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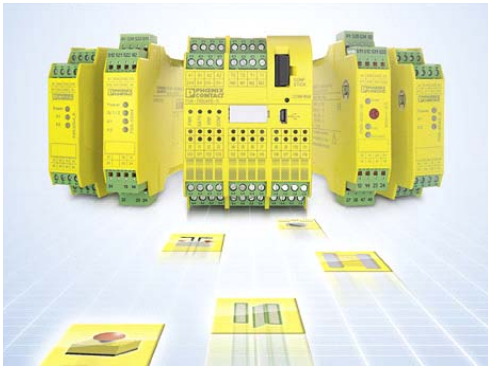
# FUNCTIONAL SAFETY CHARACTERISTICS

## Safety characteristics of Phoenix Contact safety products



Application note
105016_en_07

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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.

This document provides additional data to the respective documentation for the products enclosed.
The product documentation for the individual products takes priority and much be observed in each case.

Should you have any further questions, please contact the Safety service team.

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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 | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (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 | | | ≥ 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 | | | ≥ 00/-- | 8760 switching cycles per year at 4 A DC13 or 5 A AC15 |
| 2700499 | | | | | | | ≥ 00/-- | |
| 2700524 | PSR-MC32 | | | | 1.0E-09 | | ≥ 00/-- | 8760 switching cycles per year at 5 A DC13 or 5 A AC15 |
| 2700525 | | | | | | | ≥ 00/-- | |
| 2700540 | PSR-MC34 | | | | 1.5E-09 | | ≥ 00/-- | 8760 switching cycles per year at 4 A DC13 or 5 A AC15 |
| 2700548 | | | | | | | ≥ 00/-- | |
| 2702411 | PSR-MC37 | | | | 1.0E-09 | | ≥ 00/-- | 8760 switching cycles per year at 5 A DC13 or 5 A AC15 |
| 2702412 | | | | | | | ≥ 00/-- | |
| 2700569 | PSR-MC40 | | | | 1.5E-09 | | ≥ 00/-- | 8760 switching cycles per year at 4 A DC13 or 5 A AC15 |
| 2700570 | | | | | | | ≥ 00/-- | |
| 2700553 | PSR-MC50 | | | | | | ≥ 00/-- | |
| 2700564 | | | | | | | ≥ 00/-- | |
| 2700571 | PSR-MC60 | c | 1 | 1 | 5.5E-07 | | ≥ 00/100 | |
| 2700572 | | | | | | | ≥ 00/100 | |
| 2700574 | PSR-MC62 | e | 4 | 3 | 1.0E-09 | | ≥ 00/100 | |
| 2700575 | | | | | | | ≥ 00/100 | |



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| Order No. | Short designation | EN ISO 13849-1 PL | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (years) | Data valid for HW/FW version | Note |
|---|---|---|---|---|---|---|---|---|
| 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 | |
| 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 [1)] | | | | 1.0E-09 | | ≥ 00/-- | 8760 switching cycles per year at 3 A DC13 or 3 A AC15 |
| 2702383 | | | | | | | ≥ 00/-- | |

[1)] In conjunction with a suitable evaluating device



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## 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 | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (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<br>$B_{10D}$ = 230,000 at 3 A AC15<br>Up to PL e/SILCL 3 possible depending on the application |
| 2963954 | | | | | | | ≥ 00/-- | |
| 2963750 | PSR-ESA4 | e | 4 | 3 | 5.05E-10 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13 |
| 2963938 | | | | | | | ≥ 00/-- | |
| 2963763 | PSR-ESA4-B | | | | | | ≥ 00/-- | |
| 2963941 | | | | | | | ≥ 00/-- | |
| 2901430 | PSR-ESAM2/3x1-B | c | 1 | 1 | 2.42E-10 | | ≥ 00/-- | 8760 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13<br>Up to PL e/SILCL 3 possible depending on the application |
| 2901431 | | | | | | | ≥ 00/-- | |
| 2900525 | PSR-ESAM4/2x1 | e | 4 | 3 | 5.05E-10 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13 |
| 2900526 | | | | | | | ≥ 00/-- | |
| 2900509 | PSR-ESAM4/3x1-B | | | | 5.05E-10 | | ≥ 00/-- | |
| 2900510 | | | | | | | ≥ 00/-- | |
| 2981114 | PSR-ESAM4/3x1 | | | | 1.26E-10 | | ≥ 00/--<br>< 08/-- | 8766 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13 |
| | | | | | 8.87E-10 | | ≥ 08/-- | 8766 switching cycles per year<br>$B_{10D}$ = 160,000 at 5 A DC13 |
| 2981127 | | | | | 1.26E-10 | | ≥ 00/--<br>< 08/-- | 8766 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13 |
| | | | | | 8.87E-10 | | ≥ 08/-- | 8766 switching cycles per year<br>$B_{10D}$ = 160,000 at 5 A DC13 |
| 2963912 | PSR-ESAM4/8x1 | | | | 5.06E-10 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 230,000 at 3 A AC15 |
| 2963996 | | | | | | | ≥ 00/-- | |
| 2901416 | PSR-ESAM4-B AC | | | | 3.60E-10 | | ≥ 00/-- | 8760 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13 |
| 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 | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (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<br>$B_{10D}$ = 400,000 at 3 A AC15 DC13 |
| 2981813 | | | | | | | ≥ 00/-- | |
| 2981428 | PSR-ESD-300 [2] | | | | 1.89E-09 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 230,000 at 3 A AC15 |
| 2981431 | | | | | | | ≥ 00/-- | |
| 2981125 | PSR-ESD-T [2] | | | | 1.67E-09 | | ≥ 00/-- | |
| 2981198 | | | | | | | ≥ 00/-- | |
| 2981059 | PSR-ESL4-B | | | | 5.56E-10 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13 |
| 2981062 | | | | | | | ≥ 00/-- | |
| 2963718 | PSR-ESM4 | | | | 5.05E-10 | | ≥ 00/-- | |
| 2963705 | | | | | | | ≥ 00/-- | |
| 2963776 | PSR-ESM4-B | | | | | | ≥ 00/-- | |
| 2963925 | | | | | | | ≥ 00/-- | |
| 2981020 | PSR-ESP4 | c | 1 | 1 | 9.93E-11 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 160,000 at 5 A AC15<br>Up to PL e/SILCL 3 possible depending on the application |
| 2981017 | | | | | | | ≥ 00/-- | |
| 2981978 | PSR-FSP/1x1 [1] | e | 4 | 3 | 2.02E-11 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 1,000,000 at 5 A DC13 |
| 2981981 | | | | | | | ≥ 00/-- | |
| 2986960 | PSR-FSP/2x1 [1] | | | | 2.02E-11 | | ≥ 00/-- | |
| 2986957 | | | | | | | ≥ 00/-- | |
| 2963721 | PSR-THC4 | | | | 1.21E-09 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13 |
| 2963983 | | | | | | | ≥ 00/-- | |
| 2963734 | PSR-URM4/5x1 [1] | | | | 1.47E-09 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 230,000 at 3 A AC15 |
| 2964005 | | | | | | | ≥ 00/-- | |
| 2981033 | PSR-URM4/5x1-B [1] | | | | 1.02E-10 | | ≥ 00/-- | |
| 2981046 | | | | | | | ≥ 00/-- | |
| 2903583 | PSR-URML4 | | | | 5.56E-10 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13 |
| 2903584 | | | | | | | ≥ 00/-- | |
| 2702924 | PSR-URM4 42-230UC [1] | | | | 1.00E-09 | | ≥ 00/-- | 8766 switching cycles per year<br>$B10_D$ = 200,000 at 5 A AC15 |
| 2702925 | | | | | | | ≥ 00/-- | |

