

STN	Piezoelektrické snímače Časť 1: Všeobecné špecifikácie	STN EN IEC 63041-1 35 8400
------------	---	--

Piezoelectric sensors - Part 1: Generic specifications

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 12/21

Obsahuje: EN IEC 63041-1:2021, IEC 63041-1:2021

Oznámením tejto normy sa od 22.10.2024 ruší
STN EN IEC 63041-1 (35 8400) z februára 2019

134202

EUROPEAN STANDARD

EN IEC 63041-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2021

ICS 31.140

Supersedes EN IEC 63041-1:2018 and all of its
amendments and corrigenda (if any)

English Version

**Piezoelectric sensors - Part 1: Generic specifications
(IEC 63041-1:2021)**Capteurs piézoélectriques - Partie 1: Spécifications
génériques
(IEC 63041-1:2021)Piezoelektrische Sensoren - Teil 1: Fachgrundspezifikation
(IEC 63041-1:2021)

This European Standard was approved by CENELEC on 2021-10-22. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

EN IEC 63041-1:2021 (E)

European foreword

The text of document 49/1357/CDV, future edition 2 of IEC 63041-1, prepared by IEC/TC 49 "Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 63041-1:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2022-07-22 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2024-10-22 document have to be withdrawn

This document supersedes EN IEC 63041-1:2018 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 63041-1:2021 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068 (series) NOTE Harmonized as EN 60068 (series)
IEC 60122-1 NOTE Harmonized as EN 60122-1
IEC 60444-1 NOTE Harmonized as EN 60444-1
IEC 60444-5 NOTE Harmonized as EN 60444-5
IEC 60679 (series) NOTE Harmonized as EN 60679 (series)
IEC 60689 NOTE Harmonized as EN 60689
IEC 60758:2016 NOTE Harmonized as EN 60758:2016 (not modified)
IEC 60862-1 NOTE Harmonized as EN 60862-1
IEC 61019-1 NOTE Harmonized as EN 61019-1
IEC 61240:2016 NOTE Harmonized as EN 61240:2017 (not modified)
IEC 61760 (series) NOTE Harmonized as EN 61760-4:2015/A1 (series)
IEC 61837 (series) NOTE Harmonized as EN 61837 (series)
IEC 63041-2 NOTE Harmonized as EN IEC 63041-2
ISO 80000 (series) NOTE Harmonized as EN ISO 80000 (series)

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60027	series	Letter symbols to be used in electrical technology	EN 60027	series
IEC 60050-561	-	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	EN 60444-9	-
IEC 60617	-	Graphical symbols for diagrams	-	-
IEC 63041-3	2020	Piezoelectric sensors - Part 3: Physical sensors	EN IEC 63041-3	2020
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	-	Quantities and units - Part 1: General	EN ISO 80000-1	-



IEC 63041-1

Edition 2.0 2021-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Capteurs piézoélectriques –
Partie 1: Spécifications génériques**





THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2021 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

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

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC online collection - oc.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



IEC 63041-1

Edition 2.0 2021-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Capteurs piézoélectriques –
Partie 1: Spécifications génériques**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.140

ISBN 978-2-8322-1023-7

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD	5
1 Scope	7
2 Normative references	7
3 Terms and definitions	7
3.1 Piezoelectric sensors	8
3.2 Types of chemical sensors	9
3.3 Types of physical sensors	9
3.4 Types of sensor modules	10
3.5 Types of sensor systems	10
4 Symbols of sensor elements	10
4.1 General	10
4.2 Symbol for sensor elements of BAW resonator type	10
4.3 Symbol for sensor elements of SAW resonator type	11
4.4 Symbol for sensor elements of SAW delay-line type	11
4.5 Symbol for sensor elements of non-acoustic type	12
4.6 Symbol for wireless SAW sensor element	12
4.7 Symbols	14
5 Specifications	14
5.1 Sensor elements	14
5.1.1 General	14
5.1.2 Sensor elements of resonator and delay-line types	14
5.1.3 Sensor elements of non-acoustic type	15
5.2 Frequency ranges	15
5.3 Level of drive or input power	15
5.4 Unwanted response	15
5.5 Analysis of measurements	15
5.6 Enclosure	16
5.7 Performance confirmation	16
5.8 Long-term and short-term stabilities	16
5.9 Transmission power	16
6 Measurement and detection methods	16
7 Delivery conditions	16
7.1 Marking	16
7.2 Wrapping	16
7.3 Packaging	17
8 Quality and reliability	17
8.1 Reuse	17
8.2 Validity of release	17
8.3 Test procedures	17
8.4 Screening requirements	17
8.5 Unchecked parameters	17
9 Test and measurement procedures	17
9.1 General	17
9.1.1 Test classification	17
9.1.2 Shipping test	17

