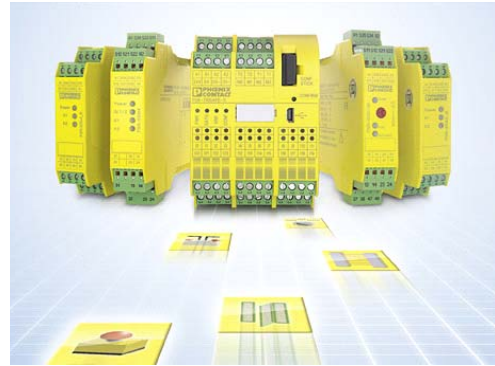


# FUNCTIONAL SAFETY CHARACTERISTICS

## Safety characteristics of Phoenix Contact safety products



Application note  
105016\_en\_05

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### 1 Aim of this document

This application note is a central data source for all safety characteristics of Phoenix Contact safety products.

It provides characteristics for:

- Machine building according to EN ISO 13849 and EN 62061
- Process automation according to IEC 61508

Phoenix Contact supports you here with the SISTEMA tool by providing you with a SISTEMA library containing all components that have already been certified according to the latest standards.

You can find the current SISTEMA library on our website under the keyword SISTEMA.

This document also contains the characteristics required to calculate safety loops in the process industry.

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Make sure you always use the latest documentation.  
It can be downloaded at [phoenixcontact.net/products](http://phoenixcontact.net/products).



Should you have any further questions, please contact the Safety service team.  
+ 49 5281 9-462777  
[safety-service@phoenixcontact.com](mailto:safety-service@phoenixcontact.com)

### 3 Safety relay modules for machine building

#### 3.1 Safety relays – PSRmini



Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Data valid for HW/FW version	Note
2904950	PSR-MS20	c	1	1	1.5E-09	20	≥ 00/--	8760 switching cycles per year at 4 A DC13 or 5 A AC15 Up to PL e/SILCL 3 possible depending on the application
2904951	PSR-MS25						≥ 00/--	
2702192	PSR-MS21	e	4	3	1.0E-09		≥ 00/--	8760 switching cycles per year at 4 A DC13 or 5 A AC15
2904952	PSR-MS30	e	4	3	1.5E-09		≥ 00/--	8760 switching cycles per year at 4 A DC13 or 5 A AC15
2904953	PSR-MS35						≥ 00/--	
2904954	PSR-MS40						≥ 00/--	
2904955	PSR-MS45						≥ 00/--	
2904956	PSR-MS50						≥ 00/--	
2904957	PSR-MS55						≥ 00/--	
2904958	PSR-MS60						≥ 00/--	
2700466	PSR-MC20	c	1	1	1.5E-09		≥ 00/--	8760 switching cycles per year at 4 A DC13 or 5 A AC15 Up to PL e/SILCL 3 possible depending on the application
2700467							≥ 00/--	
2700498	PSR-MC30	e	4	3	1.5E-09		≥ 00/--	8760 switching cycles per year at 4 A DC13 or 5 A AC15
2700499							≥ 00/--	
2700540	PSR-MC34						≥ 00/--	
2700548							≥ 00/--	
2700569	PSR-MC40						≥ 00/--	
2700570	PSR-MC50						≥ 00/--	
2700553							≥ 00/--	
2700564	≥ 00/--							
2700571	PSR-MC60	c	1	1	1.5E-06	≥ 00/100		
2700572						≥ 00/100		
2700574	PSR-MC62	e	4	3	1.5E-08	≥ 00/100		
2700575						≥ 00/100		
2702094	PSR-MC70	c	1	1	2.5E-08	≥ 00/100	8760 switching cycles per year at 4 A DC13 or 5 A AC15 Up to PL e/SILCL 3 possible depending on the application	
2702095						≥ 00/100		

FUNCTIONAL SAFETY CHARACTERISTICS

Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Data valid for HW/FW version	Note
2702096	PSR-MC72	e	4	3	1.5E-09	20	≥ 00/100	8760 switching cycles per year at 4 A DC13 or 5 A AC15
2702097							≥ 00/100	
2702382	PSR-MC82 <sup>1)</sup>				1.0E-09		≥ 00/--	8760 switching cycles per year at 3 A DC13 or 3 A AC15
2702383							≥ 00/--	

<sup>1)</sup> In conjunction with a suitable evaluating device

3.2 Safety relays – PSRclassic



1) In conjunction with a suitable evaluating device

2) Delayed contacts up to PL d, category 3

Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Data valid for HW/FW version	Note
2963802	PSR-ESA2-B	c	1	1	4.05E-10	20	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 230,000 at 3 A AC15 Up to PL e/SILCL 3 possible depending on the application
2963954							≥ 00/--	
2963750	PSR-ESA4	e	4	3	5.05E-10	20	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13
2963938							≥ 00/--	
2963763	PSR-ESA4-B	e	4	3	5.05E-10	20	≥ 00/--	
2963941							≥ 00/--	
2901430	PSR-ESAM2/3x1-B	c	1	1	2.42E-10	20	≥ 00/--	8760 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13 Up to PL e/SILCL 3 possible depending on the application
2901431							≥ 00/--	
2900525	PSR-ESAM4/2x1	e	4	3	5.05E-10	20	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13
2900526							≥ 00/--	
2900509	PSR-ESAM4/3x1-B	e	4	3	5.05E-10	20	≥ 00/--	
2900510							≥ 00/--	
2981114	PSR-ESAM4/3x1	e	4	3	3.60E-10	20	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13
							< 08/--	
2981127							≥ 08/--	8766 switching cycles per year B <sub>10D</sub> = 160,000 at 5 A DC13
							< 08/--	
2963912	PSR-ESAM4/8x1	e	4	3	5.06E-10	20	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 230,000 at 3 A AC15
							2963996	
2901416	PSR-ESAM4-B AC	e	4	3	3.60E-10	20	≥ 00/--	8760 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13
2901417							≥ 00/--	
2901426							≥ 00/--	
2901427							≥ 00/--	
2901422							≥ 00/--	
2901425							≥ 00/--	
2901428							≥ 00/--	
2901429							≥ 00/--	

