Certificate

Functional Safety

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No.: 968/FSP 2091.00/21

Product tested	Fixed gas detector	**Certificate holder**	Prosense Teknoloji Sanayi Ticaret Ltd. Cumhuriyet Mah. Mermer Sok. No 16 34876 Kartal / Istanbul Turkey
Type designation	PQN-S / PQD-S		
Codes and standards	IEC 61508 Parts 1-7:2010 EN 50402:2017 EN 50271:2018		EN 50270:2015 + AC:2016 EN 60079-29-1:2016
Intended application	The gas detector PQN-S / PQD-S series complies with the requirements of the SIL 1 according to EN 50271 and SIL 2 / SC 3 according to IEC 61508 / EN 50402. The gas detector can be used in combination with an external safety device for monitoring of hazardous flammable gas concentrations in a HFT=0 architecture up to SIL 2 and in a HFT=1 architecture up to SIL 3. The gas detector PQD-S / PQN-S series also fulfills the metrological requirements of EN 60079-29-1		
Specific requirements	The instructions of the associated User Manual and Safety Manual shall be considered. Details for the use in safety functions can be found on the seconde page of this certificate.		

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Valid until 2026-05-12

The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/FSP 2091.00/21 dated 2021-04-19.
This certificate is valid only for products which are identical with the product tested.

TÜV Rheinland Industrie Service GmbH
Bereich Automation
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Am Grauen Stein, 51105 Köln

Köln, 2021-05-12	Certification Body Safety & Security for Automation & Grid	Dipl.-Ing. (FH) Wolf Rückwart

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Precisely Right.

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Safety function:

The safety function of the fixed gas detector PQN-S and PQD-S series consists of the output of the measured gas concentration values as binary or analogue output signals (measurement levels, alarm signals, fault signals).

The safety function and safe state of the fixed gas detector PQN-S and PQD-S series are defined as the following:

1. Variant A: Safe state: Output analogue signal (4 mA ≤ Iout ≤ 20 mA)

The output analogue signal whereas 4 mA ≤ Iout ≤ 20 mA for gas concentrations within the scope of measuring range. The detection and alarming of a dangerous level of the flammable gases can be done by supervising of the 4-20 mA.

Safe State: After detection of internal faults the safe state is entered, that means that the 4 - 20 mA - interface is set to a value smaller than 2 mA. The evaluation of this must be done by an external safety device and considered as a fault condition.

2. Variant B: Safe state: Relay contact (Alarm-Relays)

The alarm relay contacts signals gas concentrations by switching the alarm relays when the threshold is greater than the set threshold. The detection and alerting alarming of a dangerous level of the flammable gases can be done by supervising of the alarm relay output contact.

Safe state: After detection of internal faults the safe state is entered, that means that the fault relay will be sets. The evaluation of this must be done by an external safety device and considered as a fault condition.

3. Variant C: Safe state: Relay contact (Alarm-Relays) with :

The relay output contacts (Alarm-relays) can be used together with analogue output (4 mA ≤ Iout ≤ 20 mA).

The evaluation of the alarm relay and the output analogue signal must be handled by an external safety device as alarm, in addition fault relay need to evaluation by an external safety device.

The HART Communication and the RS485 MODBUS communication options must not be used for safety purposes.

Safety related parameters Variants	**A**	**B**	**C**
Sensor board Pellistor	PRS-K033 Rev. 1.0		
Safety architecture	1oo1 / 1oo2		
Mode of operation	Low Demand mode		
Safety Integrity Level (SIL)	SIL 2 with HFT = 0 SIL 3 with HFT = 1		
Systematic Capability (SC)	SC 3 (with HFT 1)		
Device type	Type B		
Proof test interval in years	1 a		
Safety related parameters Variants	**A**	**B**	**C**
Undetected dangerous failure rate λ_{DU}	68 fit	166 fit	167 fit
Detected dangerous failure rate λ_{DD}	1401 fit	1488 fit	1594 fit
Dangerous failure rate λ_D (λ_{DD} + λ_{DU})	1469 fit	1654 fit	1761 fit
Safe failure rate λ_S	1469 fit	2274 fit	2381 fit

Safe Failure Fraction (SFF)	> 90%	> 90%	> 90%
1oo1 architecture configuration			
Hardware Fault Tolerance (HFT)	0		
Mean time to recovery (MTTR)	0h		
Mean Repair Time (MRT)	0h		
Average Probability of dangerous Failure on Demand PFDavg (T)	3,85 E-04	9,71 E-04	9,74 E-04
PFD (%) of SIL 2	3,9%	9,7%	9,7%
1oo2 architecture configuration	**A + A**	**B + B**	**C + C**
Hardware Fault Tolerance (HFT)	1		
Mean time to recovery (MTTR)	24h		
Mean Repair Time (MRT)	24h		
Common Cause Factor β	5%		
Common Cause Factor βD	5%		
Average Probability of dangerous Failure on Demand PFDavg (T)	1,94 E-05	4,96 E-05	4,98 E-05
PFD (%) of SIL 3	1,9%	5,0%	5,0%

Remark: Failure rates of the electronic components as per Siemens SN 29500, calculated based upon an ambient temperature of 60 °C.

Variant A: Using only the 4…20 mA output for Alarming

Variant B: Using only the Alarm- relays for Alarming

Variant C: Using the Alarm-relays together with 4…20 mA output for Alarming