

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 vibration transmitters:

- 640 Series – (XX)640yzzz/aaa (XX) Options include one or more of the following:
 - 641 Series – (XX)641yzzz/aaa
 - 642 Series – (XX)642yzzz/aaa
 - 643 Series – (XX)643yzzz/aaa
 - 645 Series – (XX)645yzzz/aaa
 - 646 Series – (XX)646yzzz/aaa
 - 647 Series – (XX)647yzzz/aaa
 - 648 Series – (XX)648yzzz/aaa
- EX – Approved for Hazardous Locations
HT – High Temperature (257°F, 125°C)
M – Metric Mounting Hardware
RV – Dual Output (4-20 Vibration/Analog Acceleration)
RVVO – Dual Output (4-20 Vibration/Analog Velocity)
TO – Dual Output (Vibration/Temperature)
- Note: “yzzz” completes the model, “aaa” indicates cable length (if applicable)

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

Parameter	64x Series – Connector or integral Cable*	64x Series - Terminal Block or Flying Leads*
SIL	2	2
Proof Test Interval (Annual)	8,760 h	8,760 h
Device Type	B	B
HFT	0	0
SFF	86.27%	86.12%
PFD _{AV} ¹	1.255 x 10 ⁻³	1.299 x 10 ⁻³
λ _{du} x 10 ⁻⁶	0.3348	0.3469
SIL Capability (Low Demand Mode)	2	2
SIL Capability (Continuous Demand Mode)	2	2
MTTF ²	24.4 y	24.4 y
1. The value comply with SIL 2 according to ISA S84.01 2. According to Siemens SN29500 and Proven in Use data		

* With or without EX, HT, M, RV, RVVO, or TO Option(s)

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.

July 3, 2019

PCB Piezotronics Authorized Representative:

Carrie Termin
Regulatory Affairs and Product Certification Specialist



PCB PIEZOTRONICS, INC. — CORPORATE HEADQUARTERS

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**AS9100 and ISO9001 Certified
ISO17025 Accredited**

INTERTEK ASSURANCE SAFETY INTEGRITY LEVEL SUMMARY REPORT

PCB SIL SENSOR RATING

CLIENT NAME

PCB Piezotronics, Inc.
3425 Walden Ave
Depew, NY 14043-2417

REPORT NO

103685042CSLT-001

COMPILED BY

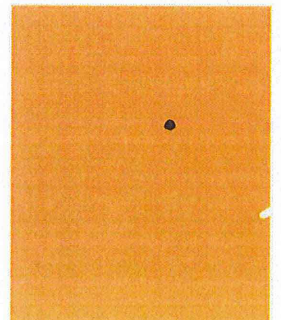
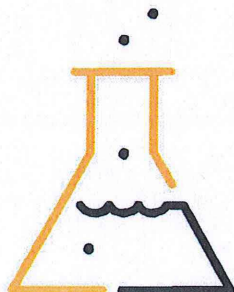
Ashton D. Hainge, CFSP, PMP

PROJECT NAME

G103685042

DATE

16 November 2018





PCB FUNCTIONAL SAFETY SIL SUMMARY AND RESULTS

Summary

This summary report details results of the reliability analysis performed on the PCB Piezotronics 4-20 mA Output Velocity Sensor and 4-20 mA Output Acceleration Sensor model 64XYZZ Series. 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 23927-B
2. Electrical schematic 24297-E
3. BOM 21459-01-L
4. BOM 24297-01-209-100-G
5. Manual 640BXX

Reliability calculations were conducted at the component and circuit level using the methodology outlined in MIL-HDKB-217F. Product level failure parameters were then calculated in accordance the functional safety approach of IEC 61508-1:2010, IEC 61508-2:2010, IEC 61508-6:2010, and IEC 61508-7:2010.

Results

The results from the FMEA are given below for the 4-20 mA Output Velocity Sensor and 4-20 mA Output Acceleration Sensor model 64XYZZ:

Name	Circular Connector	Terminal Block
Architecture	1001	1001
Proof test interval (Annual)	8,760 h	8,760 h
PFD _{avg}	1.255x10 ⁻³	1.299x10 ⁻³
SFF	86.27%	86.12%
HFT	0	0
SIL Capability (Low Demand Mode)	2	2
SIL Capability (Continuous Demand Mode)	2	2
Architecture	1001	1001

PCB Sensor Product Meets SIL 2 Capability



Name		Results*
Safe Detected failure rate	$\lambda_{SD} \times 10^{-6}$	0.4937 (0.5117)
Safe Undetected failure rate	$\lambda_{SU} \times 10^{-6}$	0.3291 (0.3411)
Dangerous Detected failure rate	$\lambda_{DD} \times 10^{-6}$	1.2813 (1.2993)
Dangerous Undetected failure rate	$\lambda_{DU} \times 10^{-6}$	0.3348 (0.3468)
Average frequency of a dangerous failure on demand	$PFH \times 10^{-6}$	1255.0477 (1299.0000)

Type B components: 64XYZZ Series (includes EX64XYZZ Series)

The safety relevant parameter PFD_{avg} is in compliance with the corresponding requirements for SIL 2 according to IEC 61508¹.

The safety relevant parameters HFT and SFF are in compliance with the corresponding requirements for SIL 1 according to IEC 61508.

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

*Note: Values are for Circular/Cylindrical connectors. Values for Terminal Block connectors are given in parenthesis.

¹ The assessment results described in this report only refer to the safety-related parameters PFD_{avg} , HFT, and SFF according to IEC 61508.

This report does not make any statements, that the manufacturer meets all other requirements of the above cited standards for hardware, software, documentation, management of functional safety, verification, and validation.

This report does not imply that the examined pressure sensors have been certified for functional safety by the assessor according to IEC 61508 or any other standards.

The sensors are only one part of a complete safety function. It is at the responsibility of the end-user to prepare and to apply an extensive reliability model, that brings out the complete safety function and that meets all requirements of the claimed SIL level according to IEC 61508.