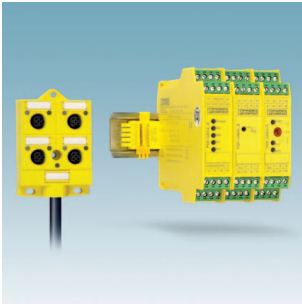
FUNCTIONAL SAFETY CHARACTERISTICS

Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Data valid for HW/FW version	Note		
2981800	PSR-ESD-30	e	4	3	1.80E-09	20	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 400,000 at 3 A AC15 DC13		
2981813							≥ 00/--			
2981428	PSR-ESD-300 <sup>2)</sup>				1.89E-09		≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 230,000 at 3 A AC15		
2981431							≥ 00/--			
2981125	PSR-ESD-T <sup>2)</sup>				1.67E-09		≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13		
2981198							≥ 00/--			
2981059	PSR-ESL4-B				5.56E-10		≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13		
2981062							≥ 00/--			
2963718							PSR-ESM4		5.05E-10	≥ 00/--
2963705										≥ 00/--
2963776	PSR-ESM4-B				≥ 00/--		8766 switching cycles per year B <sub>10D</sub> = 160,000 at 5 A AC15 Up to PL e/SILCL 3 possible depending on the application			
2963925					≥ 00/--					
2981020	PSR-ESP4	c	1	1	9.93E-11	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 160,000 at 5 A AC15 Up to PL e/SILCL 3 possible depending on the application			
2981017						≥ 00/--				
2981978	PSR-FSP/1x1 <sup>1)</sup>	e	4	3	2.02E-11	20	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 1,000,000 at 5 A DC13		
2981981							≥ 00/--			
2986960	PSR-FSP/2x1 <sup>1)</sup>				2.02E-11		≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13		
2986957							≥ 00/--			
2963721	PSR-THC4				1.21E-09		≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 230,000 at 3 A AC15		
2963983							≥ 00/--			
2963734	PSR-URM4/5x1 <sup>1)</sup>				1.47E-09		≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13		
2964005							≥ 00/--			
2981033	PSR-URM4/5x1-B <sup>1)</sup>				1.02E-10		≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 200,000 at 2.5 A DC13 or 3 A AC15		
2981046							≥ 00/--			
2903583	PSR-URML4				5.56E-10		≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13		
2903584							≥ 00/--			
2902935	PSR-URM4 42-230UC <sup>1)</sup>	4.69E-11	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 200,000 at 2.5 A DC13 or 3 A AC15						
2902936			≥ 00/--							

<sup>1)</sup> In conjunction with a suitable evaluating device

<sup>2)</sup> Delayed contacts up to PL d, category 3

3.3 Modular safety relay system – PSRmodular



Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Data valid for HW/FW version	Note	
2981486	PSR-SDC4	e	4		2.53E-10		≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13	
2981499							≥ 00/--		
2981703	PSR-URD3/T2 <sup>1)</sup>	d	3	3	1.35E-09	20	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 300,000 at 5 A DC13	
2981729							≥ 00/--		
2981732	PSR-URD3/3 <sup>1)</sup>					≥ 00/--			
2981745						≥ 00/--			
2981512	PSR-URD3/30 <sup>1)</sup>					≥ 00/--			
2981525						≥ 00/--			
2981677	PSR-URM4/B <sup>1)</sup>	e	4		9.70E-11		≥ 00/--		
2981680							≥ 00/--		
2981936	PSR-SIM4	-	-	-	-	-	≥ 00/--		Due to the series connection of safety door switches, the possible diagnostic coverage is reduced as are the maximum achievable safety classifications.
2981949							≥ 00/--		
2981871	PSR-SACB-4/4-L-5,0PUR-SD	-	-	-	-	-	≥ 00/--		
2981884							≥ 00/--		

<sup>1)</sup> In conjunction with a suitable evaluating device

3.4 Multifunctional safety relays – PSRmultifunction



Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Data valid for HW/FW version	Note
2902725	PSR-MXF1	e	4	3	1.93E-10	20	≥ 00/--	8766 switching cycles per year B <sub>10D</sub> = 780,000 at 5 A DC13 or 3 A AC15
2902726							≥ 00/--	
2903253							≥ 00/--	
2903254	PSR-MXF2						≥ 00/--	
2903255							≥ 00/--	
2903256							≥ 00/--	
2903257	PSR-MXF3						≥ 00/--	
2903258							≥ 00/--	
2903259	PSR-MXF4						≥ 00/--	
2903260							≥ 00/--	
2903261							≥ 00/--	
2903262							≥ 00/--	

#### 4 Zero-speed and over-speed safety relays – PSRmotion



Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Data valid for HW/FW version	Note
2702355	PSR-MM25	e	3	3	5.79E-08	20	≥ 00/100	17,520 switching cycles per year at 4 A DC13 or 5 A AC15
2702356							≥ 00/100	
2981538	PSR-RSM4	e	4	3	7.90E-09		≥ 00/--	In conjunction with suitable sensor systems.
2981541							≥ 00/--	

#### 5 Force-guided coupling relays – PSRclassic



Order No.	Short designation	B <sub>10D</sub>	Data valid for HW/FW version	Note
2963747	PSR-URM/5x1/2x2	230,000	≥ 00/--	3 A AC15 / 230 V 2.5 A DC13
2963970			≥ 00/--	
2981402			≥ 00/--	
2981415			≥ 00/--	
2981839	PSR-URM/3x1	300,000	≥ 00/--	5 A DC13
2981842			≥ 00/--	
2981952	PSR-URM/5x1/1x2	230,000	≥ 00/--	3 A AC15 / 230 V 2.5 A DC13
2981965			≥ 00/--	
2981363	PSR-URM/2x21	180,000	≥ 00/--	3 A AC15 / 250 V 3 A DC13
2981376			≥ 00/--	
2981444	PSR-URM/4x1	300,000	≥ 00/--	5 A DC13
2981457			≥ 00/--	
2981460			≥ 00/--	
2981473			≥ 00/--	