[1] In conjunction with a suitable evaluating device

[2] Delayed contacts up to PL d, category 3



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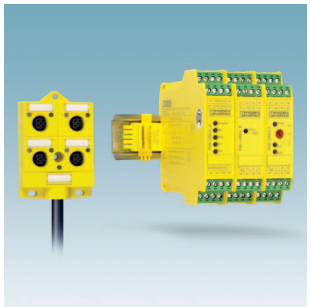
### 3.3 Modular safety relay system – PSRmodular



| Order No. | Short designation | EN ISO 13849-1 PL | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (years) | Data valid for HW/FW version | Note |
|---|---|---|---|---|---|---|---|---|
| 2981486 | PSR-SDC4 | e | 4 | | 2.53E-10 | | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13 |
| 2981499 | | | | | | | ≥ 00/-- | |
| 2981703 | PSR-URD3/T2 [1)] | d | 3 | 3 | 1.35E-09 | 20 | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 300,000 at 5 A DC13 |
| 2981729 | | | | | | | ≥ 00/-- | |
| 2981732 | PSR-URD3/3[1)] | | | | | | ≥ 00/-- | |
| 2981745 | | | | | | | ≥ 00/-- | |
| 2981512 | PSR-URD3/30 [1)] | | | | 1.39E-09 | | ≥ 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



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### 3.4 Multifunctional safety relays – PSRmultifunction

| Order No. | Short designation | EN ISO 13849-1 PL | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (years) | Data valid for HW/FW version | Note |
|---|---|---|---|---|---|---|---|---|
| 2902725 | PSR-MXF1 | e | 4 | 3 | 1.93E-10 | 20 | ≥ 00/-- | 8766 switching cycles per year<br>$B_{10D}$ = 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 | | | | | | | ≥ 00/-- | |
| 2903260 | PSR-MXF4 | | | | | | ≥ 00/-- | |
| 2903261 | | | | | | | ≥ 00/-- | |
| 2903262 | | | | | | | ≥ 00/-- | |



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

| Order No. | Short designation | EN ISO 13849-1 PL | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (years) | Data valid for HW/FW version | Note |
|---|---|---|---|---|---|---|---|---|
| 2702355 | PSR-MM25 | e | 3 | 3 | 5.79E-08 | 20 | ≥ 00/100 | 17520 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/-- | |



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# 5 Safe coupling relays – PSRclassic

## 5.1 High demand – safety characteristic data

| Order No. | Short designation | EN ISO 13849-1 PL | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (years) | Data valid for HW/FW version | Note |
|---|---|---|---|---|---|---|---|---|
| 2963747 | PSR-24UC/URM/5X1/2X2 | c | 1 | 1 | 1.00E-07 [1)]<br>1.35E-07 [2)]<br>1.56E-07 [3)] | 20 | ≥ 11/-- | **1)** 3 A AC15; 8760 switching cycles/year; 5 % of the overall SIL<br>**2)** 3 A DC13; 8760 switching cycles/year; 5 % of the overall SIL<br>**3)** 6 A AC1; 8760 switching cycles/year; 5 % of the overall SIL<br>**4)** 3 A AC15; 8760 switching cycles/year; 10 % of the overall SIL<br>**5)** 3 A DC13; 8760 switching cycles/year; 10 % of the overall SIL<br>**6)** 6 A AC1; 8760 switching cycles/year; 10 % of the overall SIL |
| 2963970 | | | | | | | ≥ 09/-- | |
| 2981444 | PSR-24UC/URM/4X1/2X2 | c | 1 | 1 | 6.00E-07 [4)]<br>6.00E-07 [5)]<br>2.40E-07 [6)] | | ≥ 04/-- | |
| 2981457 | | | | | | | ≥ 04/-- | |
| 2981839 | PSR-24UC/URM/3X1/3X2 | c | 1 | 1 | 4.00E-07 [1)]<br>4.00E-07 [2)]<br>2.40E-07 [3)] | | ≥ 06/-- | |
| 2981842 | | | | | | | ≥ 06/-- | |
| 2981952 | PSR-24UC/URM/5X1/1X2 | c | 1 | 1 | 1.00E-07 [1)]<br>1.35E-07 [2)]<br>1.56E-07 [3)] | | ≥ 04/-- | |
| 2981965 | | | | | | | ≥ 04/-- | |
| 2981402 | PSR-120UC/URM/5X1/2X2 | c | 1 | 1 | 1.00E-07 [1)]<br>1.35E-07 [2)]<br>1.56E-07 [3)] | | ≥ 08/-- | |
| 2981415 | | | | | | | ≥ 08/-- | |
| 2981363 | PSR-24UC/URM/2X21 | c | 1 | 1 | 6.67E-07 [4)]<br>3.33E-07 [5)]<br>2.00E-07 [6)] | | ≥ 03/-- | |
| 2981376 | PSR-120UC/URM/2X21 | c | 1 | 1 | 6.67E-07 [4)]<br>3.33E-07 [5)]<br>2.00E-07 [6)] | | ≥ 03/-- | |



