



# Communication Data.

M&C Group of Companies. An overview.

## ▼ M&C TechGroup Germany GmbH

<b>Site Ratingen</b>	Group Head Office
Location	Rehhecke 79, 40885 Ratingen, Germany
Mail	P.O. Box 10 42 24, 40853 Ratingen, Germany
Fon	+49 2102 935-0
E-mail	info@mc-techgroup.com
<b>Site Aach</b>	Group Factory Aach (M&C TechGroup Germany GmbH)
Location	Im Hirtenstall 9, 78267 Aach, Germany

## ▼ M&C Worldwide – Subsidiaries

M&C TechGroup MechParts GmbH	Aach, Germany	+49 2102 935-0	info@mc-techgroup.com
M&C TechGroup Genetics GmbH	Ratingen, Germany	+49 2102 935-0	genetics@mc-techgroup.com
M&C TechGroup NorthAmerica	Ventura, CA	+1 805 654 6970	info-usa@mc-techgroup.com
M&C TechGroup China Co. Ltd.	Shanghai	+86 21 64 41 9350	info-china@mc-techgroup.com
M&C TechGroup India	Pune	+91 954 572 5252	info-india@mc-techgroup.com
M&C TechGroup MiddleEast FZCO	UAE- Dubai	+971 43 235 855	info-uae@mc-techgroup.com
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## ▼ Sales Areas Germany/Austria/Switzerland

Hamburg/Dessau	Oliver Arlt	+49 171 76 45 682	oliver.arlt@mc-techgroup.com
Dusseldorf	Manfred Reinelt	+49 171 76 45 684	manfred.reinelt@mc-techgroup.com
Frankfurt Main	Roland Walterham	+49 171 76 45 686	roland.walterham@mc-techgroup.com
Stuttgart/Switzerland	Jürgen Hommel	+49 171 76 45 687	juergen.hommel@mc-techgroup.com
Munich/Austria	Ulrich Offner	+49 171 76 45 688	ulrich.offner@mc-techgroup.com

## ▼ M&C International Sales – Offices

France	Frédéric Perret & Team	+33 472 670 840	frederic.perret@mc-techgroup.com
Belgium (fr)/Luxembourg	Frédéric Perret & Team	+33 472 670 840	frederic.perret@mc-techgroup.com
Netherlands/Belgium (fl)	Jörg Behrens	+49 151 1674 7533	joerg.behrens@mc-techgroup.com
Great Britain/Ireland	Michael Davies	+44 780 926 6658	michael.davies@mc-techgroup.com
Italy	Enrico Perrone	+39 342 579 1368	enrico.perrone@mc-techgroup.com
Spain	César Salvador	+34 607 246 549	cesar.salvador@mc-techgroup.com

## ▼ M&C International Sales – Regional Management

South Europe/Africa	Frédéric Perret	+33 622 858 683	frederic.perret@mc-techgroup.com
Scandinavia	Jörg Behrens	+49 151 1674 7533	joerg.behrens@mc-techgroup.com
Asia/Pacific area	Thibault Taffonneau	+49 171 86 68 165	thibault.taffonneau@mc-techgroup.com

## ▼ Strategic Market Relations

Globally	Marcel Hengst	+49 170 63 49 107	marcel.hengst@mc-techgroup.com
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## ▼ Additionally

Distributors	Various other countries
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# SIL – Safety Integrity Level

Certified Conformity. Now also for complete systems.

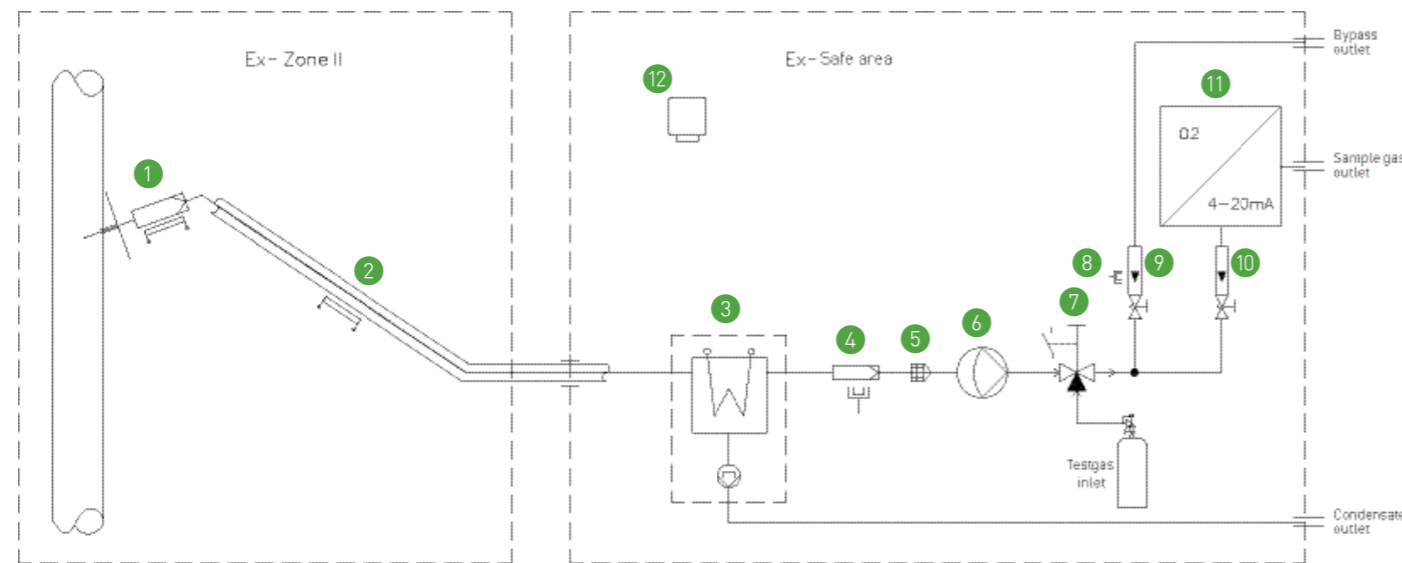


# Safety Integrity Level.

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                        | 7 Ball valve with position identification |
| 2 Heated line 120 °C                                | 8 Flow rate prealarm FA                   |
| 3 Gas cooler ECM-Ex2-2 with peristaltic pump SR25.2 | 9 Flow meter bypass FM10                  |
| 4 Filter FSS-2T with liquid alarm                   | 10 Flow meter sample gas FM10             |
| 5 Flame arrester F.4.7000.40IIC                     | 11 Oxygen analyzer PMA30-SIL              |
| 6 Sample gas pump MP47                              | 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
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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
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## ▼ 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
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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
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# 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.