

FUNCTIONAL SAFETY CHARACTERISTICS

Safety characteristics of Phoenix Contact safety products



Application note
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1 Purpose 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

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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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3 Safety switching devices for machine building

3.1 Safety relays – PSRmini



Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH _d (1/h)	t _M (years)	Valid data for HW/FW version	Note
2904950	PSR-MS20	c	1	1	1.5E-09	20	≥ 00/--	8760 switching cycles per year at 4 A DC 13 or 5 A AC 15 Up to PL e/SILCL 3 possible depending on the application
2904951	PSR-MS25						≥ 00/--	
2904952	PSR-MS30	e	4	3			≥ 00/--	8760 switching cycles per year at 4 A DC 13 or 5 A AC 15
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			≥ 00/--	8760 switching cycles per year at 4 A DC 13 or 5 A AC 15 Up to PL e/SILCL 3 possible depending on the application
2700467					≥ 00/--			
2700498	PSR-MC30	e	4	3	≥ 00/--	8760 switching cycles per year at 4 A DC 13 or 5 A AC 15		
2700499					≥ 00/--			
2700540	PSR-MC34				≥ 00/--			
2700548					≥ 00/--			
2700569	PSR-MC40				≥ 00/--			
2700570					≥ 00/--			
2700553	PSR-MC50	≥ 00/--						
2700564		≥ 00/--						

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 _d (1/h)	t _M (years)	Valid data for HW/FW version	Note
2963802	PSR-ESA2-B	c	1	1	4.05E-10	20	≥ 00/--	8766 switching cycles per year B10d = 230,000 at 3 A AC 15 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 B10d = 300,000 at 5 A DC 13
2963938							≥ 00/--	
2963763	PSR-ESA4-B	e	4	3	5.05E-10	20	≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13
2963941							≥ 00/--	
2901430	PSR-ESAM2/3x1-B	c	1	1	2.42E-10	20	≥ 00/--	8760 switching cycles per year B10d = 300,000 at 5 A DC 13 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 B10d = 300,000 at 5 A DC 13
2900526							≥ 00/--	
2900509	PSR-ESAM4/3x1-B	e	4	3	5.05E-10	20	≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13
2900510							≥ 00/--	
2981114	PSR-ESAM4/3x1	e	4	3	1.26E-10	20	≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13
2981127							< 08/--	
2981127	PSR-ESAM4/3x1	e	4	3	8.87E-10	20	≥ 08/--	8766 switching cycles per year B10d = 160,000 at 5 A DC 13
2981127							< 08/--	
2963912	PSR-ESAM4/8x1	e	4	3	5.06E-10	20	≥ 00/--	8766 switching cycles per year B10d = 230,000 at 3 A AC 15
2963996							≥ 00/--	
2901416	PSR-ESAM4-B AC	e	4	3	3.60E-10	20	≥ 00/--	8760 switching cycles per year B10d = 300,000 at 5 A DC 13
2901417							≥ 00/--	
2901426							≥ 00/--	
2901427							≥ 00/--	
2901422							≥ 00/--	
2901425							≥ 00/--	
2901428							≥ 00/--	
2901429							≥ 00/--	