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## 5.2 Low demand – safety characteristic data

| Order No. | Short designation | Device type | HFT | IEC 61508 SIL | $PFD_{avg}$ (1/h) | $T_{1max}$ (years) | $t_M$ (years) | Data valid for HW/FW version | Note |
|---|---|---|---|---|---|---|---|---|---|
| 2963747 | PSR-24UC/URM/5X1/2X2 | A | 0 | 1 | 4.05E-03 | 4.6 | 20 | ≥ 11/-- | - |
| 2963970 | | | | | | | | ≥ 09/-- | - |
| 2981444 | PSR-24UC/URM/4X1/2X2 | A | 0 | 1 | 4.05E-03 | 4.6 | | ≥ 04/-- | - |
| 2981457 | | | | | | | | ≥ 04/-- | - |
| 2981839 | PSR-24UC/URM/3X1/3X2 | A | 0 | 1 | 4.05E-03 | 4.6 | | ≥ 06/-- | - |
| 2981842 | | | | | | | | ≥ 06/-- | - |
| 2981952 | PSR-24UC/URM/5X1/1X2 | A | 0 | 1 | 4.05E-03 | 4.6 | | ≥ 04/-- | - |
| 2981965 | | | | | | | | ≥ 04/-- | - |
| 2981402 | PSR-120UC/URM/5X1/2X2 | A | 0 | 1 | 4.05E-03 | 4.6 | | ≥ 08/-- | - |
| 2981415 | | | | | | | | ≥ 08/-- | - |
| 2981363 | PSR-24UC/URM/2X21 | A | 0 | 1 | 4.05E-03 | 4.6 | | ≥ 03/-- | - |
| 2981376 | PSR-120UC/URM/2X21 | A | 0 | 1 | 4.05E-03 | 4.6 | | ≥ 03/-- | - |



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# 6 Configurable safety modules – PSRtrisafe

## 6.1 High demand – safety characteristic data

| Order No. | Short designation | Parameterization | EN ISO 13849-1 PL | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (years) | Data valid for HW/FW version | Note |
|---|---|---|---|---|---|---|---|---|---|
| 2986229<br>2986232 | PSR-TRISAFE-S | 1CH | d | 2 | 2 | 16.1E-09 | 20 | ≥ 10/1636 | - |
| | | 2CH | e | 4 | 3 | | | | - |
| 2986012<br>2986025 | PSR-TRISAFE-M | 1CH | d | 2 | 2 | 17.1E-09 | | ≥ 10/2033 | - |
| | | 2CH | e | 4 | 3 | | | | - |
| 2986038<br>2986041 | PSR-TS-SDI8-SDIO4 | 1CH | d | 2 | 2 | 3.94E-09 | | ≥ 10/1021 | - |
| | | 2CH | e | 4 | 3 | | | | - |
| 2986096<br>2986106 | PSR-TS-SDOR4 | 1CH | c | 1 | 1 | 3.67E-07 | | ≥ 03/1002 | 4 A DC13; 8760 switching cycles/year |
| | | | | | | 5.5E-07 | | | 5 A AC15; 8760 switching cycles/year |
| | | | | | | 1.41E-07 | | ≤ 02/1002 | 5 A DC13; 8760 switching cycles/year |
| | | | | | | 1.0E-07 | | | 3 A AC15; 8760 switching cycles/year |
| | | 2CH | e | 4 | 3 | 7.3E-10 | | ≥ 03/1002 | 4 A DC13; 5 A AC15; 8760 switching cycles/year |
| | | | | | | 7.3E-10 | | ≤ 02/1002 | 5 A DC13; 3 A AC15; 8760 switching cycles/year |



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### 6.1.1 High demand – alternative illustration as 1oo1 structure

| Order No. | Short designation | Parameterization | Device type | HFT | SIL | SFF (%) | $\lambda_{SD}$ (FIT) | $\lambda_{SU}$ (FIT) | $\lambda_{DD}$ (FIT) | $\lambda_{DU}$ (FIT) | $\lambda_{Total}$ (FIT) | MTBF (years) [1] | $PFH_D$ (1/h) | $T_{1max}$ (years) | $t_M$ (years) | Data valid for HW/FW version | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2986229<br>2986232 | PSR-TRISAFE-S | 1CH | B | 0 | 2 | 99.81 | 0 | 1282 | 459 | 3.39 | 1745 | 64.78 | 3.39E-09 | 20 | 20 | ≥ 10/1636 | - |
| | | 2CH | | | 3 | | | | | | | | | | | | - |
| 2986012<br>2986025 | PSR-TRISAFE-M | 1CH | | | 2 | | | | | | | | | | | ≥ 10/2033 | - |
| | | 2CH | | | 3 | | | | | | | | | | | | - |
| 2986038<br>2986041 | PSR-TS-SDI8-SDIO4 | 1CH | B | 0 | 2 | 99.88 | 0 | 1253 | 317 | 1.91 | 1572 | 71.91 | 1.91E-09 | | | ≥ 10/1021 | [2] |
| | | 2CH | | | 3 | | | | | | | | | | | | |
| 2986096<br>2986106 | PSR-TS-SDOR4 | 1CH | - | 0 | 1 | 83.79 | 873 | 990 | 33 | 367 | 2263 | 49.94 | 3.67E-07 | | | ≥ 03/1002 | 4 A DC13 |
| | | | | | | 93.88 | 873 | 1259 | 33 | 141 | 2305 | 49.02 | 1.41E-07 | | | ≤ 02/1002 | 5 A DC13; |
| | | 2CH | | | 3 | 99.99 | 910 | 2681 | 23.75 | 0.17 | 3615 | 31.26 | 1.72E-10 | | | ≥ 03/1002 | 4 A DC13 |
| | | | | | | 99.99 | 910 | 1781 | 21.51 | 0.13 | 2712 | 41.67 | 1.27E-10 | | | ≤ 02/1002 | 5 A DC13; |

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

[2] Values calculated for configuring up to 8 inputs and up to 4 outputs.

### 6.2 Low demand – safety characteristic data

| Order No. | Short designation | Parameterization | Device type | HFT | IEC 61508 SIL | $PFD_{avg}$ (1/h) | $T_{1max}$ (years) | $t_M$ (years) | Data valid for HW/FW version | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 2986229<br>2986232 | PSR-TRISAFE-S | 1CH | B | 0 | 2 | 2.99E-04 | 20 | 20 | ≥ 10/1636 | - |
| | | 2CH | | 1 | 3 | | | | | - |
| 2986012<br>2986025 | PSR-TRISAFE-M | 1CH | | 0 | 2 | | | | ≥ 10/2033 | - |
| | | 2CH | | 1 | 3 | | | | | - |
| 2986038<br>2986041 | PSR-TS-SDI8-SDIO4 | 1CH | B | 0 | 2 | 2.1E-04 | 20 | | ≥ 10/1021 | - |
| | | 2CH | | 1 | 3 | | | | | - |
| 2986096<br>2986106 | PSR-TS-SDOR4 | 1CH | - | 0 | 1 | 4.35E-03 | 5 | | ≥ 03/1002 | - |
| | | | | | | | | | ≤ 02/1002 | - |
| | | 2CH | | 1 | 3 | 1.18E-04 | 5 | | ≥ 03/1002 | - |
| | | | | | | | | | ≤ 02/1002 | - |



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### 6.2.1 Low demand – alternative illustration as 1oo1 structure

| Order No. | Short designation | Parameterization | Device type | HFT | SIL | SFF (%) | $\lambda_{SD}$ (FIT) | $\lambda_{SU}$ (FIT) | $\lambda_{DD}$ (FIT) | $\lambda_{DU}$ (FIT) | $\lambda_{Total}$ (FIT) | MTBF (years) [1] | $PFD_{avg}$ [2] (1/h) | $T_{1max}$ (years) | $t_M$ (years) | Data valid for HW/FW version | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2986229<br>2986232 | PSR-TRISAFE-S | 1CH | B | 0 | 2 | 99.84 | 0 | 1638 | 505 | 3.39 | 2146 | 64.36 | 1.49E-05 | 20 | 20 | ≥ 10/1636 | - |
| | | 2CH | | | 3 | | | | | | | | | | | | - |
| 2986012<br>2986025 | PSR-TRISAFE-M | 1CH | | | 2 | | | | | | | | | | | ≥ 10/2033 | - |
| | | 2CH | | | 3 | | | | | | | | | | | | - |
| 2986038<br>2986041 | PSR-TS-SDI8-SDIO4 | 1CH | B | 0 | 2 | 99.91 | 0 | 1729 | 349 | 1.91 | 2080 | 66.41 | 8.38E-06 | 20 | | ≥ 10/1021 | [3] |
| | | 2CH | | | 3 | | | | | | | | | | | | |
| 2986096<br>2986106 | PSR-TS-SDOR4 | 1CH | - | 0 | 1 | 94.26 | 873 | 2379 | 32 | 200 | 3484 | 32.44 | 9.69E-04 | 5 | | ≥ 03/1002 | - |
| | | | | | | | | | | | | | | | | ≤ 02/1002 | - |
| | | 2CH | | | 3 | 99.88 | 910 | 3700 | 21.18 | 5.45 | 4637 | 24.37 | 1.23E-04 | 5 | | ≥ 03/1002 | - |
| | | | | | | | | | | | | | | | | ≤ 02/1002 | - |

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

[2] For $T_1$ = 1 year

[3] Values calculated for configuring up to 8 inputs and up to 4 outputs.



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# 7 Network safety solutions

[1] In conjunction with clock signals. See user documentation for the module.

[2] Version as per illustration 6-3 in the user manual. See table 7-3, illustration 6-3 and illustration 6-4 in the user manual.

| Order No. | Short designation | | EN ISO 13849-1 PL | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (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 | | | |
| 2700606 | IB IL LPSDO 8 V2 | 1CH | d | 3 | 2 | 1E-08 | | ≥ 00/100/100 | |
| | | 2CH | e | 4 | 3 | 1E-09 | | | |
| 2701625 | IB IL LPSDO-8-V3 | 1CH | d | 3 | 2 | 1E-08 | | ≥ 00/100/100 | |
| | | 2CH | e | 4 | 3 | 1E-09 | | | |
| 2916493 | IB IL PSDO 4/4 | 1CH | d | 3 | 2 | 1E-08 | | ≥ 01/200/100 | |
| | | 2CH | e | 4 | 3 | 1E-09 | | | |
| 2985631 | IB IL PSDO 8 | 1CH | d | 3 | 2 | 1E-08 | | ≥ 01/200/100 | |
| | | 2CH | e | 4 | 3 | 1E-09 | | | |
| 2985864 | IB IL PSDOR 4 | 1CH-AC15 | c | 1 | 1 | 1E-08 | | ≥ 00/200/100 | The $PFH_D$ 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. |
| | | 1CH-DC13 | c | 1 | 1 | 1E-08 | | | |
| | | 2CH-AC15 version A [2] | e | 4 | 3 | 1E-09 | | | |
| | | 2CH-AC15 version B [2] | e | 4 | 3 | 1E-09 | | | |
| | | 2CH-DC13 version A [2] | e | 4 | 3 | 1E-09 | | | |
| | | 2CH-DC13 version B [2] | e | 4 | 3 | 1E-09 | | | |
| 2985688 | IB IL PSDI 8 | 1CH | d | 3 [1] | 2 | 1E-08 | | ≥ 00/200/- | - |
| | | 2CH | e | 4 | 3 | 1E-09 | | | |
| 2700994 | IB IL PSDI 16 | 1CH | d | 3 [1] | 2 | 1E-08 | | ≥ 00/200/- | |
| | | 2CH | e | 4 | 3 | 1E-09 | | | |
| 2702446 | IB IL SAFE 2-ECO | 1CH | c | 1 | 1 | 1E-09 | | ≥ 00/-- | |
| | | 2CH | e | 4 | 3 | | | | |
| 2701559 | AXL F PSDI8/4 1F | 1CH | d | 3 [1] | 2 | 1E-08 | | ≥ 00/100/- | |
| | | 2 CH | e | 4 | 3 | 1E-09 | | | |
| 2701560 | AXL F PSDO8/3 1F | 1CH | d | 3 | 2 | 1E-08 | | ≥ 00/100/- | |
| | | 2CH | e | 4 | 3 | 1E-09 | | | |
| 2702263 | AXL F SSDI8/4 1F | 1CH | d | 3 [1] | 2 | 1E-08 | | ≥ 01/200/- | |
| | | 2CH | e | 4 | 3 | 1E-09 | | | |
| 2702264 | AXL F SSDO8/3 1F | 1CH | d | 3 | 2 | 1E-08 | | ≥ 01/200/- | |
| | | 2CH | e | 4 | 3 | 1E-09 | | | |
| 2702171 | AXL F LPSDO8/3 1F | 1CH | d | 3 | 2 | 1E-08 | | ≥ 00/100/- | |
| | | 2 CH | e | 4 | 3 | 1E-09 | | | |



