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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Method of measurement of current noise generated in fixed resistors

Méthode pour la mesure du bruit produit en charge par les résistances fixes



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INTERNATIONAL
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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METHOD OF MEASUREMENT OF CURRENT NOISE GENERATED IN FIXED RESISTORS

FOREWORD

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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- withdrawn,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*

3 Terms and definitions

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

3.1
current-noise
combination of all random fluctuations of current flow in a resistor which are not attributed to thermal agitation of the charge carriers (thermal noise) and which depend on the applied direct current

3.2
current-noise index
A_1
logarithmic index of the ratio of the open circuit r.m.s. current-noise voltage in a frequency decade, in μV, over the d.c. voltage applied under test, in V, used to express the “noisiness” of an individual resistor

Note 1 to entry: The current-noise index is expressed in dB. The ratio between μV and V is not considered in this index, leading to its value being 120 dB less than the mathematical current-noise index A_1'. This practical index follows the history of prior revisions of this method.

3.3
mathematical current-noise index
A_1'
logarithmic index of the ratio of the open circuit r.m.s. current-noise voltage in a frequency decade over the d.c. voltage applied under test, established in consistent units and their multiples

Note 1 to entry: The mathematical current-noise index is expressed in dB. This index has been introduced for the mathematical derivation of the considered parameters.

3.4
current-noise voltage ratio
CNR_U
ratio of the open circuit r.m.s. current-noise voltage in a frequency decade over the d.c. voltage applied under test, established in μV/V, used to express the “noisiness” of an individual resistor

3.5
flicker noise
pink noise
random fluctuation present in most electronic devices and typically related to internal properties of the respective device, which depends on direct current and has a power spectral density inversely proportional to the frequency

3.6
noise
random fluctuation in an electrical signal having instantaneous amplitude values which, due to their distribution in a random manner, can only be predicted in terms of probability statements

3.7
shot noise
random fluctuation in electric current due to the flowing current consisting of discrete charges, which is independent of temperature and has nearly constant power spectral density throughout the frequency spectrum

3.8
thermal noise
random fluctuation generated by the thermal agitation of the charge carriers (usually the electrons) inside an electrical conductor at equilibrium, which is independent of any applied voltage and has nearly constant power spectral density throughout the frequency spectrum

Note 1 to entry: Thermal noise is also referred to as Johnson noise or as Nyquist noise.

4 Method of measurement

4.1 Noise basics

4.1.1 Noise

Noise appears as a spontaneous fluctuating voltage $e_n(t)$ with instantaneous amplitude values.

Noise voltage is a statistically independent random variable, where for most kinds of noise the frequency distribution of amplitudes follows a Gaussian distribution curve. Therefore noise voltage cannot be predicted except in terms of probability statements.

Usually the characteristic of principal interest is not the instantaneous amplitude value but the "time-averaged" value.