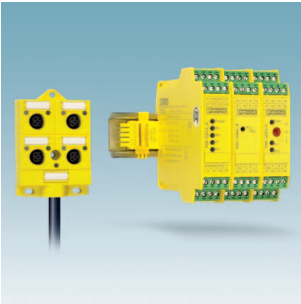
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Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH _d (1/h)	t _M (years)	Valid data for HW/FW version	Note
2981800	PSR-ESD-30	e	4	3	1.80E-09	20	≥ 00/--	8766 switching cycles per year B10d = 400,000 at 3 A AC 15 DC 13
2981813							≥ 00/--	
2981428	PSR-ESD-300 ²⁾				1.89E-09		≥ 00/--	8766 switching cycles per year B10d = 230,000 at 3 A AC 15
2981431							≥ 00/--	
2981125	PSR-ESD-T ²⁾				1.67E-09		≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13
2981198							≥ 00/--	
2981059	PSR-ESL4-B				5.56E-10		≥ 00/--	8766 switching cycles per year B10d = 160,000 at 5 A AC 15
2981062							≥ 00/--	
2963718	PSR-ESM4				5.05E-10		≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13
2963705							≥ 00/--	
2963776	PSR-ESM4-B				1.16E-10		≥ 00/--	8766 switching cycles per year B10d = 1,000,000 at 5 A DC 13
2963925							≥ 00/--	
2981020	PSR-ESP4				2.02E-11		≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13
2981017							≥ 00/--	
2981978	PSR-FSP/1x1 ¹⁾				2.02E-11		≥ 00/--	8766 switching cycles per year B10d = 230,000 at 3 A AC 15
2981981							≥ 00/--	
2986960	PSR-FSP/2x1 ¹⁾				1.21E-09		≥ 00/--	8766 switching cycles per year B10d = 200,000 at 2.5 A DC 13 or 3 A AC 15
2986957							≥ 00/--	
2963721	PSR-THC4				1.47E-09		≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13
2963983							≥ 00/--	
2963734	PSR-URM4/5x1 ¹⁾	1.02E-10	≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13				
2964005			≥ 00/--					
2981033	PSR-URM4/5x1-B ¹⁾	5.56E-10	≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13				
2981046			≥ 00/--					
2903583	PSR-URML4	4.69E-11	≥ 00/--	8766 switching cycles per year B10d = 200,000 at 2.5 A DC 13 or 3 A AC 15				
2903584			≥ 00/--					
2902935	PSR-URM4 42-230UC ¹⁾	4.69E-11	≥ 00/--	8766 switching cycles per year B10d = 200,000 at 2.5 A DC 13 or 3 A AC 15				
2902936			≥ 00/--					

¹⁾ In conjunction with a suitable evaluating device

²⁾ 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 _d (1/h)	t _M (years)	Valid data for HW/FW version	Note
2981486	PSR-SDC4	e	4		2.53E-10		≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13
2981499							≥ 00/--	
2981703	PSR-URD3/T2 ¹⁾	d	3	3	1.35E-09	20	≥ 00/--	8766 switching cycles per year B10d = 300,000 at 5 A DC 13
2981729							≥ 00/--	
2981732	PSR-URD3/3 ¹⁾					≥ 00/--		
2981745						≥ 00/--		
2981512	PSR-URD3/30 ¹⁾					≥ 00/--		
2981525						≥ 00/--		
2981677	PSR-URM4/B ¹⁾	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/--	

¹⁾ 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 _d (1/h)	t _M (years)	Valid data for HW/FW version	Note
2902725	PSR-MXF1	e	4	3	1.93E-10	20	≥ 00/--	8766 switching cycles per year B10d = 780,000 at 5 A DC 13 or 3 A AC 15
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 Speed and downtime monitors – PSRmotion



Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH _d (1/h)	t _M (years)	Valid data for HW/FW version	Note
2981538	PSR-RSM4	e	4	3	7.90E-09	20	≥ 00/--	In conjunction with suitable sensor systems.
2981541							≥ 00/--	

5 Forcibly guided coupling relays – PSRclassic



Order No.	Short designation	B10d	Valid data 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 _d (1/h)	t _M (years)	Valid data for HW/FW version	Note
2986229 2986232	TRISAFE-S	1CH	d	2	2	16.1E-09	20	≥ VS0/1.536 ≥ PT-4/1.536	Cat. 4 can only be achieved if cross circuit is prevented
		2CH	e	4	3	16.1E-09		-	
2986012 2986025	TRISAFE-M	1CH	d	2	2	17.1E-09		≥ PT-4/2.033	Cat. 4 can only be achieved if cross circuit is prevented
		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		≥ RC02/1.001	8766 switching cycles per year B10d = 1,960,000 at 3 A AC 15; 1 N/O
		1CH-DC13	c	1	2	11.3E-09		8766 switching cycles per year B10d = 780,000 at 3 A DC 13; 1 N/O	
		2CH-AC15	e	4	3	0.73E-09		8766 switching cycles per year B10d = 1,960,000 at 3 A AC 15; 1 N/O	
		2CH-DC13	e	4	3	0.73E-09		8766 switching cycles per year B10d = 780,000 at 3 A DC 13; 1 N/O	

