IEC 63203-401-1

Edition 1.0 2023-10

INTERNATIONAL STANDARD

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colour inside

Wearable electronic devices and technologies – Part 401-1: Devices and systems: functional elements – Evaluation method of the stretchable resistive strain sensor

Technologies et dispositifs électroniques prêt-à-porter – Partie 401-1: Dispositifs et systèmes: éléments de fonctionnement – Méthode d'évaluation de la jauge de contrainte extensible de type résistif



IEC 63203-401-1:2023-10(en-fr)



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IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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WEARABLE ELECTRONIC DEVICES AND TECHNOLOGIES –

Part 401-1: Devices and systems: functional elements – Evaluation method of the stretchable resistive strain sensor

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

Draft	Report on voting
124/223/FDIS	124/239/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 63203 series, published under the general title *Wearable electronic devices and technologies*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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WEARABLE ELECTRONIC DEVICES AND TECHNOLOGIES –

Part 401-1: Devices and systems: functional elements – Evaluation method of the stretchable resistive strain sensor

1 Scope

This part of IEC 63203-401 specifies a measurement method of tensile strain for stretchable, resistive strain sensors. This document describes characterization procedures for evaluation of the gauge factor, linearity, response characteristics, and hysteresis of unimodal tension sensors but is not appropriate for assessment of the physical properties of the sensor material such as the elastic modulus, elastic limit, and Poisson's ratio.

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 62899-202-4:2021, *Printed electronics – Part 202-4: Materials – Conductive ink – Measurement methods for properties of stretchable printed layers (conductive and insulating)*

ISO 291:2008, *Plastics – Standard atmospheres for conditioning and testing*

ISO/TS 12901-2:2014, *Nanotechnologies – Occupational risk management applied to engineered nanomaterials – Part 2: Use of the control banding approach*

3 Terms and definitions

3.1 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

3.1.1
stretchable substrate
stretchable material
substrate or material able to recover original size and shape immediately after the removal of the extending force causing deformation

Note 1 to entry: In this document, the notion of "stretchability" is based on the elasticity of the substrate.

[SOURCE: IEC 63203-101-1:2021, 3.10 [1]]

3.1.2
gauge factor
G_F
ratio of the change in electrical resistance divided by the original resistance (R_o, resistance in the undeformed configuration) to engineering strain (e) along the axis of the stretching

Note 1 to entry: Gauge factor is expressed as $G_F = \frac{(R - R_O)/R_O}{e}$, where R_O is the initial resistance in the undeformed configuration, R is the electrical resistance in the deformed configuration, and e is the tensile strain.

[SOURCE: IEC 62047-22:2014, 3.1.1 [2] modified – "along the axis of the stretching" has been added to the definition, and, in the note to entry, "where R is the electrical resistance in the deformed configuration" has been replaced with "where R_O is the initial resistance in the undeformed configuration, R is the electrical resistance in the deformed configuration, and e is the tensile strain".]

3.1.3
gauge length
length of the strain-sensitive section of a stretchable strain sensor in the direction of the measurement axis

3.2 Symbols and abbreviated terms

Symbol	Unit	Description
a	mm	Width of the resistive thin film
h	µm	Thickness of the resistive thin film
l_0	mm	Gauge length of the sensor
l_1	mm	Length of the stretchable resistive thin film

4 Test environments

The tests shall be performed under constant temperature and humidity conditions. As environmental conditions, including temperature and humidity, can affect the electrical and mechanical properties of resistive materials and substrates, the testing temperature and humidity shall be monitored during testing. Fluctuations in temperature during a test shall be kept to less than ±2 °C. Thus, when testing such materials, the change in relative humidity (RH) in the testing laboratory shall be kept to less than ±10 % RH. The recommended temperature and relative humidity are 23 °C ± 2 °C and relative humidity of 50 ± 10 %, respectively, conforming to standard atmosphere class 2 specified in ISO 291. Whenever testing is conducted, the environmental conditions shall be recorded.