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# 8 Safe control technology

| Order No. | Short designation | EN ISO 13849-1 PL | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (years) | Data valid for HW/FW/FW version | | | | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | HW | FW | FW COP | SIS FW HW/FW | |
| 2916794 | RFC 470S PN 3TX | e | 4 | 3 | 1E-09 | 20 | > 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 ≥ 30 years.
If the total MTBF is < 30 years, please contact Phoenix Contact.

| Order No. | Short designation | EN ISO 13849-1 PL | EN ISO 13849-1 Category | EN 62061 SILCL | $PFH_D$ (1/h) | $t_M$ (years) | Note |
|---|---|---|---|---|---|---|---|
| 2400057 | SAFE AI | e | 4 | 3 | 2E-09 [1] 5E-09 [2] | 20 | When only using safety-related input signals in the station |
| | | d | 3 | 2 | | | When using safety-related and non-safety-related input signals in the station |

[1] When used with the AXL F AI8 1F module (Order No. 2688064)

[2] When used with the AXL F AI8 W 1F module (Order No. 2702525)



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# 9 CONTACTRON hybrid motor starters

| Order No. | Short designation | EN ISO 13849-1 PL | EN ISO 13849-1 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<br>2900414<br>2900421 | ELR-H5-IES-SC-24DC/500AC... | | | 2.67E-09 | | |
| 2903902<br>2903904<br>2903906 | ELR-H5-IES-PT-24DC/500AC... | | | | | |
| 2900692<br>2900420<br>2900422 | ELR-H5-IES-SC-230AC/500AC... | | | 6.82E-09 | | |
| 2900559<br>2900561 | ELR-H5-ES-SC-24DC/500AC... | | | 2.67E-09 | | |
| 2900566<br>2900567<br>2900569 | ELR-H3-IES-SC-24DC/500AC... | | | 2.40E-09 | | |
| 2903914<br>2903916<br>2903918 | ELR-H3-IES-PT-24DC/500AC... | | | | | |
| 2900689<br>2900568<br>2900570 | ELR-H3-IES-SC-230AC/500AC... | | | 6.27E-09 | | |



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| Order No. | Short designation | EN ISO 13849-1 PL | EN ISO 13849-1 Category | $PFH_D$ (1/h) | $t_M$ (years) | Note |
|---|---|---|---|---|---|---|
| 2905151<br>2905138<br>2905152<br>2905139<br>2905153<br>2905140 | ELR H5-IES…-IFS | e | 3 | 0.1E-09 | 20 | - |
| 2905154<br>2905141<br>2905155<br>2905142<br>2905156<br>2905143 | ELR H3-IES…-IFS | | | | | |
| 2903933<br>2903934<br>2903935 | ELR H5-IES…SWD… | | | 0.1E-09 | | |
| 2903936<br>2903937<br>2903938 | ELR H3-IES…SWD… | | | | | |
| 2908669<br>2908670 | ELR H5-IES...-IOL | | | | | |
| 2908671<br>2908672 | ELR H3-IES...-IOL | | | | | |



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# 10 Safety relay modules for the process industry