7 Network safety solutions



Order No.	Short designation		EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH _d (1/h)	t _M (years)	Valid data 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 _d value is an example value. 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	2	2	1E-08		≥ 00/200/-		
		1CH-DC13	c	2	2	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-CAP-B	e	4	3	1E-09		≥ 00/100/-		
		2CH-DC13-A	e	4	3	1E-09		≥ 00/100/-		
2985688	IB IL PSDI 8	1CH	d	3	2	1E-08		≥ 00/100/-		
		2CH	e	4	3	1E-09		≥ 00/100/-		
2700994	IB IL PSDI 16	1CH	d	3	2	1E-08		≥ 00/100/-		
		2CH	e	4	3	1E-09		≥ 00/100/-		
2701559	AXL F PSDI8/4 1F	1CH	d	3	2	1E-08	≥ 00/100/-			
		2 CH	e	4	3	1E-09	≥ 00/100/-			
2701560	AXL F PSDO8/3 1F	1CH	d	3	2	1E-08	≥ 00/100/-			
		2CH	e	4	3	1E-09	≥ 00/100/-			

8 Safe control technology



Order No.	Short designation	EN ISO 13849-1 PL	Category	EN 62061 SILCL	PFH _d (1/h)	t _M (years)	Valid data 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	-	

9 Contactron solid-state contactors



Order No.	Short designation	EN ISO 13849-1 PL	Category	PFH _d (1/h)	t _M (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...			6.27E-09		
2900689 2900568 2900570	ELR-H3-IES-SC-230AC/500AC...					
2900550 2900552 2900554	ELR-H3-ES-SC-24DC/500AC...			2.40E-09		
2900686 2900553 2900555	ELR-H3-ES-SC-230AC/500AC...			6.27E-09		

10 Safety switching devices for the process industry

10.1 Safe coupling relays – PSRmini



Substitute values as 1oo1 structure

Order No.	Short designation	Device type	HFT	SIL	SFF (%)	λ_{SD} (FIT)	λ_{SU} (FIT)	λ_{DD} (FIT)	λ_{DU} (FIT)	λ_{Total} (FIT)	MTBF (years) ¹⁾	PFD _{avg} ²⁾	PFH _d	T _{1max} (years)	t _M (years)	Valid data for HW/FW version
2700356	PSR-PS20	High ³⁾	A	0	3	99.98	989.32	148.96	52.58	0.20	1191.06	80.63	-	1.95E-10	20	≥ 00/--
		Low				99.66	0	1579	0	5.392	1584	63	2.36E-05	-	6	
2700357	PSR-PS21	High ³⁾			2	99.18	494.66	79.10	494.66	8.80	1077.22	91.65	-	8.80E-09	20	
		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	
		Low				99.72	0	1891	0	5.236	1896	52	2.29E-05	-	6	
2700577 2700578	PSR-PC20	High ³⁾				99.98	989.32	230.38	52.58	0.20	1272.48	76.43	-	1.95E-10	20	
		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	
		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	

¹⁾ Includes faults that are not part of the safety function. MTTR was set to 8 hours.

²⁾ For T₁ = 1 year

³⁾ Only in conjunction with a suitable evaluating device

10.2 Safe coupling relays – PSRclassic



Substitute values as 1oo1 structure

Order No.	Short designation	Device type	HFT	SIL	SFF (%)	λ_{SD} (FIT)	λ_{SU} (FIT)	λ_{DD} (FIT)	λ_{DU} (FIT)	λ_{Total} (FIT)	MTBF (years) ¹⁾	PFD _{avg} ²⁾	PFH _d	T _{1max} (years)	t _M (years)	Valid data for HW/FW version			
2981978 2981981	PSR-FSP	High ³⁾	A	0	3	99.99	198	62.7	3.66	0.02	264.38	319	-	2.02E-11	20	≥ 00/--			
Low		99.77				0	909.7	0	2.09	911.79	113	9.15E-06	-	10	≥ 00/--				
2981020 2981017	PSR-ESP4	High				99.99	949	58.3	44.5	0.093	1052	106.9	-	9.93E-11	20	≥ 00/--			
Low		99.56				0	849	0	3.68	853	132.3	1.61E-05	-	9	≥ 00/--				
2986960 2986957	PSR-FSP/2x1	High 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 ³⁾				0	2	99.61	99	55.7	99	1	254.7	361	-	1E-09	20	≥ 00/--	
Low		81.97						0	455	0	100	555	185	4.38E-04	-	2.25	≥ 00/--		
2901416 2901417 2901426 2901427 2901422 2901425 2901428 2901429	PSR-ESAM4-B AC	High						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/--

¹⁾ Includes faults that are not part of the safety function. MTTR was set to 8 hours.