6 Configurable safety modules – Trisafe



Order No.	Short designation		EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Data valid for HW/FW version	Note	
2986229 2986232	TRISAFE-S	1CH	d	2	2	16.1E-09	20	VS0/1.536	-	
		2CH	e	4	3	16.1E-09		PT-4/1.536	-	
2986012 2986025	TRISAFE-M	1CH	d	2	2	17.1E-09		RC02/1.001	PT-4/2.033	-
		2CH	e	4	3	17.1E-09				-
2986038 2986041	TS-SDI8-SDIO4	1CH	d	2	2	3.94E-09			PT-3/1.021	Switchable I/O contacts can only achieve Cat. 2 if clock signals are used Outputs: Cat 4 can only be achieved if cross-circuit is prevented
		2CH	e	4	3	3.94E-09				-
2986096 2986106	TS-SDOR4	1CH-AC15	c	1	2	11.3E-09			8766 switching cycles per year B <sub>10D</sub> = 1,960,000 at 3 A AC15; 1 N/O	
		1CH-DC13	c	1	2	11.3E-09			8766 switching cycles per year B <sub>10D</sub> = 780,000 at 3 A DC13; 1 N/O	
		2CH-AC15	e	4	3	0.73E-09		8766 switching cycles per year B <sub>10D</sub> = 1,960,000 at 3 A AC15; 1 N/O		
		2CH-DC13	e	4	3	0.73E-09		8766 switching cycles per year B <sub>10D</sub> = 780,000 at 3 A DC13; 1 N/O		

7 Network safety solutions



Order No.	Short designation		EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Data valid for HW/FW/FW version	Note	
2916024	IB IL LPSDO 8	1CH	d	3	2	1E-08	20	≥ 00/100/100		
		2CH	e	4	3	1E-09		≥ 00/100/100		
2700606	IB IL LPSDO 8 V2	1CH	d	3	2	1E-08		≥ 00/100/100		
		2CH	e	4	3	1E-09		≥ 00/100/100		
2701625	IB IL LPSDO-8-V3	1CH	d	3	2	1E-08		≥ 00/100/100		
		2CH	e	4	3	1E-09		≥ 01/200/100		
2916493	IB IL PSDO 4/4	1CH	d	3	2	1E-08		≥ 01/200/100		
		2CH	e	4	3	1E-09		≥ 01/200/100		
2985631	IB IL PSDO 8	1CH	d	3	2	1E-08		≥ 00/200/100		The PFH <sub>D</sub> value is an example value here. It depends on the parameterization and wiring. You can determine the exact value with the aid of the product documentation.
		2CH	e	4	3	1E-09		≥ 00/200/100		
2985864	IB IL PSDOR 4	1CH-AC15	c	1	1	1E-08		≥ 00/200/-		
		1CH-DC13	c	1	1	1E-08		≥ 00/200/-		
		2CH-AC15-A	e	4	3	1E-09		≥ 00/100/-		
		2CH-AC15-B	e	4	3	1E-09		≥ 00/100/-		
		2CH-DC13-A	e	4	3	1E-09		≥ 01/200/-		
2985688	IB IL PSDI 8	1CH	d	3 <sup>1)</sup>	2	1E-08		≥ 00/100/-		
		2CH	e	4	3	1E-09		≥ 01/200/-		
2700994	IB IL PSDI 16	1CH	d	3 <sup>1)</sup>	2	1E-08		≥ 00/100/-		
		2CH	e	4	3	1E-09		≥ 01/200/-		
2701559	AXL F PSDI8/4 1F	1CH	d	3 <sup>1)</sup>	2	1E-08		≥ 00/100/-		
		2 CH	e	4	3	1E-09	≥ 01/200/-			
2701560	AXL F PSDO8/3 1F	1CH	d	3	2	1E-08	≥ 00/100/-			
		2CH	e	4	3	1E-09	≥ 01/200/-			
2702263	AXL F SSDI8/4 1F	1CH	d	3 <sup>1)</sup>	2	1E-08	≥ 01/200/-			
		2CH	e	4	3	1E-09	≥ 01/200/-			
2702264	AXL F SSDO8/3 1F	1CH	d	3	2	1E-08	≥ 01/200/-			
		2CH	e	4	3	1E-09	≥ 00/100/-			
2702171	AXL F LPSDO8/3 1F	1CH	d	3	2	1E-08	≥ 00/100/-			
		2 CH	e	4	3	1E-09				

<sup>1</sup> In conjunction with clock signals. See user documentation for the module.

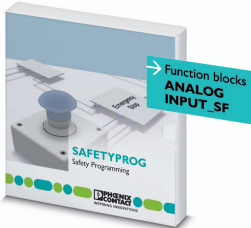
## 8 Safe control technology



Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Data valid for HW/FW/FW version				Note
							HW	FW	FW COP	SIS FW HW/FW	
2985563	SAFETY SLC 400 PND-4TX-IB	e	4	3	1E-09	20	> 11	> 473	> 201	> 10/210	-
2916794	RFC 470S PN 3TX						> 01	> 46F	> 360Q	> 10/236	
2700651	FL PN/PN SDIO-2TX/2TX						> 01	> 100	> 010	-	

### 8.1 Safe analog value processing

Function block library for safety-related analog value acquisition with standard I/O modules.



The following characteristics are only valid if the total MTBF of the network infrastructure components used between the controller and SAFE AI station is  $\geq 30$  years.  
If the total MTBF is  $< 30$  years, please contact Phoenix Contact.

Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Note
2400057	SAFE AI	e	4	3	2E-09 <sup>1)</sup>	20	When only using safety-related input signals in the station
		d	3	2	5E-09 <sup>2)</sup>		When using safety-related and non-safety-related input signals in the station

<sup>1)</sup> When used with the AXL F AI8 1F module (Order No. 2688064)

<sup>2)</sup> When used with the AXL F AI8 W 1F module (Order No. 2702525)

