switched on.

## **STEP 7**

The basic STEP 7 software is the standard tool for the SIMATIC S7, SIMATIC C7, and SIMATIC WinAC automation systems.

## **STOP category 0**

EN 60204-1: Uncontrolled stop by means of immediate power shutdown.

## **STOP category 1**

EN 60204-1: Controlled stop by means of interrupting the power supply when standstill has been reached

## **Substitute value**

Substitute values are, for example, values that are output to the process if signal output modules or signal input modules are defective.

Substitute values are used in the user program instead of a process value. In some cases, the substitute values can be preset. These are values that the outputs or output will output in case of CPU STOP.

On the safety relay, a substitute value can be set as a fixed value for a deactivated function element.

## **SW**

Abbreviation for software

## **Synchronous operation time**

Two input signals are monitored for simultaneity especially at signal change. Any deviation of the signal from the setpoint is tolerated for the duration of the synchronous operation time without a fault being generated.

## **Target/actual comparison**

Comparison of configured and actual system configuration.

## **Teaching (of the code sequences)**

During the "teaching," the code sequences of a safety-related AS-i slave (8x4-bit code sequences) for the signal processing are read in. The operation comprises the following phases:

1. Recording the code sequences from the AS-i bus. (The user must operate the sensor depending on the type of AS-i slave in this case.)
2. Validating the code sequences: the validity and the one-to-one assignment of the code sequence in the system is checked.

3. Storage of the recorded code sequences. Storage of the recorded code sequences completes the teaching operation and the system processes the code sequences received from the AS-i slave in its internal logic.

**Terminal comments**

Parameterizable remarks referring to an input or output terminal.

**Terminal identifier**

Symbolic name for an input or output terminal that can be parameterized.

**Work space**

View in the software interface in which the configuration is created.



# Index

## 3

- 3RM1 Failsafe motor starter, 19
- 3RM1 motor starter, 152
- 3SK1 output expansion, 19
- 3SK1 output expansions, 152
- 3ZY12 device connectors, 19

## A

- Access path, 81, 284
- Add diagram, 61
- Addressing
  - AS-i slaves, 113
  - PROFIBUS DP, 50
  - PROFINET IO, 51
  - Simulated AS-i slaves, 115
- AND, 228
- Apply code tables, 80
- Approve configuration..., 76
- Article number, 11, 12
- AS-i 1..4F-DO, 278
  - Messages, 313
- AS-i 2F-DI, 206
- AS-i code sequence error, 282
- AS-i interface, 112, 291
- AS-i monitor function, 292
- AS-i output, 278
- AS-i slave function, 292
- AS-i slaves, 115, 151
- AS-i subsystem, 114
- AS-Interface, 114, 291
- AS-Interface signals, 146
- ASIsafe, 292
- ATEX, 24
- Automation License Manager, 41
  - Installation, 42
- Automation License Manager, 43

## B

- Basic Settings..., 92
- Basic unit, 102
- Baud rate, 110, 111
- BMK, 94, 107
- Bus error, 283

## C

- Cancel access rights, 80
- Cancel configuration release, 77
- Catalog window, 38, 91
- Cell function
  - Input cell, 178
  - Output cell, 179
- Check consistency, 64, 108
- Clocking, 262
- Close, 52
- Code sequences, 74
- Commands, 80
- Commissioning, 141, 153, 154, 166
- Communication, 30
- Compare with file, 69, 162
- Compare with switching device, 162
- Compare with switching device..., 70
- Comparison function, 161
- Comparison of configurations, 162
- Conductive contamination, 19
- Configuration, 106
  - Main system, 143
  - Subsystem, 143
- Configuration approval, 75, 76, 159
- Configuration CRC, 105, 156, 160
- Configuration error, 283
- Configuration release, 77
- Configuration test, 141, 153
- Configuring, 143, 167, 286
- Configuring error, 283
- Configuring mode, 77, 141
- Connecting, 147
- Consistency check
  - Messages, 314, 315
- Control function
  - Device command, 227
- Copy, 58
- Counter function
  - Counter (0 -> 1 / 1 -> 0), 236
  - Counter (0 -> 1), 233
  - Counter (1 -> 0), 235
  - Messages, 309
- Create macro, 62
- Cross references, 97, 163
- Cross-circuit detection, 149, 176
- CTT2 protocol, 115
- CTT2 slave, 115