²⁾ For T₁ = 1 year

³⁾ 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.

Substitute values as 1oo1 structure

Order No.	Short designation		Device type	Operating mode	SIL	SFF (%)	λ_{SD} (FIT)	λ_{SU} (FIT)	λ_{DD} (FIT)	λ_{DU} (FIT)	MTBF (years)	PFD _{avg} ¹⁾	PFH _d	DC (%)
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		Low/High	A	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		Low/High	A	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		Low/High	A	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		Low/High	A	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		Low/High	A	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		Low/High	A	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		Low/High	A	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		Low/High	A	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		Low/High	A	4)	2	87.6	0	195	198	55.3	254	2.48E-04	5.53E-08	78.1

¹⁾ For $T_1 = 1$ year

²⁾ Input isolator $I \approx 1$ (4 ... 20 mA)

³⁾ Output isolator $I \approx 1$ (4 ... 20 mA)

⁴⁾ 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.

Substitute values as 1001 structure

Order No.	Short designation	Device type	Operating mode											
				SIL	SFF (%)	λ_{SD} (FIT)	λ_{SU} (FIT)	λ_{DD} (FIT)	λ_{DU} (FIT)	MTBF (years)	PFD _{avg} ¹⁾	PFH _d	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		Low/High		³⁾	2	93.00	0	0	789	56	97	3.75E-04	5.60E-08	93.00
2811873			Low/High	⁴⁾	2	94.00	0	234	543	43	85	2.88E-04	4.30E-08	92.00
2811970		Low/High		⁵⁾	2	93.00	0	238	522	56	85	3.67E-04	5.60E-08	90.00
2811387	MACX MCR-T-UIREL-UP(-SP)(-C)		Low/High	B	-	2	96.60	461	11.2	318	32.3	105	1.30E-04	3.23E-08
2811828		Low/High	-		2	96.50	438	11	314	32.4	108	1.31E-04	3.24E-08	90.70
2811514			Low/High	-	2	96.60	461	11.2	318	32.3	105	1.30E-04	3.23E-08	90.80
2811831		Low/High		-	2	96.50	438	11	314	32.4	108	1.31E-04	3.24E-08	90.70
2865065	MACX MCR-SL-RTD-I(-SP)(-NC)		Low/High	B	-	2	96.60	461	11.2	318	32.3	105	1.30E-04	3.23E-08
2924317		Low/High	-		2	96.50	438	11	314	32.4	108	1.31E-04	3.24E-08	90.70
2865078			Low/High	-	2	96.60	461	11.2	318	32.3	105	1.30E-04	3.23E-08	90.80
2924320		Low/High		-	2	96.50	438	11	314	32.4	108	1.31E-04	3.24E-08	90.70
2924333	MACX MCR-SL-TC-I(-NC)		Low/High	B	-	2	96.60	461	11.2	318	32.3	105	1.30E-04	3.23E-08
2924346		Low/High	-		2	96.50	438	11	314	32.4	108	1.31E-04	3.24E-08	90.70

¹⁾ For T₁ = 1 year

²⁾ PT 100 3-wire, output 4 ... 20 mA

³⁾ Voltage input mV, output 4 ... 20 mA

⁴⁾ Pt 100 3-wire, output relay

⁵⁾ Voltage input mV, output relay

11.3 Digital IN



For additional operating modes, please refer to the corresponding data sheet for the relevant product at phoenix-contact.net/products.