9 CONTACTRON hybrid motor starters



Order No.	Short designation	EN ISO 13849-1 PL	Category	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Note
2297031	ELR-W3-24DC/500AC-2I	e	3	2.67E-09	20	-
2297044	ELR-W3-230AC/500AC-2I			6.82E-09		
2297057	ELR-W3-24DC/500AC-9I			2.67E-09		
2297060	ELR-W3-230AC/500AC-9I			6.82E-09		
2900582 2900414 2900421	ELR-H5-IES-SC-24DC/500AC...			2.67E-09		
2903902 2903904 2903906	ELR-H5-IES-PT-24DC/500AC...			6.82E-09		
2900692 2900420 2900422	ELR-H5-IES-SC-230AC/500AC...					
2900558 2900559 2900561	ELR-H5-ES-SC-24DC/500AC...			2.67E-09		
2900688 2900560 2900562	ELR-H5-ES-SC-230AC/500AC...			6.82E-09		
2900566 2900567 2900569	ELR-H3-IES-SC-24DC/500AC...			2.40E-09		
2903914 2903916 2903918	ELR-H3-IES-PT-24DC/500AC...					
2900689 2900568 2900570	ELR-H3-IES-SC-230AC/500AC...			6.27E-09		
2900550 2900552 2900554	ELR-H3-ES-SC-24DC/500AC...			2.40E-09		
2900686 2900553 2900555	ELR-H3-ES-SC-230AC/500AC...			6.27E-09		

Order No.	Short designation	EN ISO 13849-1 PL	Category	PFH <sub>D</sub> (1/h)	t <sub>M</sub> (years)	Note
2905151 2905138 2905152 2905139 2905153 2905140	ELR H5-IES...-IFS	e	3	0.1E-09	20	-
2905154 2905141 2905155 2905142 2905156 2905143	ELR H3-IES...-IFS					
2903933 2903934 2903935	ELR H5-IES...SWD...			0.3E-09		
2903936 2903937 2903938	ELR H3-IES...SWD...					

## 10 Safety relay modules for the process industry

### 10.1 Safe coupling relays – PSRmini



Substitute values for 1oo1 structure

Order No.	Short designation	Demand	Device type	HFT	SIL	SFF (%)	$\lambda_{SD}$ (FIT)	$\lambda_{SU}$ (FIT)	$\lambda_{DD}$ (FIT)	$\lambda_{DU}$ (FIT)	$\lambda_{Total}$ (FIT)	MTBF (years) <sup>1</sup>	PFD <sub>avg</sub> <sup>2</sup>	PFH <sub>D</sub>	T <sub>1max</sub> (years)	t <sub>M</sub> (years)	Data valid for HW/FW version		
2700356	PSR-PS20	High <sup>3)</sup>	A	0	3	99.98	989.32	148.96	52.58	0.20	1191.06	80.63	-	1.95E-10	20	20	≥ 00/--		
		Low				99.66	0	1579	0	5.392	1584	63	2.36E-05	-	6				
2700357	PSR-PS21	High <sup>3)</sup>			2	99.18	494.66	79.10	494.66	8.80	1077.22	91.65	-	8.80E-09	20		20	≥ 00/--	
		Low				81.20	0	794.1	0	183.8	977.9	99	8.06E-04	-	1.6				
2700398	PSR-PS40	High			3	99.99	989.32	460.91	51.90	0.10	1502.24	64.01	-	1.04E-10	20		20	≥ 00/--	
		Low				99.72	0	1891	0	5.236	1896	52	2.29E-05	-	6				
2700577 2700578	PSR-PC20	High <sup>3)</sup>				99.98	989.32	230.38	52.58	0.20	1272.48	76.43	-	1.95E-10	20			20	≥ 00/--
		Low				99.68	0	1660	0	5.392	1666	60	2.36E-05	-	6				
2700588 2700589	PSR-PC40	High				99.99	989.32	397.43	51.90	0.10	1438.75	64.98	-	1.04E-10	20			20	≥ 00/--
		Low				99.71	0	1798	0	5.236	1803	54	2.29E-05	-	6				
2904664 2904665	PSR-PC50	Low				99.60	4.27	849	4.21	3.40	860.88	110.5	1.49E-05	-	10			10	≥ 00/--

<sup>1</sup> Includes faults that are not part of the safety function. MTTR was set to 8 hours.

<sup>2</sup> For T<sub>1</sub> = 1 year

<sup>3</sup> Only in conjunction with a suitable evaluating device

10.2 Safe coupling relays – PSRclassic



Substitute values for 1oo1 structure

Order No.	Short designation	Demand	Device type	HFT	SIL	SFF (%)	$\lambda_{SD}$ (FIT)	$\lambda_{SU}$ (FIT)	$\lambda_{DD}$ (FIT)	$\lambda_{DU}$ (FIT)	$\lambda_{Total}$ (FIT)	MTBF (years) <sup>1</sup>	PFD <sub>avg</sub> <sup>2</sup>	PFH <sub>D</sub>	T <sub>1max</sub> (years)	t <sub>M</sub> (years)	Data valid for HW/FW version				
2981978 2981981	PSR-FSP	High <sup>5)</sup>	A	0	3	99.99	198	62.7	3.66	0.02	264.38	319	-	2.02E-11	20	20	≥ 00/--				
2981020 2981017		Low <sup>3)</sup>				99.77	0	909.7	0	2.09	911.79	113	9.15E-06	-	12		≥ 00/--				
2986960 2986957	PSR-FSP/2x1	High <sup>5)</sup>			3	99.99	198	63.9	3.66	0.02	264.38	342	-	2.02E-11	20		≥ 00/--				
		Low				99.76	0	1026.9	0	2.42	1029.32	104	1.06E-05	-	5		≥ 00/--				
2986575 2986588	PSR-FSP2/2x1	High <sup>5)</sup>			2	99.61	99	55.7	99	1	254.7	361	-	1E-09	20		≥ 00/--				
		Low <sup>3)</sup>				81.97	0	455	0	100	555	185	4.38E-04	-	2.25		20	≥ 00/--			
2901416 2901417 2901426 2901427 2901422 2901425 2901428 2901429	PSR-ESAM4-B AC	High			3	99.99	660	1298	26.7	0.359	1985	50.9	-	3.60E-10	20		≥ 00/--				
		Low				99.66	0	1723	0	5.876	1729	57.46	2.57E-05	-	6.5		≥ 00/--				
						2986711 2986562	PSR-ETP/1x1	Low	3	99.64	0	815.86	1.4	2.94	820.19		126.54	1.29E-05	-	11	≥ 00/--
						≥ 00/--															

<sup>1</sup> Includes faults that are not part of the safety function. MTTR was set to 8 hours.

