



# Communication Data.

M&C Group of Companies. An overview.

## ▼ M&C TechGroup Germany GmbH

|                      |   |
|----------------------|---|
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|                               |                   |                   |                             |
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## ▼ M&C International Sales – Regional Management

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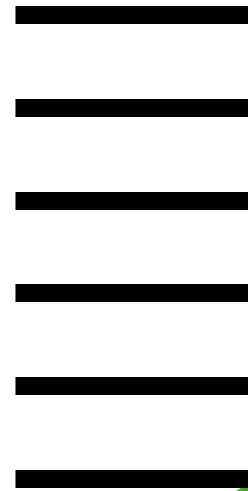
## ▼ Strategic Market Relations

|          |               |                   |                                |
|----------|---------------|-------------------|--------------------------------|
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|----------|---------------|-------------------|--------------------------------|

## ▼ Additionally

|              |                         |
|--------------|-------------------------|
| Distributors | Various other countries |
|--------------|-------------------------|

Detailed information at [www.mc-techgroup.com](http://www.mc-techgroup.com)



# SIL – Safety Integrity Level

Certified Conformity. Now also for complete systems.



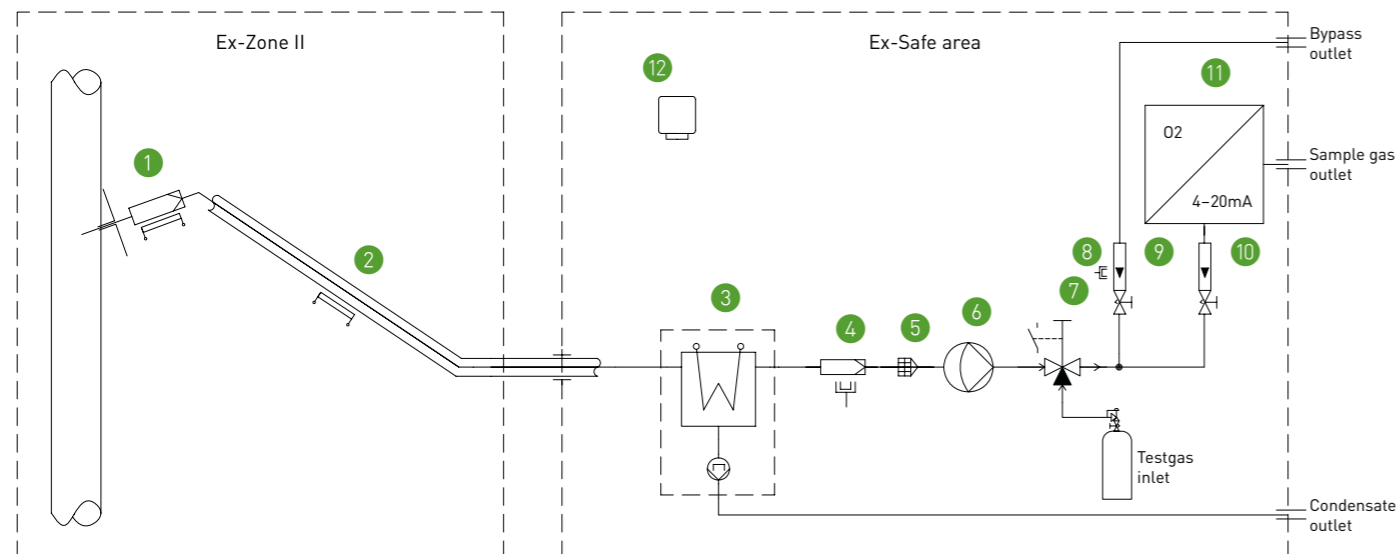
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# Safety Integrity Level.

Functional Safety. Now also for gas analyzing systems.

## Design of gas analyzing systems in conformity with SIL

- ▶ Functional safety for complex systems according to DIN EN 61508
- ▶ Control of oxygen concentration (UEG/OEG)



- 1 Gas sample probe SP3200/Ex
- 2 Heated line 120 °C
- 3 Gas cooler ECM-Ex2-2 with peristaltic pump SR25.2
- 4 Filter FSS-2T with liquid alarm
- 5 Flame arrester F.4.7000.40IIC
- 6 Sample gas pump MP47

- 7 Ball valve with position identification
- 8 Flow rate prealarm FA
- 9 Flow meter bypass FM10
- 10 Flow meter sample gas FM10
- 11 Oxygen analyzer PMA30-SIL
- 12 LEL sensor in cabinet