Substitute values as 1oo1 structure

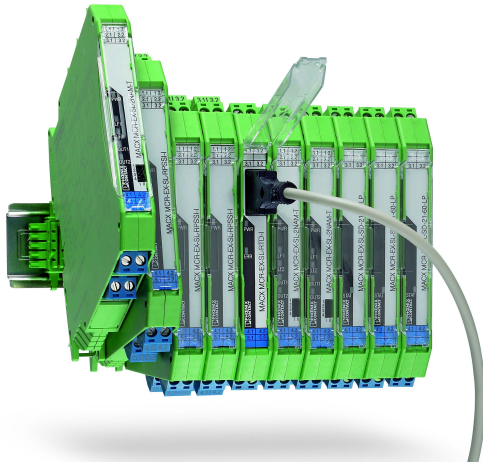
Order No.	Short designation		Device type	Operating mode										
					SIL	SFF (%)	λ_{SD} (FIT)	λ_{SU} (FIT)	λ_{DD} (FIT)	λ_{DU} (FIT)	MTBF (years)	PFD _{avg} ¹⁾	PFH _d	DC (%)
2865997	MACX MCR-SL-NAM-R(-SP)	Low	A	²⁾	2	78.9	6	242	7	60	304	2.90E-04	-	10.0
2924252				³⁾	2	78.0	1	249	6	64	304	3.08E-04	-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

¹⁾ For T₁ = 1 year

²⁾ Non-inverted output (N)

³⁾ 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 phoenix-contact.net/products.

Substitute values as 1oo1 structure

Order No.	Short designation		Device type	Operating mode										
				SIL	SFF (%)	λ_{SD} (FIT)	λ_{SU} (FIT)	λ_{DD} (FIT)	λ_{DU} (FIT)	MTBF (years)	$PFD_{avg}^{1)}$	PFH_d	DC (%)	
2865340	MACX MCR-EX-SL-RPSSI-I(-SP)	Low/High	A	2 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⁾	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⁾	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 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 ²⁾	3	92.3	0	316.0	345	55.3	159	2.52E-04	5.53E-08	86.2
2924676														

¹⁾ For $T_1 = 1$ year

²⁾ Repeater Power Supply

³⁾ 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 phoenix-contact.net/products.

Substitute values as 1oo1 structure

Order No.	Short designation		Device type	Operating mode											
					SIL	SFF (%)	λ_{SD} (FIT)	λ_{SU} (FIT)	λ_{DD} (FIT)	λ_{DU} (FIT)	MTBF (years)	PFD _{avg} ¹⁾	PFH _d	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		Low/High			3)	2	93.0	0	0	789	56	97	3.75E-04	5.60E-08	93.0
2924692															
2865751	MACX MCR-EX-T-UIREL-UP(-SP)(-C)	Low/High	B	4)	2	94.0	0	234	543	43	85	2.88E-04	4.30E-08	92.0	
2924799															
2865722		Low/High			5)	2	93.0	0	238	522	56	85	3.67E-04	5.60E-08	90.0
2924809															
2865939	MACX MCR-EX-SL-RTD-I(-SP)(-NC)	Low/High	B	-	2	96.6	461	11.2	318	32.3	105	1.30E-04	3.23E-08	90.8	
2924142															
2865573															
2924168															
2865942	MACX MCR-EX-SL-TC-I(-NC)	Low/High	B	-	2	96.5	438	11	314	32.4	108	1.31E-04	3.24E-08	90.7	
2865586															
2864587	MCR-FL-TS-LP-I-EX	Low/High	B		2	>75	136	183	17	111	255	4.85E-04	-	13.0	
2864545	MCR-HT-TS-I-EX	Low/High	B		2	>73	136	183	17	111	255	4.69E-04	-	13.0	

1) For T₁ = 1 year

2) Pt 100 3-wire, output 4...20 mA

3) Voltage input mV, output 4...20 mA

4) Pt 100 3-wire, output relay

5) Voltage input mV, 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.

Substitute values as 1oo1 structure

Order No.	Short designation		Device type	Operating mode	SIL	SFF (%)	λ_{SD} (FIT)	λ_{SU} (FIT)	λ_{DD} (FIT)	λ_{DU} (FIT)	MTBF (years)	PFD _{avg} ¹⁾	PFH _d	DC (%)
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	3.08E-04	-	8.0
2865476	MACX MCR-EX-SL-2NAM-RO(-SP)	Low	A	²⁾	2	78.3	6	249	7	64	204	3.08E-04	-	9.0
2924087				³⁾		78.3	1	248	6	62	204	3.08E-04	-	8.0
2865984	MACX MCR-EX-SL-2NAM-R-UP(-SP)	Low	A	²⁾	2	86.6	6	403	0	63	226	3.08E-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
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-48-LFD(-SP)	Low	A	-	3	94.8	0	406	45.1	24.6	167	1.08E-04	2.46E-8	64.7
2924870														