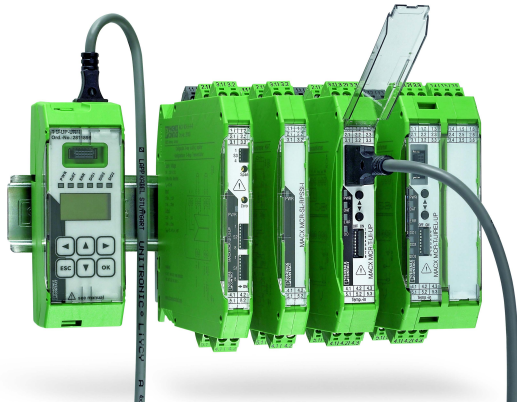
<sup>2</sup> For T<sub>1</sub> = 1 year

<sup>3</sup> Calculated assuming an average ambient temperature of 40°C. At higher ambient temperatures, a safety factor of 1.8 should be applied to the failure rates.

<sup>4</sup> Up to SIL 3 possible depending on the application.

<sup>5</sup> Only in conjunction with a suitable evaluating device

## 11 Signal conditioners



### 11.1 Analog IN/Analog OUT



For additional operating modes, please refer to the corresponding data sheet for the relevant product at [phoenixcontact.net/products](http://phoenixcontact.net/products).

Substitute values for 1oo1 structure

Order No.	Short designation	Demand	Device type	Operating mode		SFF (%)	$\lambda_{SD}$ (FIT)	$\lambda_{SU}$ (FIT)	$\lambda_{DD}$ (FIT)	$\lambda_{DU}$ (FIT)	MTBF (years)	PFD <sub>avg</sub> <sup>1</sup>	PFH <sub>D</sub>	DC (%)
				SIL										
2811284	MACX MCR-UI-UI(-SP)(-NC)	Low/High	A	2	2	83.50	0	317.3	0	62.9	259	2.76E-04	6.29E-08	0.00
2811572				3	2	83.00	0	318.2	0	62.1	259	2.83E-04	6.46E-08	0.00
2811446		Low/High	A	2	2	86.10	0	369.8	0	59.5	228	2.61E-04	5.95E-08	0.00
2811556				3	2	82.80	0	353.7	0	69.7	228	3.19E-04	7.27E-08	0.00
2811459	MACX MCR-UI-UI-UP(-SP)(-NC)	Low/High	A	2	2	86.10	0	369.8	0	59.5	228	2.61E-04	5.95E-08	0.00
2811585				3	2	82.80	0	353.7	0	69.7	228	3.19E-04	7.27E-08	0.00
2811297		Low/High	A	4	2	91.2	0	245	332	55.4	161	2.46E-04	5.54E-08	85.7
2811569				4	2	90.5	0	558	0	58.3	183	2.53E-04	5.83E-08	0.00
2865955	MACX MCR-SL-RPSSI-I(-SP)	Low/High	A	4	2	91.2	0	245	332	55.4	161	2.46E-04	5.54E-08	85.7
2924207				4	2	90.5	0	558	0	58.3	183	2.53E-04	5.83E-08	0.00
2865968	MACX MCR-SL-RPSSI-I-UP(-SP)	Low/High	A	4	2	90.5	0	558	0	58.3	183	2.53E-04	5.83E-08	0.00
2924210				4	2	85.5	0	145.5	224.1	62.3	197	2.73E-04	6.23E-08	78.3
2924825	MACX MCR-RPSSI-2I(-SP)	Low/High	A	4	2	85.5	0	145.5	224.1	62.3	197	2.73E-04	6.23E-08	78.3
2924838				4	2	94.7	0	496.5	0	27.9	204	1.22E-04	2.79E-08	0.00
2865971	MACX MCR-SL-IDSI-I(-SP)	Low/High	A	4	2	94.7	0	496.5	0	27.9	204	1.22E-04	2.79E-08	0.00
2924223				4	2	87.6	0	195	198	55.3	254	2.48E-04	5.53E-08	78.1
2904089	MACX MCR-SL-RPSS-2I-2I(-SP)	Low/High	A	4	2	87.6	0	195	198	55.3	254	2.48E-04	5.53E-08	78.1
2904090				4	2	87.6	0	195	198	55.3	254	2.48E-04	5.53E-08	78.1

<sup>1</sup> For  $T_1 = 1$  year

<sup>2</sup> Input isolator  $I \approx 1$  (4 ... 20 mA)

<sup>3</sup> Output isolator  $I \approx 1$  (4 ... 20 mA)

<sup>4</sup> Repeater power supply



11.2 Temperature



For additional operating modes, please refer to the corresponding data sheet for the relevant product at [phoenixcontact.net/products](http://phoenixcontact.net/products).

Substitute values for 1oo1 structure

Order No.	Short designation	Demand	Device type	Operating mode										
					SIL	SFF (%)	$\lambda_{SD}$ (FIT)	$\lambda_{SU}$ (FIT)	$\lambda_{DD}$ (FIT)	$\lambda_{DU}$ (FIT)	MTBF (years)	PFD <sub>avg</sub> <sup>1</sup>	PFD <sub>D</sub>	DC (%)
2811394	MACX MCR-T-UI-UP(-SP)(-C)	Low/High	B	2	2	94.00	0	0	805	43	97	2.95E-04	4.30E-08	94.00
2811860					2	93.00	0	0	789	56	97	3.75E-04	5.60E-08	93.00
2811873		Low/High		3	2	93.00	0	0	789	56	97	3.75E-04	5.60E-08	93.00
2811970					2	94.00	0	234	543	43	85	2.88E-04	4.30E-08	92.00
2811378	MACX MCR-T-UIREL-UP(-SP)	Low/High	B	4	2	94.00	0	234	543	43	85	2.88E-04	4.30E-08	92.00
2811828					2	94.00	0	234	543	43	85	2.88E-04	4.30E-08	92.00

<sup>1</sup> For T<sub>1</sub> = 1 year

<sup>2</sup> Pt 100 3-conductor, output 4 ... 20 mA

<sup>3</sup> Voltage input mV, output 4 ... 20 mA

<sup>4</sup> Pt 100 3-conductor, output relay

11.3 Digital IN



For additional operating modes, please refer to the corresponding data sheet for the relevant product at [phoenixcontact.net/products](http://phoenixcontact.net/products).

