SIL Declaration of Conformity
Functional safety according to IEC 61508

Manufacturer: PCB Piezotronics
3425 Walden Avenue
Depew, NY 14043 USA

PCB Piezotronics declares as manufacturer, that the industrial, differential charge output pressure sensor:

- 176XYYY/MZZZ

Options include one or more of the following:
X – One alpha character A to Z representing Family Type
YYY – up to three numbers indicating model
M – Metric Mounting Hardware
ZZZ – completes the model, connector Type, cable length, cable type

Is hardware suitable for use in safety-instrumented systems according to IEC 61508, if the safety instructions and the following parameters are observed:

Parameter	176 Series*
SIL	2
Proof Test Interval (Annual)	8,760 h
Device Type	B
HFT	0
SFF	86.31%
PFD_{AV}[1]	1.243×10^{-3}
$\lambda_{du} \times 10^{-6}$	0.3315
SIL Capability (Low Demand Mode)	2
SIL Capability (Continuous Demand Mode)	2
$MTTF$[2]	241.08 y
1. The values comply with SIL2 according to ISA S84.01	
2. According to Siemens SN29500 and Proven In Use data	

* With or without the M (metric) option

The PCB sensor hardware is suitable for inclusion in Safety Instrumented Systems (SIS) that are designed using IEC 61511 (for the process industry sector), IEC 62061 (safety of machinery), EN 50129 (railway applications), and ISO 26262 (automotive industry).

Note: The use of SIL Hardware in specific safety standard application may apply different number of sequences or definitions to those in IEC 61508.

January 28, 2020

PCB Piezotronics Authorized Representative:

Carrie Termin
Regulatory Affairs and Product Certification Specialist

PCB PIEZOTRONICS, INC. — CORPORATE HEADQUARTERS
3425 Walden Avenue, Depew, New York 14043-2495 USA
Phone: 716-684-0001 Fax: 716-684-0987
E-mail: info@pcb.com
Web site: www.pcb.com
AS9100 and ISO9001 Certified
ISO17025 Accredited

INTERTEK ASSURANCE SAFETY INTEGRITY LEVEL SUMMARY REPORT

PCB 176XYY/MZZZ-AA SERIES HIGH TEMPERATURE PRESSURE TRANSDUCERS

CLIENT NAME

PCB Piezotronics, Inc.
3425 Walden Ave
Depew, NY 14043-2417
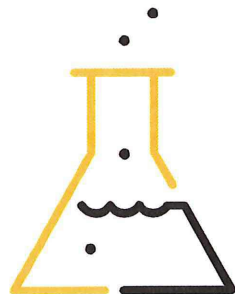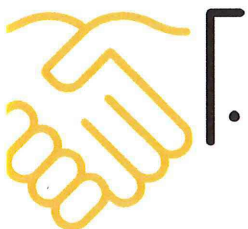
REPORT NO

104040218CSLT-001

COMPILED BY

Ashton D. Hainge, CFSP, PMP

PROJECT NAME

G104040218

DATE

14 August 2019

PCB FUNCTIONAL SAFETY SIL SUMMARY AND RESULTS

Summary

This summary report details results of the reliability analysis performed on the PCB Piezotronics 176XYY/MZZZ-AA Series High Temperature Pressure Transducers. These results are based the following PCB Piezotronics documentation. Design changes from this documentation package would need to be evaluated for the impact on reliability characteristics.

1.   Electrical schematic 57333-C
2.   Electrical schematic 57334-E
3.   Electrical schematic 30737-A
4.   ATEX TECHNICAL FILE Intrinsic Safety
5.   Imi-series176_lowres Drawings

Results

The results from the FMEA are given below for the PCB Piezotronics 176XYY/MZZZ-AA Series High Temperature Pressure Transducers:

Name	Result
Architecture	1oo1
Proof test interval (Annual)	8,760 h
PFD_{avg}	1.243×10^{-3}
SFF	86.31%
HFT	0
SIL Capability (Low Demand Mode)	2
SIL Capability (Continuous Demand Mode)	2
Architecture	1oo1

PCB Pressure Sensor Meets SIL 2 Capability

Name		Result
Safe Detected failure rate	λ_{SD} x 10^{-6}	0.4887
Safe Undetected failure rate	λ_{SU} x 10^{-6}	0.3258
Dangerous Detected failure rate	λ_{DD} x 10^{-6}	1.2763
Dangerous Undetected failure rate	λ_{DU} x 10^{-6}	0.3315
Average frequency of a dangerous failure on demand	PFH x 10^{-6}	0.3315[1]

Type B components: PCB Piezotronics 176XYY/MZZZ-AA Series High Temperature Pressure Transducers

If this sensor is fully defined as type B, then the SIL capability is SIL 1 because SFF falls within this range. However, if this sensor is fully defined as type A, then the SIL capability is SIL 2. According to IEC 61508-2 section 7.4.4.2.3 if the sensor has both type A and type B, then SFF may fall below 90 % with HFT of zero and can be considered to have SIL 2 capability.

The user should consider, that the hardware fault tolerance of all inspected devices is zero and that a single fault can lead to a dangerous failure.

Senior Consultant,

Ashton Hainge, Intertek
CFSP, PMP

---

[1] Note for 1o1 systems $PFH = \lambda_{DU}$