Cut, 58

## D

Delay time, 174  
DELAYED, 152  
Delete, 59, 121  
Delete highlighting, 90, 131  
Determine online, 108  
    AS-Interface, 114  
Device command, 227  
Device configuration, 287  
Device connector, 113, 152  
Device connectors, 147  
Device logbooks..., 83  
Device messages, 81  
    AS-Interface, 291  
    Configuration, 287  
    Configuring, 285  
    Device bus interface, 290  
    Overview, 282  
    PROFIBUS DP, 288, 289  
    Status, 283  
Device resources, 287  
Device self-test, 285  
Device status, 225  
Diagnostics, 28, 29, 281  
Diagnostics configuration, 81, 281  
Diagnostics display, 29, 109  
Diagnostics logic, 82, 293  
Diagnostics software, 27  
Diagnostics using PROFIBUS, 110, 111  
Disconnect, 282  
Discrepancy monitoring, 175, 212  
Discrepancy time, 175  
Display settings, 89, 96, 131  
Displaying all the switching devices in the PROFIBUS segment, 72  
Documentation, 28, 104, 117, 156, 160  
DP interface, 109  
DP interface module, 28  
DP status, 289, 290

## E

Edit terminal identifier..., 63  
Electromagnetic interference, 20  
Electrostatic charge, 20  
Element comment, 94, 95  
Element error, 286  
Element messages, 82, 293, 294

Element name, 94  
Element numbers in macros, 95  
Element positions, 94  
Element reset, 82  
Element status, 226, 293  
EMC Directive, 20  
EMERGENCY STOP, 182  
    Messages, 296  
EN 62061, 19  
EN ISO 13849-1, 19  
Enabling button, 200  
    Interconnecting, 149  
    Messages, 304  
Engineering system (ES), 30  
Error in configuration, 282  
Error messages, 134  
ESPE, 184  
    Messages, 297  
Exit, 57  
Expansion modules, 113  
Export macro..., 100, 136  
Export..., 52

## F

F output, 269  
F output delayed, 271, 273  
Factory settings, 80  
FAQs, 13  
FAULT, 177  
Fault acknowledgment, 284  
Fault signaling output (FAULT), 177  
Flags, 146, 150, 166  
Flip-flop  
    FF-SR, 232  
Floating license, 43  
Footer, 54  
Forcing, 27, 83, 158, 161  
Function elements, 119  
    Connections, 119  
Function test, 22, 23  
Functional extra-low voltage, 20

## G

Go Offline, 72  
Go to, 162  
Go to..., 59  
Grid settings, 89, 132

**H**

Header, 53  
 Help file, 101  
 Help topics, 101  
 Highlight signal flow, 90, 130  
 HMI module, 109

**I**

Identification, 102, 104, 105  
 Import macro..., 100, 136  
 Import..., 48  
 Info, 102  
 Information window, 38  
 Initialization error, 282  
 Input cell, 178  
 Input delay, 174  
 Input terminals, 148  
 Insert comment, 60, 126  
 Installation, 44  
     Automation License Manager, 42  
 Intended use, 21  
 Interconnecting, 147, 151  
     Monitoring function, 149  
 Interface module, 28, 109  
 Interfaces, 153  
 Interrupt connection, 61, 127

**L**

Language, 92  
 Learn ASIsafe code tables..., 73  
 License key, 41, 43  
 License Manager, 41  
 Licenses, 31, 32  
 Line view, 72  
 Load to PC..., 71  
 Load to switching device..., 70, 154  
 Local device interface, 49  
 Logic diagram, 117, 118, 144  
 Logic error, 282, 283  
 Logic function  
     AND, 228  
     NAND, 230  
     NEGATION, 231  
     NOR, 231  
     OR, 229  
     XOR, 229

**M**

Machine safety, 21  
 Macrofunction, 134  
 Manual start, 174, 267  
 Marking, 104  
 Memory module, 154, 288  
     Delete, 80  
 Menu bar, 38  
 Menu commands, 32  
 Messages  
     Consistency check, 314, 315  
     Logic diagram, 134  
 Minimize / restore online dialogs, 92  
 Mode selector switch, 205  
     Interconnecting, 149  
     Messages, 307  
 Modification of the configuration, 167  
 Modular Safety System ES settings, 94  
 Module list of the device connector, 94  
 Module status, 81, 281  
 Monitored start, 174, 266  
 Monitoring, 79, 82, 293  
 Monitoring function  
     AS-i 2F-DI, 206  
     EMERGENCY STOP, 182  
     Enabling button, 200  
     ESPE, 184  
     Mode selector switch, 205  
     Protective door, 190  
     Protective door with tumbler, 193  
     Safety shutdown mat (cross-circuit principle), 188  
     Safety shutdown mat (NC principle), 186  
     Two-hand operation, 202  
     Universal, 179  
 Monitoring Universal, 179  
     Messages, 294  
 Most recently used files, 56  
 Move diagram, 90  
 Move mode, 125  
 Muting, 208, 211, 216  
     Discrepancy monitoring, 212  
     Messages, 308  
     Sequence monitoring, 213  
     Time limit, 213  
 Muting (2-sensor-parallel), 217  
 Muting (4-sensor-parallel), 220  
 Muting (4-sensor-sequential), 223

**N**

NAND, 230  
Navigation window, 38, 91  
NEGATION, 231  
New..., 47  
Newsletters, 24  
Noise immunity, 20  
NOR, 231

**O**

Object properties, 63  
Offline logbook viewer..., 68  
Open online..., 49  
Open..., 48  
Operating state, 284  
Operating system, 41  
Operational safety, 24  
OR, 229  
Output cell, 179  
Output function  
    AS-i 1..4F-DO, 278  
    F output, 269  
    F output delayed, 271, 273  
    Standard output, 268  
Output functions  
    Messages, 311  
Output terminals, 148  
Output window, 38, 91  
Overall response time, 174  
Overall view, 89, 126

**P**

Page Setup..., 52, 53, 54, 55  
Parameter "Input type", 177  
Parameterization software, 27  
Passing make contact, 246  
Passing make contact (trigger), 250  
Password, 136  
    Default password, 157  
    forgot, 65, 140  
    Reset, 65  
Password for device access..., 67  
Password for project access..., 64  
Password for test mode..., 67  
Password protection, 285  
Paste, 58  
PELV, 20

Prepare configuration test..., 75  
Print, 53, 55, 76, 101, 156, 160, 163  
    DIN A3, 52  
Print Preview..., 55  
Print..., 56  
PROFIBUS  
    Grounding, 20  
PROFIBUS signals, 145  
PROFIBUS DP, 49, 110, 111, 288, 289  
    Line view, 72  
PROFINET IO, 50  
    Line view, 73  
Program cycle time, 112, 317  
Programming device, 41  
Project, 105  
Properties  
    AS-i slaves, 116  
    Basic units, 112  
    Expansion module, 113  
    HMI modules, 109  
    Interface modules, 109  
Protective door, 190  
    Messages, 301  
Protective door with lock  
    Messages, 303  
Protective door with tumbler, 193

**R**

Realign graphic, 60, 122, 124  
Redraw partial connection, 61, 129  
Reference points, 128  
References, 12  
Release information, 100, 160  
Release information..., 100  
Remove diagram, 62  
Report printout, 75, 76, 156, 160  
Reset, 80  
Response time, 174  
Restart, 80  
Restore, 57  
Rules  
    Interconnecting / wiring / connecting, 147

**S**

Safe state, 22  
Safety concept, 22  
Safety function, 28  
Safety guidelines, 159  
Safety information, 19



Safety mode, 79, 142, 160  
 Safety protocol error, 283  
 Safety regulations, 147  
 Safety shutdown mat (cross-circuit principle), 188  
     Messages, 300  
 Safety shutdown mat (NC principle), 186  
     Messages, 299  
 Safety shutdown mat cross-circuit principle  
     Interconnecting, 149, 189  
 Safety systems, 27  
 Safety ES, 27, 30  
 Save, 51  
 Save as..., 51  
 Save memory space, 95  
 Screen grid, 96, 132  
 Select all, 59, 121  
 SELV, 20  
 Settings of Safety ES, 95  
 Settings of Safety ES..., 93  
 Show hardware configuration, 108  
 Signals, 144  
     AS-Interface, 146  
     PROFIBUS, 145  
 Simulated slaves, 112, 115, 144  
 SIRIUS ES, 47  
 Slave status, 74  
 Slide switch, 152  
 Slot, 106, 108  
 Software versions, 35  
 Standard output, 268  
 Standards, 19  
     DIN EN ISO 7200, 54  
     EN 61496-1-A.7, 208  
 Start  
     Manual, 174  
     monitored, 174  
 Start conditions, 174  
 Start functions  
     Manual start, 267  
     Messages, 311  
     Monitored start, 266  
 Start wizard, 45, 93  
 Starting the program, 44  
 Startup test, 174  
 Status bar, 38, 39, 87  
 Status function  
     Device status, 225  
     Element status, 226  
 Status of function inputs, 294  
 Status of function outputs, 294  
 Substitute value, 294  
 Symbol list, 97, 164

System interfaces, 21  
 System test, 141, 153

## T

Terminal identifier, 94, 95, 99, 107, 165  
 Terminal list, 99, 165  
 Terminals  
     Interconnecting, 144  
 Test interval, 23  
 Test mode, 78, 142, 157  
 Timer functions  
     Clocking, 262  
     Messages, 310  
     Passing make contact, 246  
     Passing make contact (trigger), 250  
     With OFF delay, 254  
     With OFF delay (trigger), 258  
     With ON delay, 238  
     With ON delay (trigger), 242  
 Title line, 38  
 Toolbar, 38, 39, 86  
 Two-hand operation, 202  
     Messages, 306

## U

UNDELAYED, 152  
 Undo, 57  
 Undo the fixed assignment of the interface, 72

## W

Wiring, 147  
 Wiring error, 283  
     With OFF delay, 254  
     With OFF delay (trigger), 258  
     With ON delay, 238  
     With ON delay (trigger), 242  
 Work space, 38

## X

XOR, 229

## Z

Zoom dialog, 88, 126  
 Zoom in, 88, 126  
 Zoom out, 88, 126