Substitute values for 1oo1 structure

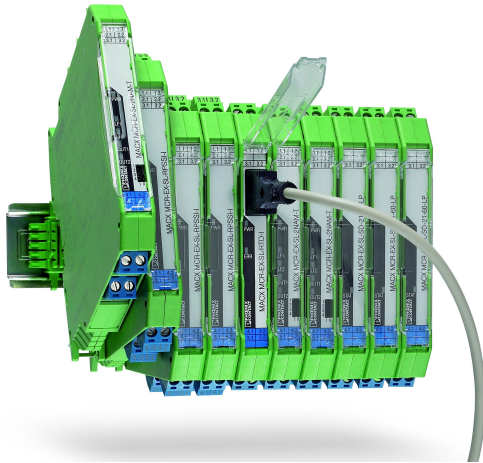
Order No.	Short designation	Demand	Device type	Operating mode										
					SIL	SFF (%)	$\lambda_{SD}$ (FIT)	$\lambda_{SU}$ (FIT)	$\lambda_{DD}$ (FIT)	$\lambda_{DU}$ (FIT)	MTBF (years)	PFD <sub>avg</sub> <sup>1</sup>	PFH <sub>D</sub>	DC (%)
2865997	MACX MCR-SL-NAM-R(-SP)	Low	A	<sup>2</sup>	2	78.9	6	242	7	60	304	2.90E-04	-	10.0
2924252				<sup>3</sup>	2	78.0	1	249	6	64	304	3.08E-04	-	8.0
2865010	MACX MCR-SL-NAM-2RO(-SP)	Low	A	<sup>2</sup>	2	79.4	6	244	7	57	223	2.83E-04	-	10.0
2924265				<sup>3</sup>	2	78.0	1	251	6	64	223	3.09E-04	-	8.0
2865049	MACX MCR-SL-2NAM-RO(-SP)	Low	A	<sup>2</sup>	2	78.3	6	249	7	64	204	3.09E-04	-	9.0
2924294				<sup>3</sup>	2	78.3	1	248	6	62	204	3.01E-04	-	8.0
2865052	MACX MCR-SL-2NAM-R-UP(-SP)	Low	A	<sup>2</sup>	2	86.6	6	403	0	63	226	3.01E-04	-	0.0
2924304				<sup>3</sup>	2	86.4	0	413	0	65	226	3.10E-04	-	0.0
2865023	MACX MCR-SL-NAM-2T(-SP)	Low	A	<sup>2</sup>	2	83.0	11	203	2	43	336	1.88E-04	-	0.0
2924278				<sup>3</sup>	2	85.0	1	201	6	35	336	1.53E-04	-	0.0
2865036	MACX MCR-SL-2NAM-T(-SP)	Low	A	<sup>2</sup>	2	81.0	12	251	15	64	269	2.80E-04	-	0.0
2924281				<sup>3</sup>	2	81.0	2	262	12	64	269	2.80E-04	-	0.0

<sup>1</sup> For T<sub>1</sub> = 1 year

<sup>2</sup> Non-inverted output (N)

<sup>3</sup> Inverted output (I)

## 12 Ex i signal conditioners



### 12.1 Analog IN/Analog OUT



For additional operating modes, please refer to the corresponding data sheet for the relevant product at [phoenixcontact.net/products](http://phoenixcontact.net/products).

Substitute values for 1oo1 structure

Order No.	Short designation	Demand	Device type	Operating mode		SFF (%)	$\lambda_{SD}$ (FIT)	$\lambda_{SU}$ (FIT)	$\lambda_{DD}$ (FIT)	$\lambda_{DU}$ (FIT)	MTBF (years)	PFD <sub>avg</sub> <sup>1</sup>	PFH <sub>D</sub>	DC (%)
				SIL	SIL									
2865340	MACX MCR-EX-SL-RPSSI-I(-SP)	Low/High	A	2	2	91.0	0	247	333.3	56.7	161	2.52E-04	5.67E-08	85.4
2924016														
2865793	MACX MCR-EX-SL-RPSSI-I-UP(-SP)	Low/High	A	2	2	90.5	0	558.0	0	58.3	183	2.53E-04	5.83E-08	0.0
2924029														
2865366	MACX MCR-EX-SL-RPSSI-2I(-SP)	Low/High	A	2	2	85.5	0	145.5	224.1	62.3	197	2.73E-04	6.23E-08	78.3
2924236														
2865405	MACX MCR-EX-SL-IDSI-I(-SP)	Low/High	A	3	2	94.7	0	496.5	0	27.9	204	1.22E-04	2.79E-08	0.0
2924032														
2865382	MACX MCR-EX-SL-RPSS-2I-2I(-SP)	Low/High	A	2	3	92.3	0	316.0	345	55.3	159	2.52E-04	5.53E-08	86.2
2924676														

<sup>1</sup> For T<sub>1</sub> = 1 year

<sup>2</sup> Repeater power supply

<sup>3</sup> Output isolator I  $\hat{=}$  I (4 ... 20 mA)

12.2 Temperature



For additional operating modes, please refer to the corresponding data sheet for the relevant product at [phoenixcontact.net/products](http://phoenixcontact.net/products).

Substitute values for 1oo1 structure

Order No.	Short designation	Demand	Device type	Operating mode										
					SIL	SFF (%)	$\lambda_{SD}$ (FIT)	$\lambda_{SU}$ (FIT)	$\lambda_{DD}$ (FIT)	$\lambda_{DU}$ (FIT)	MTBF (years)	PFD <sub>avg</sub> <sup>1</sup>	PFH <sub>D</sub>	DC (%)
2865654	MACX MCR-EX-T-UI-UP(-SP)(-C)	Low/High	B	2	2	94.0	0	0	805	43	97	2.95E-04	4.30E-08	94.0
2924689														
2811763														
2924692														
2865751	MACX MCR-EX-T-UIREL-UP(-SP)	Low/High	B	4	2	94.0	0	234	543	43	85	2.88E-04	4.30E-08	92.0
2924799														
2864587	MCR-FL-TS-LP-I-EX	Low/High	B	2	2	> 75	136	183	17	111	255	4.85E-04	-	13.0
2864545	MCR-HT-TS-I-EX	Low/High	B	2	2	> 73	136	183	17	111	255	4.69E-04	-	13.0

<sup>1</sup> For T<sub>1</sub> = 1 year

<sup>2</sup> Pt 100 3-conductor, output 4 ... 20 mA

<sup>3</sup> Voltage input mV, output 4 ... 20 mA

<sup>4</sup> Pt 100 3-conductor, output relay

12.3 Digital IN/Digital OUT



For additional operating modes, please refer to the corresponding data sheet for the relevant product at [phoenixcontact.net/products](http://phoenixcontact.net/products).

Substitute values for 1oo1 structure

Order No.	Short designation	Demand	Device type	Operating mode		SFF (%)	$\lambda_{SD}$ (FIT)	$\lambda_{SU}$ (FIT)	$\lambda_{DD}$ (FIT)	$\lambda_{DU}$ (FIT)	MTBF (years)	PFD <sub>avg</sub> <sup>1</sup>	PFH <sub>D</sub>	DC (%)
				SIL										
2865434	MACX MCR-EX-SL-NAM-R(-SP)	Low	A	2	2	78.9	6	242	7	60	304	2.90E-04	-	10.0
2924045				3		78.0	1	249	6	64	304	3.08E-04	-	8.0
2865450	MACX MCR-EX-SL-NAM-2RO(-SP)	Low	A	2	2	79.4	6	244	7	57	223	2.83E-04	-	10.00
2924061				3		78.0	1	251	6	64	223	3.09E-04	-	8.0
2865476	MACX MCR-EX-SL-2NAM-RO(-SP)	Low	A	2	2	78.3	6	249	7	64	204	3.09E-04	-	9.0
2924087				3		78.3	1	248	6	62	204	3.01E-04	-	8.0
2865984	MACX MCR-EX-SL-2NAM-R-UP(-SP)	Low	A	2	2	86.6	6	403	0	63	226	3.01E-04	-	0.0
2924249				3		86.4	0	413	0	65	226	3.10E-04	-	0.0
2865463	MACX MCR-EX-SL-NAM-2T(-SP)	Low	A	2	2	83.0	11	203	2	43	336	1.88E-04	-	0.0
2924074				3		85.0	1	201	6	35	336	1.53E-04	-	0.0
2865489	MACX MCR-EX-SL-2NAM-T(-SP)	Low	A	2	2	81.0	12	251	15	64	269	2.80E-04	-	0.0
2924090				3		81.0	2	262	12	64	269	2.80E-04	-	0.0
2866006	MACX MCR-EX-SL-NAM-NAM(-SP)	Low	A	2	2	84.0	0	106	72	32	266	1.74E-04	-	69.0
2924883				3		83.0	0	108	72	36	266	1.74E-04	-	66.0
2905723	MACX MCR-EX-SL-NAM-YO(-SP)	Low	A	2	2	84.0	0	106	72	32	266	1.74E-04	-	69.0
2905724				3		83.0	0	108	72	36	266	1.74E-04	-	66.0
2907404	MACX MCR-EX-SL-NAM-HO(-SP)	Low	A	2	2	84.0	0	106	72	32	266	1.74E-04	-	69.0
2907405				3		83.0	0	108	72	36	266	1.74E-04	-	66.0
2865492	MACX MCR-EX-SL-SD-21-25-LP(-SP)	Low	A	-	3	100.0	0	284	0	0	378	0.00E+00	-	0.0
2924113														
2865764	MACX MCR-EX-SL-SD-21-40-LP(-SP)	Low	A	-	3	100.0	0	284	0	0	378	0.00E+00	-	0.0
2924139														
2865502	MACX MCR-EX-SL-SD-21-45-LP(-SP)	Low	A	-	3	100.0	0	284	0	0	378	0.00E+00	-	0.0
2924197														
2865609	MACX MCR-EX-SL-SD-24-48-LP(-SP)	Low	A	-	3	100.0	0	284	0	0	378	0.00E+00	-	0.0
2924126														
2865515	MACX MCR-EX-SL-SD-21-60-LP(-SP)	Low	A	-	3	100.0	0	284	0	0	378	0.00E+00	-	0.0
2924100														
2924867	MACX MCR-EX-SL-SD-23-48-LFD (-SP)	Low	A	-	3	94.8	0	406	45.1	24.6	167	1.08E-04	2.46E-8	64.7
2924870														
2905669	MACX MCR-EX-SL-SD-21-25-LFD (-SP)	Low	A	-	3	94.8	0	406	45.1	24.6	167	1.08E-04	2.46E-8	64.7
2905674														
2906155	MACX MCR-EX-SL-SD-24-48-LFD (-SP)	Low	A	-	3	94.8	0	406	45.1	24.6	167	1.08E-04	2.46E-8	64.7
2906156														

<sup>1</sup> For T<sub>1</sub> = 1 year

<sup>2</sup> Non-inverted output (N)

<sup>3</sup> Inverted output (I)

### 13 Explanation of terms

Abbreviation	Term	Explanation
<b>EN ISO 13849-1</b>		
<b>PL</b>	Performance level	Classification of the ability of safety functions to meet a safety demand.
<b>Category</b>	Category	Classification of the resistance to faults according to EN ISO 13849-1.
<b>PFD<sub>D</sub></b>	Probability of dangerous failure per hour	Probability of dangerous failure per hour
<b>t<sub>M</sub></b>	Mission time	Duration of use
<b>EN IEC 61508 / 61511 / 62061</b>		
<b>HFT</b>	Hardware fault tolerance	Ability of a function unit to continue with the execution of a demanded function despite existing faults or deviations.
<b>SIL</b>	Safety integrity level	Safety integrity level
<b>SILCL</b>	Safety integrity level claim limit	SIL claim limit (suitability)
<b>SFF</b>	Safe failure fraction	Fraction of safe failures
<b>λ<sub>SD</sub></b>	Failure rate – safe detected	Failure rate of safe detected failures
<b>λ<sub>SU</sub></b>	Failure rate – safe undetected	Failure rate of safe undetected failures
<b>λ<sub>DD</sub></b>	Failure rate – dangerous detected	Failure rate of dangerous detected failures
<b>λ<sub>DU</sub></b>	Failure rate – dangerous undetected	Failure rate of dangerous undetected failures
<b>λ<sub>Total</sub></b>	Total failure rate	Failure rate of all failures
<b>DC</b>	Diagnostic coverage	Diagnostic coverage
<b>MTBF</b>	Mean time between failure	Average failure time period
<b>PFD<sub>avg</sub></b>	Average probability of failure on demand	Average probability of failure on demand
<b>FIT</b>	Failure in time (in 10 <sup>9</sup> hours)	Failures per unit time (1 failure every 10 <sup>9</sup> hours)
<b>T<sub>1max</sub></b>	Proof test interval	Repeat testing