## ▼ Dangerous failure: Oxygen signal is too small

| Component                                       | Nr.       | Failure class | su       | sd       | dd       | du       | Number of incidents for rate | supposed incidents | Operating time in years |
|---|-----------|---------------|----------|----------|----------|----------|------------------------------|--------------------|-------------------------|
| Probe   | 1.2       | sd            |          | 8,65E-03 |          |          | 3                            |                    | 347                     |
| Line  | 2.1       | su            | 5,28E-03 |          |          |          |                              | 33                 | 6252                    |
| Cooler  | 3.1 – 3.3 | dd            |          |          | 3,02E-02 |          | 50                           |                    | 1658                    |
| Sample gas pump                                 | 6.4       | dd            |          |          | 2,68E-02 |          | 8                            |                    | 298                     |
| PMA30 hazardous, if O <sub>2</sub> is too small | 9         |               | 3,21E-03 | 3,00E-06 | 3,64E-03 | 6,19E-04 |                              |                    |                         |

|          |          |                |   |
|----------|----------|----------------|---|
| 6,19E-04 | 1,24E-03 | Safety factor: | 3 |
|----------|----------|----------------|---|

|                   |       |             |           |           |           |                  |           |
|-------------------|-------|-------------|-----------|-----------|-----------|------------------|-----------|
| Sum failure rates | [1/a] | 8,484E-03   | 8,649E-03 | 6,065E-02 | 1,86E-03  | SFF              | 97,67 %   |
|                   | [1/h] | 9,685E-07   | 9,873E-07 | 6,923E-06 | 2,121E-07 | T1 (1 year) in h | 8760      |
|                   |       | d = dd + du |           | 7,135E-06 |           | MTTR in h        | 72,00     |
|                   |       |             |           |           |           | PFD              | 1,443E-03 |

|         |           |
|---------|-----------|
| Sum PDF | 1,443E-03 |
|---------|-----------|

## ▼ Dangerous failure: Oxygen signal is too large

| Component                                       | Nr.       | Failure class | su       | sd       | dd       | du       | Number of incidents for rate | supposed incidents | Operating time in years |
|---|-----------|---------------|----------|----------|----------|----------|------------------------------|--------------------|-------------------------|
| Probe   | 1.2       | sd            |          | 8,65E-03 |          |          | 3                            |                    | 347                     |
| Line  | 2.1       | su            | 5,28E-03 |          |          |          |                              | 33                 | 6252                    |
| Cooler  | 3.1 – 3.3 | dd            |          |          | 3,02E-02 |          | 50                           |                    | 1658                    |
| Sample gas pump                                 | 6.4       | dd            |          |          | 2,68E-02 |          | 8                            |                    | 298                     |
| PMA30 hazardous, if O <sub>2</sub> is too small | 9         |               | 3,58E-03 | 3,00E-06 | 3,64E-03 | 2,44E-04 |                              |                    |                         |

|          |          |                 |   |
|----------|----------|-----------------|---|
| 2,44E-04 | 4,87E-03 | Safety factor:: | 3 |
|----------|----------|-----------------|---|

|                   |       |             |             |            |           |                  |           |
|-------------------|-------|-------------|-------------|------------|-----------|------------------|-----------|
| Sum failure rates | [1/a] | 0,008861151 | 0,008648529 | 0,06064661 | 7,31E-04  | SFF              | 99,07 %   |
|                   | [1/h] | 1,012E-06   | 9,873E-07   | 6,923E-06  | 8,340E-08 | T1 (1 year) in h | 8760      |
|                   |       | d = dd + du |             | 7,007E-06  |           | MTTR in h        | 72,00     |
|                   |       |             |             |            |           | PFD              | 8,698E-04 |

|         |           |
|---------|-----------|
| Sum PDF | 8,698E-04 |
|---------|-----------|

# SIL – Safety Integrity Level

Novelties regarding the SIL certification of products and systems.



## ▼ SIL certified products

SIL certified oxygen analyser PMA30.

- ▶ PMA 30
- ▶ NE 21 certified
- ▶ DIN EN 61508 certified as device type B
- ▶ SIL-Level 2
- ▶ Declaration/statement of conformity issued by independent authorized experts available
- ▶ ATEX-certified analyser PMA50Ex also according to SIL2!



## ▼ SIL certified systems

Functional safety for complete analysing systems according to DIN EN 61508.

- ▶ Complete systems for oxygen measurement (UEG/OEG) incl. gas sampling and conditioning
- ▶ Hazard analyse of the user is taken into account
- ▶ System construction according to measuring task
- ▶ Selection of components based on FMEDA-calculation/M&C-data base
- ▶ SFF und PFD-values



# Systems in conformity with SIL according to DIN EN 61508.

## Description/Handling

- ▶ The background is DIN EN 61508, systems are considered as equipment type B.
- ▶ Description of the measuring task and derivation of the Safety Instrumented Function (SIF).
- ▶ Consideration of the requirements out of the user's risk-/hazard analysis (HAZOP).
- ▶ Definition of the intended use.
- ▶ Selection of appropriate components, if possible certified according to SIL.
- ▶ Based on FMEDA calculation and the M&C data bank (failure statistic).
- ▶ If no analysis of failure mode is possible, the allocation of hazardous/non hazardous failures are evaluated.
- ▶ Identification and classification of possible failures on devices/components within the safety chain.
- ▶ Determination of the failure rates  $s_u$ ,  $s_d$ ,  $d_d$ ,  $d_u$ , description of the failure consequences.
- ▶ Specification of appropriate countermeasures, arrangement of supporting diagnosis features.
- ▶ Calculation of the Probability of Failure on Demand (PFD) and Safety Failure Fraction (SFF).
- ▶ Determination of the SIL level by weighting 35 % for measurement technique, 15 % for process control, 50 % for actuating elements and inclusion of a reasonable safety factor.

## ▼ Conclusion

SIL is an important addition to the measurement system performance confidence.