Certificate

No.: V 524.01/16

Product tested	Air Volume Booster	**Certificate holder**	POWER-GENEX LTD. 99, Eunbong-ro Namdong-gu Incheon, 21639 South Korea
Type designation	AVB-1xxx, AVB-2xxx, AVB-3xxx		
Codes and standards	IEC 61508 Parts 1-2 and 4-7:2010	IEC 61511 Parts 1-3:2004	
Intended application	Safety Function: If a signal air is not supplied, the AVB moves to a safety position. The safety position is a closed position when the internal inlet valve of the AVB blocks a supply of air by elasticity of spring. The volume boosters are suitable for use in a safety instrumented system up to SIL 3 under consideration of the minimum required hardware fault tolerance HFT = 1 in a redundant architecture.		
Specific requirements	The instructions of the associated Installation, Operating and Safety Manual must be considered.		

Valid until 2021-04-05

The issue of this certificate is based upon an examination, whose results are documented in Report No. V 524.01/16 dated 2016-04-05.
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.

TÜV Rheinland Industrie Service GmbH
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Köln, 2016-04-05

Certification Body Safety & Security for Automation & Grid

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Manufacturer	**POWER-GENEX LTD.** **99, Eunbong-ro, Namdong-gu** **Incheon, 21639** **Republic of Korea**
Product tested	**Volume Booster** **AVB-1xxx, AVB-2xxx, AVB-3xxx**

Device-Specific Values

Probability of Dangerous Failure on Demand	PFD_{spec}	2,89 E-05
Confidence Level	1-α	95 %
Safe Failure Fraction (see note)	SFF	87 %
Hardware Fault Tolerance	HFT	0
Diagnostic Coverage	DC	0 %
Type of Sub System		Type A
Mode of Operation		Low Demand
Proof Test Coverage	PTC	86 %

Note

The Safe Failure Fraction (SFF) was estimated by an alternative method with a FMEA according to EN 161:2011/A3:2013.

Derived Values for 1oo1-Architecture

Assumed Demands per Year	n_{op}	1 / a	1,14 E-04 / h
Assumed Test Interval	T_i	8760 h	1 a
Total Failure Rate	$\lambda_S + \lambda_D$	2,54 E-08 / h	25 FIT
Lambda Dangerous	λ_D	3,30 E-09 / h	3 FIT
Lambda Safe	λ_S	2,21 E-08 / h	22 FIT
Mean Time To Failure	MTTF	3,94 E+07 h	4.501 a
Mean Time To Dangerous Failure	$MTTF_D$	3,03 E+08 h	34.623 a
Average Probability of Failure on Demand	**PFD_{avg}**	**1,44 E-05**	

Useful Lifetime

A time of usage of more than 5 years (+ 1.5 years of storage) can only be favored under responsibility of the operator, consideration of specific external conditions (securing of required quality of media, max. temperature, time of impact), and adequate test cycles.

Quality Management

These statements are bound to a proven and verified deployment of safety-related quality management of the manufacturer.