

INTERNATIONAL STANDARD

**Piezoelectric sensors –
Part 1: Generic specifications**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PIEZOELECTRIC SENSORS –**Part 1: Generic specifications**

FOREWORD

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International Standard IEC 63041-1 has been prepared by IEC technical committee TC 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.

The text of this International Standard is based on the following documents:

| | |
|-------------|------------------|
| CDV | Report on voting |
| 49/1220/CDV | 49/1249/RVC |

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 63041 series, published under the general title *Piezoelectric sensors*, can be found on the IEC website.

A bilingual version of this publication may be issued at a later date.

PIEZOELECTRIC SENSORS –

Part 1: Generic specifications

1 Scope

This part of IEC 63041 applies to piezoelectric sensors of resonator, delay-line and non-acoustic types, which are used in physical and engineering sciences, chemistry and biochemistry, medical and environmental sciences, etc.

The purpose of this document is to specify the terms and definitions for the piezoelectric sensors, and to make sure from a technological perspective that users understand the state-of-art piezoelectric sensors and how to use them correctly.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050-561:2014, *International Electrotechnical Vocabulary – Part 561: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection*

IEC 60122-2-1, *Quartz crystal units for frequency control and selection – Part 2: Guide to the use of quartz crystal units for frequency control and selection – Section One: Quartz crystal units for microprocessor clock supply*

IEC 60444-9, *Measurement of quartz crystal unit parameters – Part 9: Measurement of spurious resonances of piezoelectric crystal units*

IEC 60617, *Graphical symbols for diagrams*, available at <http://std.iec.ch/iec60617>

ISO 2859-1:1999, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 80000-1:2009, *Quantities and units – Part 1: General*

3 Terms and definitions

3.1 General

For the purpose of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses;

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

Units, letter symbols and terminology shall, wherever possible, be taken from the following standards: IEC 60027, IEC 60050-561, IEC 60617, and ISO 80000-1.

NOTE Piezoelectric sensors covered herein are those used for the detection and measurement of physical quantities, chemical substances or biological molecules.

3.2 Piezoelectric sensors

3.2.1

piezoelectric sensor element

electronic component which is able to detect physical quantities as a change in its frequency, phase, delay, electrical charge, resistance, Q-value, bandwidth, etc.

Note 1 to entry: For chemical and biochemical sensor applications, the piezoelectric sensor element includes a sensitive or receptive layer (target recognition material).

3.2.2

resonator type sensor element

piezoelectric sensor component using acoustic resonances

3.2.3

delay line type sensor element

piezoelectric sensor component using a surface acoustic wave (SAW) delay-line of transversal type

3.2.4

non-acoustic type sensor element

piezoelectric sensor component using the electrical charge induced by a quasi-static force, torque or the like

Note 1 to entry: Here, the term, "non-acoustic", represents "quasi-static piezoelectric". Accordingly, the (piezoelectric) non-acoustic type sensor element means a sensor element using the quasi-static piezoelectric effect.

3.2.5

piezoelectric sensor cell

sensor element equipped with necessary mechanical accessories and attachments to correctly detect the parameters to be measured

3.2.6

piezoelectric sensor module

sensor element or cell equipped with electronic accessories for interfacing to external data acquisitions

3.2.7

piezoelectric sensor

generic term that includes a sensor element, cell and module

3.2.8

QCM

quartz crystal microbalance

one of the families of chemical and biochemical sensors using crystal resonators

Note 1 to entry: A thickness shear mode (TSM) sensor is identical with a QCM.

3.3 Types of chemical sensors

3.3.1

piezoelectric chemical sensor element

piezoelectric sensor component including a sensitive layer (target recognition material), which is necessary for the practical measurement of simple non-biological molecules in quantity, and which works and detects chemical substances mainly in the gas phase

Note 1 to entry: A gas sensor element is one of the chemical sensor elements.

3.3.2

piezoelectric biochemical sensor element

piezoelectric sensor component including a receptive layer (target recognition material), which is necessary for the practical measurement of complex biological molecules in quantity, and which works mainly in aqueous media and detects biomolecules therein

3.4 Types of physical sensors

3.4.1

piezoelectric force sensor element

piezoelectric sensor component whose resonance frequency, delay or electrical charge/voltage is used for force measurement

3.4.2

piezoelectric pressure sensor element

piezoelectric sensor component whose resonance frequency, delay or electrical charge/voltage is used for pressure measurement

3.4.3

piezoelectric torque sensor element

piezoelectric sensor component whose resonance frequency, delay or electrical charge/voltage is used for torque measurement

3.4.4

piezoelectric viscosity sensor element

piezoelectric sensor component whose resonance frequency, delay or insertion loss/gain is used for viscosity measurement

3.4.5

piezoelectric temperature sensor element

piezoelectric sensor component whose resonance frequency or delay is used for temperature measurement

3.4.6

piezoelectric film-thickness sensor element

piezoelectric sensor component whose resonance frequency is used for film-thickness measurement

4 Symbols of sensor elements

4.1 General

Figures 1 to 6 show the conceptual diagrams and defined symbols for sensor elements of bulk acoustic wave (BAW) resonator, SAW resonator and SAW delay-line types. The symbols are essentially the same as those given in IEC 60122-1, IEC 61019-1 and IEC 60862-1.

Figure 7 and Figure 8 show the conceptual diagram and defined symbol for sensor elements of non-acoustic type.

NOTE 1 The diagonal line in Figure 2, Figure 4, Figure 6 and Figure 8 shows an emblem expressing changes in objects to be measured.

NOTE 2 Letter symbols (see 4.6) showing the types of sensors are put in the circle at the upper right corner in Figure 2, Figure 4, Figure 6 and Figure 8.