

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, quartz or ceramic shear ICP® accelerometers:

- | | |
|--|--|
| <ul style="list-style-type: none"> • 621 Series - (XX)621yzzz/aaa • 622 Series - (XX)622yzzz/aaa • 623 Series - (XX)623yzzz/aaa • 624 Series - (XX)624yzzz/aaa • 625 Series - (XX)625yzzz/aaa • 626 Series - (XX)626yzzz/aaa • 627 Series - (XX)627yzzz/aaa • 628 Series - (XX)628yzzz/aaa | <p>(XX) Options include one or more of the following:</p> <p>EX – Approved for Hazardous Locations</p> <p>M – Metric Mounting Hardware</p> <p>TO – Dual Output (Vibration/Temperature)</p> <p>HT – High Temperature (325°F, 163°C)</p> <p>VO – Velocity Output</p> <p>Note: “yzzz” completes the model, “aaa” indicates cable length (if applicable)</p> |
|--|--|

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

Parameter	62x Series*	EX, HT, TO, VO 62x Series*
SIL	2	2
Proof Test Interval (Annual)	8,760 h	8,760 h
Device Type	B	B
HFT	0	0
SFF	78.18%	78.18%
PFD _{AV} ¹	7.99 x 10 ⁻⁵	7.99 x 10 ⁻⁵
$\lambda_{du} \times 10^{-6}$	0.018	0.018
SIL Capability (Low Demand Mode)	2	2
SIL Capability (Continuous Demand Mode)	2	2
MTTF ²	75.11 y	7 y
1. The values comply with SIL2 according to ISA S84.01 2. According to Siemens SN29500 and Proven In Use data		

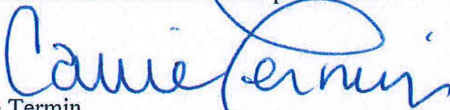
* With or without the M (metric) option

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.

June 28, 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-002

COMPILED BY

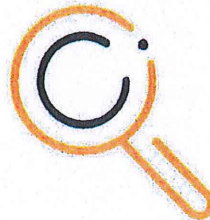
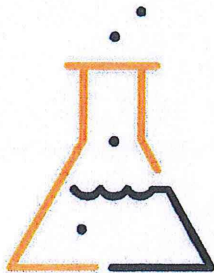
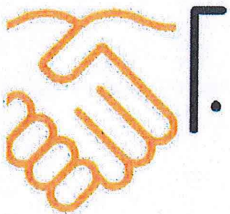
Ashton D. Hainge, CFSP, PMP

PROJECT NAME

G103685042

DATE

22 February 2019





PCB FUNCTIONAL SAFETY SIL SUMMARY AND RESULTS

Summary

This report details the results of the reliability analysis performed on the PCB Piezotronics ICP® Sensor model 62X series. Design changes from this documentation package would need to be evaluated for the impact on the reliability characteristics. These results are based on the following PCB Piezotronics documentation.

1. Electrical schematic 65009-NR
2. Electrical schematic 65010-NR
3. Electrical schematic 65038-NR
4. 622801 MTTF Calculation
5. 62X Returns FY 2018

Results

The 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 with the functional safety approach of IEC 61508-1:2010, IEC 61508-2:2010, IEC 61508-6:2010, IEC 61508-7:2010. The results from the FMEA are given below for the ICP® Sensor model 62X:

Name	Result
Architecture	1001
Proof test interval (Annual)	8,760 h
PFD _{avg}	7.99x10 ⁻⁵
SFF	78.18%
HFT	0
SIL Capability (Low Demand Mode)	2
SIL Capability (Continuous Demand Mode)	2

PCB Sensor Product Meets SIL 2 Capability



Name		Result
Safe Detected failure rate	$\lambda_{SD} \times 10^{-6}$	0.021
Safe Undetected failure rate	$\lambda_{SU} \times 10^{-6}$	0.014
Dangerous Detected failure rate	$\lambda_{DD} \times 10^{-6}$	0.029
Dangerous Undetected failure rate	$\lambda_{DU} \times 10^{-6}$	0.018
Average frequency of a dangerous failure on demand	$PFH \times 10^{-6}$	0.018

Type B components: 62X Series

The safety relevant parameter PFD_{avg} is in compliance with the corresponding requirements for SIL 2 according to IEC 61508¹. If this sensor is fully defined as type B, then the SIL capability is SIL 1 because the SFF is 78.18 %. 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 "0" and can be considered to have SIL 2 capability. Even though PFD_{avg} has the range of SIL 4, the hardware fault tolerance limits the capability to SIL 2. 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
Certified Functional Safety Professional (CFSP)

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.