¹⁾ For T₁ = 1 year

²⁾ Non-inverted output (N)

³⁾ Inverted output (I)

13 Explanation of terms

Abbreviation	Term	Explanation
EN ISO 13849-1		
PL	Performance Level	Classification of the ability of safety functions to meet a safety demand.
Category	Category	Classification of the resistance to faults according to EN ISO 13849-1
PFD_d	Probability of dangerous failure per hour	Probability of dangerous failure per hour
t_M	Mission time	Duration of use
EN IEC 61508 / 61511 / 62061		
HFT	Hardware Failure Tolerance	Ability of a function unit to continue with the execution of a demanded function despite existing faults or deviations.
SIL	Safety Integrity Level	Safety integrity level
SILCL	Safety Integrity Level Claim Limit	SIL claim limit (suitability)
SFF	Safe Failure Fraction	Fraction of safe failures
λ_{SD}	Failure rate – safe detected	Failure rate of safe detected failures
λ_{SU}	Failure rate – safe undetected	Failure rate of safe undetected failures
λ_{DD}	Failure rate – dangerous detected	Failure rate of dangerous detected failures
λ_{DU}	Failure rate – dangerous undetected	Failure rate of dangerous undetected failures
λ_{Total}	Total failure rate	Failure rate of all failures
DC	Diagnostic Coverage	Diagnostic coverage
MTBF	Mean Time Between Failures	Average failure time period
PFD_{avg}	Average probability of failure on demand	Average probability of failure on demand
FIT	Failure in time (in 10 ⁹ hours)	Failures per unit time (1 failure every 10 ⁹ hours)
T_{1max}	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 Corrected values for items ESA2-B and ESAM2/3x1 in "Safety relays" on page 2 and items PSR-URML4, PSR-URM4 42-230UC and PSR-MXF added Moved "Forcibly guided coupling relays" on page 6 into Chapter 3 "Safety switching devices" (previously Chapter 6) Updated values for items 2986229, 2986232, 2986012, 2986025, 2986038 and 298604 in "Configurable safety module PSR-TRISAFE" on page 7 and added items 2986096 and 2986106 Added items 2700994 and 2701625 in "Safe control technology" on page 10, corrected PL and Cat. for items IL-PSDOR-4-1CH-AC15 and IL-PSDOR-4-1CH-DC13, reduced information text on item 2985864 Corrected designation for item 2916794 in "Safe control technology" on page 10. Renamed "Safe coupling relay" on page 12 (previously "Process technology"), added item PSR-ETP/1x1 and inserted footnote for item PSR-FSP and PSR-ETP/1x1 Added "Signal conditioners" on page 13 Added "Ex-i Signal conditioners" on page 16 Added to "Explanation of terms" on page 19
04	04/2015	Layout adjustments / Editing the structure / Renaming the chapter according to the designations of the product ranges Inserted column for HW/FW version in tables, if relevant "Safety relays – PSRmini" on page 2 added Inserted second data record for item 2981114/2981127 "PSR-ESAM4/3x1" on page 3 "Multifunctional safety relays – PSRmultifunction" on page 6 added (was previously contained in Chapter 3.1 "Safety relays") Revised data in Chapter "Configurable safety modules – TRISAFE" on page 8 Inserted items 2701559/270160 in Chapter "Network safety solutions" on page 9 Inserted items 2903902, 2903904, 2903906, 2903914, 2903916, 2903918 in Chapter "Contactron solid-state contactors" on page 11 Updated data for chapter "Contactron solid-state contactors" on page 11 "Safe coupling relays – PSRmini" on page 12 added In Chapter "Safe coupling relays – PSRclassic" on page 13 for PSR-FSP, PSR-ESP4, PSR-FSP2/2X1, PSR-ESAM4-B AC HFT changed from 1 to 0 Data for signal conditioner "Analog IN / Analog OUT" on page 14 updated Data for Ex-i signal conditioner "Analog IN / Analog OUT" on page 17 updated