## 14 Revision history

Revision	Date	Contents
00	12/2011	First publication
01	01/2012	Layout adjustments PSR-SIM4 modular safety relay added PSR-SACB-4/4-L-5,0PUR-SD accessory added
02	04/2012	FL PN/PN SDIO-2TX/2TX safe PROFINET gateway added
03	01/2014	Layout adjustments Values for ESA2-B and ESAM2/3x1 corrected in "Safety relays" on page 2 and PSR-URML4, PSR-URM4 42-230UC, and PSR-MXF added "Force-guided coupling relays" on page 6 moved to Section 3 "Safety relay modules" (previously Section 6) Values for order numbers 2986229, 2986232, 2986012, 2986025, 2986038, and 298604 updated in "PSR-TRISAFE configurable safety module" on page 7 and order numbers 2986096 and 2986106 added Order numbers 2700994 and 2701625 added in "Safe control technology" on page 10, PL and Cat. corrected for IL-PSDOR-4-1CH-AC15 and IL-PSDOR-4-1CH-DC13, note text for order number 2985864 reduced Designation for order number 2916794 corrected in "Safe control technology" on page 10. "Safe coupling relay" on page 12 renamed (previously "Process technology"), PSR-ETP/1x1 added and footnote for PSR-FSP and PSR-ETP/1x1 inserted. "Signal conditioners" on page 13 added "Ex i signal conditioners" on page 16 added "Explanation of terms" on page 19 extended
04	03/2015	Layout adjustments / Structure revised / Sections renamed in accordance with the designations of the product ranges Column for HW/FW version inserted in tables, if relevant "Safety relays – PSRmini" on page 2 inserted Second data record for order number 2981114/2981127 "PSR-ESAM4/3x1" on page 4 inserted "Multifunctional safety relays – PSRmultifunction" on page 7 inserted (previously included in Section 3.1 "Safety relays") Data in "Configurable safety modules – Trisafe" on page 9 revised Order number 2701559/270160 in "Network safety solutions" on page 10 inserted Order numbers 2903902, 2903904, 2903906, 2903914, 2903916, and 2903918 in "CONTACTRON hybrid motor starters" on page 12 inserted Data for "CONTACTRON hybrid motor starters" on page 12 updated "Safe coupling relays – PSRmini" on page 14 inserted In "Safe coupling relays – PSRclassic" on page 15 for PSR-FSP, PSR-ESP4, PSR-FSP2/2X1, PSR-ESAM4-B AC HFT changed from 1 to 0 Data for signal conditioners "Analog IN/Analog OUT" on page 16 updated Data for Ex i signal conditioners "Analog IN/Analog OUT" on page 19 updated
04_c00	04/2015	Notes for TRISAFE-S, -M, and -SDI8-SDIO4 on page 9 modified

Revision	Date	Contents
05	06/2016	<p><b>Section 3.1 “Safety relays – PSRmini” :</b>                      New products inserted:                      PSR-MS21, PSR-MC60, PSR-MC62, PSR-MC70, PSR-MC72, PSR-MC82</p> <p><b>Section 3.2 “Safety relays – PSRclassic” :</b>                      PL/Cat./SILCL/PFH<sub>D</sub> for PSR-ESP4 modified</p> <p><b>Section 4 “Zero-speed and over-speed safety relays – PSRmotion” :</b>                      New product inserted: PSR-MM25</p> <p><b>Section 6 “Configurable safety modules – Trisafe” :</b>                      HW/FW version column revised                      Note for TRISAFE-S 1CH and TRISAFE-M 1CH removed</p> <p><b>Section 7 “Network safety solutions” :</b>                      Cat./SILCL (for 1CH-AC15 and 1CH-DC13) for order number 2985864 IB IL PSDO 4 adjusted                      Characteristics for 2CH-CAP-B for order number 2985864 IB IL PSDOR 4 removed                      Footnote 1 inserted                      New products inserted:                      AXL F SSDI8/4 1F, AXL F SSDO8/3 1F, AXL F LPSDO8/3 1F</p> <p><b>Section 8.1 “Safe analog value processing” inserted</b></p> <p><b>Section 9 “CONTACTRON hybrid motor starters” :</b>                      Heading modified (previously “CONTACTRON solid-state contactors”)                      New products inserted:                      ELR H5-IES...-IFS , ELR H3-IES...-IFS , ELR H5-IES...SWD... , ELR H3-IES...SWD...</p> <p><b>Section 10.2 “Safe coupling relays – PSRclassic” :</b>                      T<sub>1max</sub> for PSR-FSP (low demand) modified                      SIL for PSR-ESP4 modified and corresponding footnote inserted                      Footnote for low demand values for PSR-FSP, PSR-ESP4, PSR-FSP2/2x1 inserted</p> <p><b>Section 11 “Signal conditioners” :</b>                      Order number for MACX MCR-T-UIREL-UP(-SP)(-C) corrected                      Order numbers removed:                      2811514, 2811831, 2865065, 2924317, 2865078, 2924320, 2924333, 2924346</p> <p><b>Section 12 “Ex i signal conditioners” :</b>                      Order numbers removed:                      2865722, 2924809, 2865939, 2924142, 2865573, 2924168, 2865942, 2865586                      New products inserted:                      MACX MCR-EX-SL-NAM-YO(-SP), MACX MCR-EX-SL-NAM-HO(-SP), MACX MCR-EX-SL-SD-21-25-LFD(-SP),                      MACX MCR-EX-SL-SD-24-48-LFD(-SP)</p>