## 10.1 Safe coupling relays – PSRmini

Alternative illustration as 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) [1] | $PFD_{avg}$ [2] (1/h) | $PFH_D$ (1/h) | $T_{1max}$ (years) | $t_M$ (years) | Data valid 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 | 20 | ≥ 00/-- |
| | | Low | | | | 99.66 | 0 | 1579 | 0 | 5.392 | 1584 | 63 | 2.36E-05 | - | 6 | | |
| 2702524 | PSR-PS22 | High [4] | | | | 99.996 | 0 | 2857.88 | 5.45 | 0.11 | 2863.44 | 29.18 | - | 1.10E-10 | 20 | | ≥ 00/-- |
| | | Low [4][5] | | | | 99.839 | 0 | 2639.18 | 0 | 4.26 | 2643.44 | 30.94 | 1.87E-05 | - | 6 | | |
| | | High [6] | | | | 99.961 | 0 | 2855.45 | 6.86 | 1.12 | 2863.44 | 29.18 | - | 1.12E-09 | 20 | | |
| | | Low [6] | | | | 99.907 | 0 | 2634.25 | 6.74 | 2.45 | 2643.44 | 30.94 | 7.08E-05 | - | 3.8 | | |
| 2700357 | PSR-PS21 | High [3] | | | 2 | 99.18 | 494.66 | 79.10 | 494.66 | 8.80 | 1077.22 | 91.65 | - | 8.80E-09 | 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 | | ≥ 00/-- |
| | | 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 | | ≥ 00/-- |
| | | Low | | | | 99.68 | 0 | 1660 | 0 | 5.392 | 1666 | 60 | 2.36E-05 | - | 6 | | ≥ 00/-- |
| 2700581 2700582 | PSR-PC32 | High [3] | | | | 99.99 | 0 | 3135.22 | 62.35 | 1 | 3198.57 | 22.44 | - | 1.00E-09 | 20 | | ≥ 00/-- |
| | | Low | | | | 99.85 | 0 | 3577.81 | 0 | 5.5 | 3583.32 | 22.51 | 2.41E-05 | - | 6 | | ≥ 00/-- |
| 2700588 2700589 | PSR-PC40 | High | | | | 99.99 | 989.32 | 397.43 | 51.90 | 0.10 | 1438.75 | 64.98 | - | 1.04E-10 | 20 | | ≥ 00/-- |
| | | Low | | | | 99.71 | 0 | 1798 | 0 | 5.236 | 1803 | 54 | 2.29E-05 | - | 6 | | ≥ 00/-- |
| 2904664 2904665 | PSR-PC50 | Low | | | | 99.60 | 4.27 | 849 | 4.21 | 3.40 | 860.88 | 110.5 | 1.49E-05 | - | 10 | | ≥ 00/-- |
| | | | | | | | | | | | | | | | | | ≥ 00/-- |
| 2702522 2702523 | PSR-PC51 | Low | | | | 99.68 | 0 | 1831.13 | 3.66 | 5.72 | 1840.51 | 66.98 | 2.5E-05 | - | 6 | | ≥ 00/-- |
| | | | | | | | | | | | | | | | | | ≥ 00/-- |

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

[2] For $T_1$ = 1 year

[3] Only in conjunction with a suitable evaluating device.

[4] Diagnostics / Proof test: Readback via N/C contact 22

[5] Diagnostics / Proof test: Error message about the diagnostic LEDs

[6] Diagnostics / Proof test: Error acknowledgment via A1 to DO



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## 10.2 Safe coupling relays – PSRclassic

Alternative illustration as 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) [1] | $PFD_{avg}$ [2] (1/h) | $PFH_D$ (1/h) | $T_{1max}$ (years) | $t_M$ (years) | Data valid for HW/FW version |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2981978<br>2981981 | PSR-FSP | High [5] | A | 0 | 3 | 99.99 | 198 | 62.7 | 3.66 | 0.02 | 264.38 | 319 | - | 2.02E-11 | 20 | 20 | ≥ 00/-- |
| | | Low [3] | | | | 99.77 | 0 | 909.7 | 0 | 2.09 | 911.79 | 113 | 9.15E-06 | - | 12 | | ≥ 00/-- |
| 2981020<br>2981017 | PSR-ESP4 | High | | | 1 [4] | 99.99 | 949 | 58.3 | 44.5 | 0.093 | 1052 | 106.9 | - | 9.93E-11 | 20 | | ≥ 00/-- |
| | | Low [3] | | | | 99.56 | 0 | 849 | 0 | 3.68 | 853 | 132.3 | 1.61E-05 | - | 9 | | ≥ 00/-- |
| 2986960<br>2986957 | PSR-FSP/2x1 | High [5] | | | 3 | 99.99 | 198 | 63.9 | 3.66 | 0.02 | 264.38 | 342 | - | 2.02E-11 | 20 | | ≥ 00/-- |
| | | Low [3] | | | | 99.76 | 0 | 1026.9 | 0 | 2.42 | 1029.32 | 104 | 1.06E-05 | - | 5 | | ≥ 00/-- |
| 2986575<br>2986588 | PSR-FSP2/2x1 | High [5] | | | 2 | 99.61 | 99 | 55.7 | 99 | 1 | 254.7 | 361 | - | 1E-09 | 20 | | ≥ 00/-- |
| | | Low [3] | | | | 81.97 | 0 | 455 | 0 | 100 | 555 | 185 | 4.38E-04 | - | 2.25 | | ≥ 00/-- |
| 2901416<br>2901417<br>2901426<br>2901427<br>2901422<br>2901425<br>2901428<br>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/-- |

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

[2] For $T_1$ = 1 year

[3] 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.

[4] Up to SIL 3 possible depending on the application.

[5] Only in conjunction with a suitable evaluating device.



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# 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.

Alternative illustration as 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) | $PFD_{avg}$ [1] (1/h) | $PFH_D$ (1/h) | 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 | | | | | | | | | | | | | | |
| 2811446 | | Low/High | A | [3] | 2 | 83.00 | 0 | 318.2 | 0 | 62.1 | 259 | 2.83E-04 | 6.46E-08 | 0.00 |
| 2811556 | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | |
| 2811297 | | Low/High | A | [3] | 2 | 82.80 | 0 | 353.7 | 0 | 69.7 | 228 | 3.19E-04 | 7.27E-08 | 0.00 |
| 2811569 | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | |

[1] For $T_1$ = 1 year

[2] Input isolator I ≙ I (4 … 20 mA)

[3] Output isolator I ≙ I (4 … 20 mA)

[4] Repeater power supply



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## 11.2 Temperature

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

Alternative illustration as 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) | $PFD_{avg}$ [1] (1/h) | $PFH_D$ (1/h) | 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 | | | | | | | | | | | | | | |
| 2811873 | | Low/High | | [3] | 2 | 93.00 | 0 | 0 | 789 | 56 | 97 | 3.75E-04 | 5.60E-08 | 93.00 |
| 2811970 | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | |

[1] For $T_1$ = 1 year

[2] Pt 100 3-conductor, output 4 ... 20 mA

[3] Voltage input mV, output 4 ... 20 mA

[4] Pt 100 3-conductor, output relay



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### 11.3 Digital IN

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

Alternative illustration as 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) | $PFD_{avg}$ [1] (1/h) | $PFH_D$ (1/h) | 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 | 3.09E-04 | - | 8.0 |
| 2865049 | MACX MCR-SL-2NAM-RO(-SP) | Low | A | [2] | 2 | 78.3 | 6 | 249 | 7 | 64 | 204 | 3.09E-04 | - | 9.0 |
| 2924294 | | | | [3] | 2 | 78.3 | 1 | 248 | 6 | 62 | 204 | 3.01E-04 | - | 8.0 |
| 2865052 | MACX MCR-SL-2NAM-R-UP(-SP) | Low | A | [2] | 2 | 86.6 | 6 | 403 | 0 | 63 | 226 | 3.01E-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 $T_1$ = 1 year