9.1.3	Mechanical and environmental test	18
9.2	Test and measurement conditions	18
9.2.1	Standard conditions for testing	18
9.2.2	Equilibrium state	18
9.2.3	Power supply	18
9.2.4	Alternative test system	19
9.2.5	Visual inspection	19
9.3	Test conditions for shipment	19
9.3.1	Temperature dependence of frequency, phase, insertion loss/gain, motional resistance, and electric charge / voltage	19
9.3.2	Unwanted response	19
9.3.3	Shunt capacitance	19
9.3.4	Insulation resistance	20
Annex A	(normative) Measurement methods	21
A.1	General	21
A.2	Measurement methods using reflection and transmission characteristics	21
A.3	Measurement methods using oscillation circuits	22
A.4	Measurement method of non-acoustic type sensor elements and cells	23
A.5	Other measurement methods	23
Annex B	(normative) Detection methods	24
B.1	General	24
B.2	Detection methods	24
B.2.1	Frequency difference measurement	24
B.2.2	Insertion loss/gain measurement	25
B.2.3	Phase difference measurement	26
B.2.4	Other detection methods	26
Annex C	(normative) Wireless SAW sensor	27
C.1	General	27
C.2	Detection methods	27
C.2.1	General	27
C.2.2	Conceptual diagrams of wireless SAW resonator type sensor system	27
C.2.3	Conceptual diagrams of wireless SAW reflective delay-line type sensor system	27
C.2.4	Key points of detection mechanism	28
C.2.5	Technical documents	28
Bibliography	29
Figure 1	– Conceptual diagrams for sensor elements of BAW resonator type	11
Figure 2	– Symbol for sensor elements of BAW resonator type	11
Figure 3	– Conceptual diagram of sensor elements of SAW resonator type	11
Figure 4	– Symbol for sensor elements of SAW resonator type	11
Figure 5	– Conceptual diagram for sensor elements of SAW delay-line type	12
Figure 6	– Symbol for sensor elements of SAW delay-line type	12
Figure 7	– Conceptual diagrams for sensor elements of non-acoustic type	12
Figure 8	– Symbol for sensor elements of non-acoustic type	12
Figure 9	– Conceptual diagram for basic sensor elements of wireless SAW resonator type	13
Figure 10	– Symbol for basic sensor elements of wireless SAW resonator type	13

Figure 11 – Conceptual diagram for basic sensor elements of wireless SAW reflective delay-line type	13
Figure 12 – Symbol for basic sensor elements of wireless SAW reflective delay-line type	13
Figure A.1 – Measurement method using reflection characteristics of BAW resonator type sensor elements and cells	21
Figure A.2 – Measurement method using reflection characteristics of SAW resonator type sensor elements and cells	21
Figure A.3 – Measurement method using transmission characteristics of SAW delay-line type sensor elements and cells	22
Figure A.4 – Measurement method using oscillation circuit consisting of BAW resonator type sensor elements and cells	22
Figure A.5 – Measurement method using oscillation circuit consisting of SAW resonator type sensor elements and cells	22
Figure A.6 – Measurement method using oscillation circuit consisting of SAW delay-line type sensor elements and cells	23
Figure A.7 – Measurement method using amplifier consisting of non-acoustic type sensor elements and cells.....	23
Figure B.1 – Measurement of frequency difference using two oscillation circuits	24
Figure B.2 – Measurement of frequency difference using an oscillation circuit and frequency synthesizer	25
Figure B.3 – Conceptual diagram of piezoelectric dual mode sensor module	25
Figure B.4 – Measurement of insertion loss/gain difference using two oscillation circuits	26
Figure B.5 – Measurement of phase difference using signal generator and phase detector	26
Figure C.1 – Fundamental measurement system of wireless SAW resonator type sensor	27
Figure C.2 – Fundamental measurement system of wireless SAW reflective delay-line type sensor	28

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PIEZOELECTRIC SENSORS –

Part 1: Generic specifications

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

This second edition cancels and replaces the first edition published in 2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the new terms "piezoelectric sensor system" and "wireless SAW sensor system" and their definitions have been added;
- b) new types of sensor modules and sensor system have been added;
- c) some symbols of sensor elements are added in Clause 4;
- d) a new Figure B.3 has been added in Annex B;
- e) Annex C has been added.

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

Draft	Report on voting
49/1357/CDV	49/1364/RVC

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/standardsdev/publications.

A list of all parts in the IEC 63041 series, published under the general title *Piezoelectric sensors*, 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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 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, *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 crystals 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 <https://std.iec.ch/iec60617>

IEC 63041-3:2020, *Piezoelectric sensors – Part 3: Physical sensors*

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, *Quantities and units – Part 1: General*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN