

© Copyright SEK. Reproduction in any form without permission is prohibited.

Elektronikkomponenter – Mätning av strömbrys i fasta motstånd

Method of measurement of current noise generated in fixed resistors

Som svensk standard gäller europastandarden EN 60195:2016. Den svenska standarden innehåller den officiella engelska språkversionen av EN 60195:2016.

Nationellt förord

Europastandarden EN 60195:2016

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 60195, Second edition, 2016 - Method of measurement of current noise generated in fixed resistors**

utarbetad inom International Electrotechnical Commission, IEC.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

English Version

Method of measurement of current noise generated in fixed
resistors
(IEC 60195:2016)

Méthode pour la mesure du bruit produit en charge par les
résistances fixes
(IEC 60195:2016)

Messverfahren für das Stromrauschen in Festwiderständen
(IEC 60195:2016)

This European Standard was approved by CENELEC on 2016-05-12. 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, 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: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 40/2431/FDIS, future edition 2 of IEC 60195, prepared by IEC/TC 40 "Capacitors and resistors for electronic equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60195:2016.

The following dates are fixed:

- latest date by which the document has to be (dop) 2017-02-12
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2019-05-12
standards conflicting with the
document have to be withdrawn

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

Endorsement notice

The text of the International Standard IEC 60195:2016 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 60027 (series)

NOTE Harmonized as EN 60027 (series).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When 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 60068-1	2013	Environmental testing -- Part 1: General and guidance	EN 60068-1	2014

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	6
4 Method of measurement	7
4.1 Noise basics	7
4.1.1 Noise	7
4.1.2 Thermal noise	8
4.1.3 Current noise	8
4.2 Measurement principle	9
4.3 Measurement system	10
4.3.1 Proposal of a suitable measuring system	10
4.3.2 Alternative measuring systems	11
4.4 Measurement system requirements	11
4.4.1 Input circuit.....	11
4.4.2 Isolation resistor R_M	12
4.4.3 DC voltage source	12
4.4.4 DC electronic voltmeter	12
4.4.5 Calibration resistor R_{Cal}	12
4.4.6 Calibration source	13
4.4.7 Determination of the calibration voltage	13
4.4.8 AC band-pass amplifier	15
4.4.9 AC r.m.s. meter.....	16
4.4.10 Test fixture	16
4.5 Verification of the measuring system	17
4.5.1 Performance check by measurement of instrument and thermal noise	17
4.5.2 Performance check by comparison of repeated measurements.....	17
5 Measurement procedure	18
5.1 Ambient conditions.....	18
5.2 Preparation of specimen.....	18
5.3 Procedure	18
5.3.1 General	18
5.3.2 Calibration	18
5.3.3 Measurement of system noise S	18
5.3.4 Measurement of total noise T	19
5.4 Precautions.....	22
6 Evaluation of measurement results.....	22
6.1 Term for the contribution of system noise	22
6.2 Determination of the current-noise index A_1	24
6.3 Determination of the current-noise voltage ratio CNR_U	25
6.4 Accuracy.....	26
6.5 Requirements.....	26
7 Information to be given in the relevant component specification	26
Annex A (informative) Letter symbols and abbreviations	27
A.1 Letter symbols	27

A.2 Abbreviations	27
Annex X (informative) Cross-reference for references to the prior revision of this standard	28
Bibliography	29
Figure 1 – Block schematic of a suitable measuring system	11
Figure 2 – Typical transfer function of the band-pass amplifier	16
Figure 3 – Contribution of system noise, $f(T - S)$	23
Table 1 – Permissible limits of system noise	17
Table 2 – Recommended operating conditions (1 of 2)	20
Table 3 – Numeric values of the contribution of system noise, $f(T - S)$	24
Table X.1 – Cross reference for references to the 1 st edition of this standard	28

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**METHOD OF MEASUREMENT OF CURRENT
NOISE GENERATED IN FIXED RESISTORS****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.

International Standard IEC 60195 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This second edition cancels and replaces the first edition published in 1965 and constitutes a technical revision.

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

- harmonization of the allocation of isolation resistors R_M in the recommended operating conditions given in Table 2;
- correction of erroneous numeric values of the contribution of system noise, $f(T - S)$ in Table 3;
- addition of advice on the prescription of requirements in a relevant component specification;
- addition of a set of recommended measuring conditions for specimens with a rated dissipation of less than 100 mW;

- complete editorial revision.

The text of this standard is based on the following documents:

FDIS	Report on voting
40/2431/FDIS	40/2458/RVD

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

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

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

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

METHOD OF MEASUREMENT OF CURRENT NOISE GENERATED IN FIXED RESISTORS

1 Scope

This International Standard specifies a method of measurement and associated test conditions to assess the "noisiness", or magnitude of current noise, generated in fixed resistors of any given type. The method applies to all classes of fixed resistors. The aim is to provide comparable results for the determination of the suitability of resistors for use in electronic circuits having critical noise requirements.

The current noise in resistive materials reflects the granular structure of the resistive material. For some resistor technologies utilizing homogenous layers it is regarded as providing an indication of defects, which are considered as a root cause for abnormal ageing of the component under the influence of temperature and time.

The method described in this International Standard is not a general specification requirement and therefore is applied if prescribed by a relevant component specification, or, if agreed between a customer and a manufacturer.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*