[2] Non-inverted output (N)

[3] Inverted output (I)



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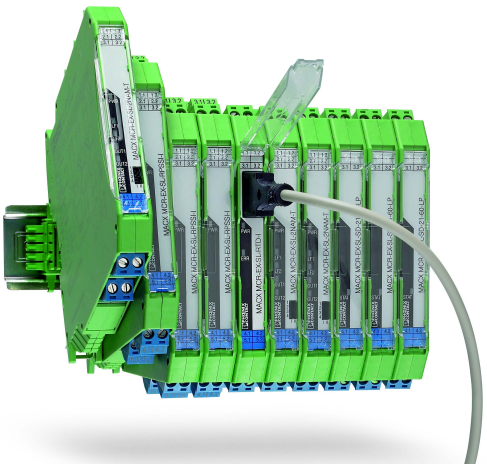
# 12 Ex i signal conditioners



## 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.

Alternative illustration as 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) | $PFD_{avg}$ [1] (1/h) | $PFH_D$ (1/h) | DC (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2865340<br>2924016 | 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 |
| 2865793<br>2924029 | 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 |
| 2865366<br>2924236 | 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 |
| 2865405<br>2924032 | 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 |
| 2865382<br>2924676 | 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 |

[1] For $T_1$ = 1 year

[2] Repeater power supply

[3] Output isolator I ≙ I (4 … 20 mA)



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## 12.2 Temperature

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

Alternative illustration as 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) | $PFD_{avg}$ [1] (1/h) | $PFH_D$ (1/h) | 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) | 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 | >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 $T_1$ = 1 year

[2] Pt 100 3-conductor, output 4 ... 20 mA

[3] Voltage input mV, output 4 ... 20 mA

[4] Pt 100 3-conductor, output relay



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### 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.

Alternative illustration as 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) | $PFD_{avg}$ [1] (1/h) | $PFH_D$ (1/h) | 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 | 3.09E-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/High | A | - | 3 | 100.0 | 0 | 50 | 0 | 0 | 237 | 0.00E+00 | - | 0.0 |
| 2924113 | | | | | | | | | | | | | | |
| 2865764 | MACX MCR-EX-SL-SD-21-40-LP(-SP) | Low/High | A | - | 3 | 100.0 | 0 | 50 | 0 | 0 | 237 | 0.00E+00 | - | 0.0 |
| 2924139 | | | | | | | | | | | | | | |
| 2865609 | MACX MCR-EX-SL-SD-24-48-LP(-SP) | Low/High | A | - | 3 | 100.0 | 0 | 50 | 0 | 0 | 237 | 0.00E+00 | - | 0.0 |
| 2924126 | | | | | | | | | | | | | | |
| 2865515 | MACX MCR-EX-SL-SD-21-60-LP(-SP) | Low/High | A | - | 3 | 100.0 | 0 | 50 | 0 | 0 | 237 | 0.00E+00 | - | 0.0 |
| 2924100 | | | | | | | | | | | | | | |
| 2924867 | MACX MCR-EX-SL-SD-23-48-LFD (-SP) | Low/High | 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/High | 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/High | A | - | 3 | 94.8 | 0 | 406 | 45.1 | 24.6 | 167 | 1.08E-04 | 2.46E-8 | 64.7 |
| 2906156 | | | | | | | | | | | | | | |

[1] For $T_1$ = 1 year

[2] Non-inverted output (N)

[3] Inverted output (I)



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## 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. |
| **$PFH_D$** | 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 fault 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 |
| **$\lambda_{SD}$** | Failure rate – safe detected | Failure rate of safe detected failures |
| **$\lambda_{SU}$** | Failure rate – safe undetected | Failure rate of safe undetected failures |
| **$\lambda_{DD}$** | Failure rate – dangerous detected | Failure rate of dangerous detected failures |
| **$\lambda_{DU}$** | Failure rate – dangerous undetected | Failure rate of dangerous undetected failures |
| **$\lambda_{Total}$** | Total failure rate | Failure rate of all failures |
| **DC** | Diagnostic coverage | Diagnostic coverage |
| **MTBF** | Mean time between failure | 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 |



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## 14 Revision history

| Revision | Date | Contents |
|---|---|---|
| **00** | 12/2011 | First publication |
| **01** | 01/2012 | Layout adjustments<br>PSR-SIM4 modular safety relay added<br>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<br>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<br>“Forcibly guided coupling relays” moved to page 6 in Section 3, “Safety switching devices” (previously Section 6)<br>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<br>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<br>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<br>PSR-ETP/1x1 inserted.<br>Added “Signal conditioners” on page 13<br>“Ex i signal conditioners” on page 16 added<br>“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<br>Column for HW/FW version inserted in tables, if relevant<br>“Safety relays – PSRmini” on page 2 inserted<br>Second data record for order number 2981114/2981127 “PSR-ESAM4/3x1” on page 4 inserted<br>“Multifunctional safety relays – PSRmultifunction” on page 7 inserted (previously included in Section 3.1 “Safety relays”)<br>Data in “Configurable safety modules – PSRtrisafe” on page 11 revised<br>Order number 2701559/270160 in “Network safety solutions” on page 14 inserted<br>Order numbers 2903902, 2903904, 2903906, 2903914, 2903916, and 2903918 in “CONTACTRON hybrid motor starters” on page 16 inserted<br>Data for “CONTACTRON hybrid motor starters” on page 16 updated<br>“Safe coupling relays – PSRmini” on page 18 inserted<br>In “Safe coupling relays – PSRclassic” on page 19 for PSR-FSP, PSR-ESP4, PSR-FSP2/2X1, PSR-ESAM4-B AC HFT changed from 1 to 0<br>Data for signal conditioners “Analog IN / Analog OUT” on page 20 updated<br>Data for Ex i signal conditioners “Analog IN / Analog OUT” on page 23 updated |
| **04_c00** | 04/2015 | Notes for TRISAFE-S, -M, and -SDI8-SDIO4 on Page 11 modified |



