Certificate

No.: 968/FSP 1064.04/20

Product tested	Quartz™ Valve Position Indicator/Sensor	**Certificate holder**	Neles USA Inc. dba StoneL 26271 US Highway 59 Fergus Falls, MN 56537 USA
Type designation	QX- and QN- Models (Details see Appenix of Certificate)		
Codes and standards	IEC 61508 Parts 1-7:2010 (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. Some variants listed on the next pages 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. Other variants listed on the next pages 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 2025-07-03

The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/FSP 1064.04/20 dated 2020-07-03.
This certificate is valid only for products which are identical with the product tested.

Köln, 2020-07-03

Certification Body Safety & Security for Automation & Grid

Dr.-Ing. Thorsten Gantevoort

TÜV Rheinland Industrie Service GmbH, Am Grauen Stein, 51105 Köln / Germany
Tel.: +49 221 806-1790, Fax: +49 221 806-1539, E-Mail: industrie-service@de.tuv.com

TÜVRheinland®
Precisely Right.

Safety function: **Sensing of the position of valves or actuators. The configuration and number of switches (HFT = 0 or 1) depend on the target safety level (SIL) up to SIL 3 and the evaluation of the signals in the safety controller.**

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	λ_s / 1/h	λ_d / 1/h	SFF
QX2J, QX4J, QX5J, QX7J QN2J, QN4J, QN5J, QN7J	A	9.93E-09	8.27E-09	1.66E-09	83,3%
QX2L, QX4L, QX5L, QX7L QN2L, QN4L, QN5L, QN7L	A	1.97E-08	1.23E-08	7.38E-09	62,4%
QX2P, QX4P, QX5P, QX7P QN2P, QN4P, QN5P, QN7P	A	9.93E-09	8.27E-09	1.66E-09	83,3%
QX2G, QX4G, QX5G, QX7G QN2G, QN4G, QN5G, QN7G	A	9.93E-09	8.27E-09	1.66E-09	83,3%
QX2H, QX4H, QX5H, QX7H, QX8H QN2H, QN4H, QN5H, QN7H, QN8H,	A	9.93E-09	8.27E-09	1.66E-09	83,3%
QX2M, QX4M, QX5M, QX7M, QN2M, QN4M, QN5M, QN7M	A	9.93E-09	8.27E-09	1.66E-09	83,3%
QX2S, QX4S, QX5S, QX7S QN2S, QN4S, QN5S, QN7S	A	1.97E-08	1.23E-08	7.38E-09	62,4%
QX4X,QX6X, QN4X, QN6X	A	1.60E-07	9.34E-08	6.62E-08	58,4%
QX2A, QX4A, QX5A, QX7A, QN2A, QN4A, QN5A, QN7A	A	2.97E-08	1.91E-08	1.07E-08	64,4%
QX2N, QX4N, QX5N, QX6N, QX7N QN2N, QN4N, QN5N, QN6N, QN7N	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 ($\lambda = \lambda_s + \lambda_d$)
λ_s Safe Failure Rate
λ_d Dangerous Failure Rate
Safe Failure Fraction SFF = λ_s / λ

TÜVRheinland®
Precisely Right.

Safety function: **Sensing of the position of valves or actuators and translating it into a 4-20mA value. Certified up to SIL 2, see note below.**

Diagnostic measures: For the calculation of the safety related reliability data it is assumed that the safety controller has to perform the following diagnostic measures:
In case the current <3mA or >21mA the safety controller has to perform a safety related action.

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
λ_d Current deviates more than 20% from the “real” value (valve Position)
λ_s Current deviates less than 20% from the “real” value (valve Position)
λ_{dd} Current is <3mA or >21mA
λ_{du} 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 this fact the hardware fault tolerance is 0 (HFT=0) and considering the achieved SFF, which is smaller than 90%, the devices fulfil the requirements for the hardware integrity up to SIL 2 of IEC 61511-1, table 6 and IEC61508-2, table 2.

Safety function: **Sensing of the position of valves or actuators and translating it into a 0-10kOhm resistance value. Certified up to SIL 2, see note below.**

Diagnostic measures: For the calculation of the safety related reliability data it is assumed that the safety controller has to perform the following diagnostic measures:
In case the resistance is > 11kOhm the safety controller has to perform a safety related action.

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
λ_d Resistance deviates more than 20% from the “real” value (valve Position)
λ_s Resistance deviates less than 20% from the “real” value (valve Position)
λ_{dd} Resistance is >11kOhm
λ_{du} 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 this fact the hardware fault tolerance is 0 (HFT=0) and considering the achieved SFF, which is smaller than 90%, the devices fulfil the requirements for the hardware integrity up to SIL 2 of IEC 61511-1, table 6 and IEC61508-2, table 2.

Safety function: **Sensing of the position of valves or actuators. Certified up to SIL 2.**

Model Series	λ 1/h	λ_S / 1/h	λ_d / 1/h	λ_{dd} / 1/h	λ_{du} / 1/h	SFF
QN35, QX35	2,24E-07	1,40E-07	8,40E-08	0	8,40E-08	62,5%
QN45, QX45	3,55E-07	2,43E-07	1,11E-07	0	1,11E-07	68,6%