Certificate

No.: 968/FSP 1064.02/15

Product tested	Quartz™ Valve Position Indicator/Sensor	**Certificate holder**	StoneL 26271 US Highway 59 Fergus Falls, MN 56537 USA
Type designation	QX- and QN- Models (Details see pages 2 and 3)		
Codes and standards	IEC 61508 Parts 1-7:2010 (in extracts)	IEC 61511-1:2003 + Corr. 1:2004 (in extracts)	
Intended application	The Quartz™ Valve Position Indicator/Sensor can be used in a safety instrumented system (SIS) as sensor(s) to indicate the position of a valve assembly. The switches on page 2 can be used in applications up to SIL 3 acc. to IEC 61508 and IEC 61511-1. The configuration and number of switches (HFT = 0 or 1) depend on the target safety level (SIL) and the evaluation of the signals in the safety controller. The sensors on page 3 are not available in a redundant configuration. Due to this fact the hardware fault tolerance is 0 (HFT=0) and considering the achieved SFF of < 90%, the devices fulfil the requirements for the hardware integrity of SIL 2 of IEC 61511-1, table 6 and IEC 61508-2, table 2.		
Specific requirements	The instructions of the associated Installation, Maintenance and Operating Instructions and Safety Manual shall be considered.		

Valid until 2020-06-04

The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/FSP 1064.02/15 dated 2015-06-04.
This certificate is valid only for products which are identical with the product tested. It becomes invalid at any change of the codes and standards forming the basis of testing for the intended application.

Köln, 2015-06-04

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Safety function: Sensing of the position of valves or actuators.
Opening and closing position of the switches may be configured such that an open contact results to an action into the safe direction of the SIF.

Model Series	Type	λ / 1/h	λs / 1/h	λd / 1/h	SFF
QX_J, QN_J	A	9.93E-09	8.27E-09	1.66E-09	83,3%
QX_K, QN_K	A	1.97E-08	1.23E-08	7.38E-09	62,4%
QX_L, QN_L	A	1.97E-08	1.23E-08	7.38E-09	62,4%
QX_P, QN_P	A	9.93E-09	8.27E-09	1.66E-09	83,3%
QX_G, QN_G	A	9.93E-09	8.27E-09	1.66E-09	83,3%
QX_H, QN_H	A	9.93E-09	8.27E-09	1.66E-09	83,3%
QX_M, QN_M	A	9.93E-09	8.27E-09	1.66E-09	83,3%
QX_S, QN_S	A	1.97E-08	1.23E-08	7.38E-09	62,4%
QX_X, QN_X	A	1.60E-07	9.34E-08	6.62E-08	58,4%
QX_A, QN_A	A	2.97E-08	1.91E-08	1.07E-08	64,4%
QX_N, QN_N	A	2.90E-08	2.21E-08	6.91E-09	76,2%
QX33, QN33	A	2.73E-07	1.64E-07	1.10E-07	60,1%
QX44, QN44	A	2.02E-07	1.35E-07	6.78E-08	66,8%

λ Total Failure Rate (λ = λs + λd)
λs Safe Failure Rate
λd Dangerous Failure Rate
Safe Failure Fraction SFF = λs / λ

Safety function: Sensing of the position of valves or actuators and translating it into a 4-20mA value.

Diagnostic measures: In case the current is <3mA or >21mA the sensor has an internal failure and the process has to be controlled in a way to lower the risk.

Model Series	λ / 1/h	λ_S / 1/h	λ_d / 1/h	λ_{dd} / 1/h	λ_{du} / 1/h	SFF
QN5O, QX5O	1,36E-07	2,84E-08	1,07E-07	7,03E-08	3,69E-08	72,8%
QN7O, QX7O	1,31E-07	2,84E-08	1,03E-07	6,65E-08	3,64E-08	72,3%

λ total failure rate
λd Current deviates more than 20% from the “real” value (valve Position)
λs Current deviates less than 20% from the “real” value (valve Position)
λdd Current is <3mA or >21mA
λdu Current deviates more than 20% from the “real” value (valve Position), but is still within 3 to 21mA

Safe Failure Fraction SFF = $(\lambda - \lambda_{du)} / \lambda$

Note: The models listed in the table above are not available in a redundant configuration. Due to the SFF is smaller than 90% and the limitation of HFT=0, they can only be used up to SIL 2.

Safety function: Sensing of the position of valves or actuators and translating it into a 0-10kOhm value.

Diagnostic measures: In case the resistance is >11kOhm the sensor has an internal failure and the process has to be controlled in a way to lower the risk.

Model Series	λ / 1/h	λ_S / 1/h	λ_d / 1/h	λ_{dd} / 1/h	λ_{du} / 1/h	SFF
QNBO, QXBO	3,80E-08	3,50E-09	3,45E-08	3,04E-08	4,10E-09	89,2%
QNCO, QXCO	3,37E-08	3,07E-09	3,06E-08	2,70E-08	3,67E-09	89,1%

λ total failure rate
λd Resistance deviates more than 20% from the “real” value (valve Position)
λs Resistance deviates less than 20% from the “real” value (valve Position)
λdd Resistance is >11kOhm
λdu Resistance deviates more than 20% from the “real” value (valve Position), but is still below 11kOhm

Safe Failure Fraction SFF = $(\lambda - \lambda_{du)} / \lambda$

Note: The models listed in the table above are not available in a redundant configuration. Due to the SFF is smaller than 90% and the limitation of HFT=0, they can only be used up to SIL 2.