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



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| Revision | Date | Contents |
|---|---|---|
| **06** | 03/2017 | **Page 1:**<br>Information about important product information added<br><br>**Section 3.1 "Safety relays – PSRmini" :**<br>New products added:<br>PSR-MC32, PSR-MC37<br>$PFH_D$ figures for PSR-MC60 and PSR-MC62 added<br>Order numbers 2902935 and 2902936 replaced by order numbers 2702924 and 2702925<br><br>**Section 5 "Safe coupling relays – PSRclassic"** :<br>Section fully revised due to new SIL qualification of the products<br><br>**Section 6 "Configurable safety modules – PSRtrisafe"** :<br>Section fully revised, new data added, for PSR-TS-SDI8-SDIO4: $PFH_D$ figures changed, SILCL on 1CH assignment changed<br><br>**Section 7 "Network safety solutions"** :<br>New product added: IB IL SAFE 2-ECO<br>Footnote 2 added<br><br>**Section 8 "Safe control technology" :**<br>Order number 2985563 removed<br><br>**Section 9 "CONTACTRON hybrid motor starters"** :<br>Order numbers removed:<br>2900558, 2900688, 2900560, 2900562, 2900550, 2900552, 2900554, 2900686, 2900553, 2900555<br>$PFH_D$ figure for ELR H3-IES…SWD… changed<br>New products added:<br>ELR H5-IES...-IOL and ELR H5-IES...-IOL<br><br>**Section 10.1 "Safe coupling relays – PSRmini"** :<br>New products added:<br>PSR-PS22, PSR-PC32, PSR-PC51<br><br>**Section 10.2 "Safe coupling relays – PSRclassic"** :<br>Footnote for low demand figures for PSR-FSP/2x1 added<br>Order numbers removed:<br>2986711, 2986562<br><br>**Section 12 "Ex i signal conditioners"** :<br>Order numbers removed:<br>2865502, 2924197<br>High demand changed for order numbers 2865492 to 2906156<br>$\lambda_{SU}$ and MTBF values changed for order numbers 2865492 to 2924100 |
| **07** | 03/2018 | **Section 5 "Safe coupling relays – PSRclassic"** :<br>Safety characteristic data changed ($PFH_D$ and $PFD_{avg}$ values) |



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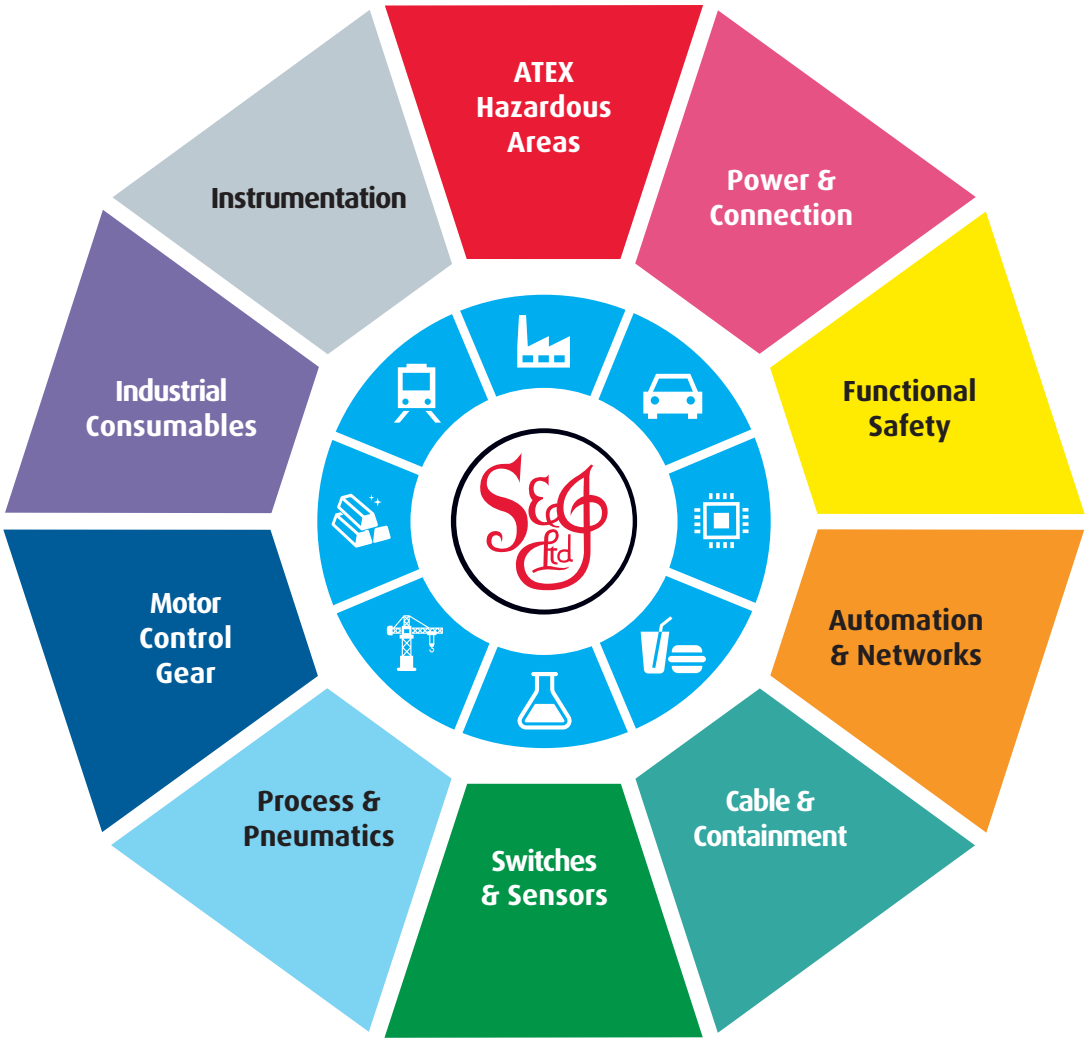


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