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Edition 3.0 2021-01

TECHNICAL SPECIFICATION

Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection – Glossary –
Part 3: Piezoelectric, dielectric and electrostatic oscillators

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PIEZOELECTRIC, DIELECTRIC AND ELECTROSTATIC DEVICES AND ASSOCIATED MATERIALS FOR FREQUENCY CONTROL, SELECTION AND DETECTION – GLOSSARY –

Part 3: Piezoelectric, dielectric and electrostatic oscillators

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 61994-3, which is a technical specification, has been prepared by IEC technical committee 49: Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection.

This third edition of IEC 61994-3 cancels and replaces the second edition published in 2011. This edition constitutes a technical revision.

The main changes with respect to the previous edition are as listed below:

– some definitions have been updated;
– the terminology given in IEC 60679-1:2017 has been taken into account;
– new terminologies are added.

The text of this Technical Specification is based on the following documents:

Enquiry draft	Report on voting
49/1348/DTS	49/1355/RVC

Full information on the voting for the approval of this technical specification 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 61994 series, published under the general title *Piezoelectric, dielectric and electrostatic devices and associated materials for frequency control, selection and detection – Glossary*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://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- withdrawn,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, DIELECTRIC AND ELECTROSTATIC DEVICES AND ASSOCIATED MATERIALS FOR FREQUENCY CONTROL, SELECTION AND DETECTION – GLOSSARY –

Part 3: Piezoelectric, dielectric and electrostatic oscillators

1 Scope

This part of IEC 61994 gives the terms and definitions for piezoelectric, dielectric and electrostatic oscillators representing the state of the art, which are intended for use in the standards and documents of IEC TC 49.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes 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

3.1
adjustment frequency
frequency to which an oscillator must be adjusted, under a particular combination of operating conditions, in order to meet the requirement for the frequency tolerance specification over the specified range of operating conditions

Note 1 to entry: Adjustment frequency corresponds to nominal frequency plus frequency offset.

[SOURCE: IEC 60679-1:2017, 3.2.22]

3.2
ADEV of fractional frequency fluctuation
Allan deviation of fractional frequency fluctuation
measure in the time domain of the short-term frequency stability of oscillator, based on the statistical properties of a number of frequency measurements, each representing an average of the frequency over the specified sampling interval τ

Note 1 to entry: The preferred measure of fractional frequency fluctuation is:

$$\sigma_y(\tau) \cong \left[\frac{1}{2(M-1)} \sum_{k=1}^{M-1} \left(Y_{k+1} - Y_k \right)^2 \right]^{1/2}$$

where

Y_k are the average fractional frequency fluctuations obtained sequentially, with no systematic dead time between measurements;

τ is the sample time over which measurements are averaged;

M is the number of measurements.

Note 2 to entry: The confidence of the estimate improves as M increases.

[SOURCE: IEC 60679-1:2017, 3.2.38, modified – ADEV of fractional frequency fluctuation has been replaced as the first preferred term. The meaning of the symbols used in the mathematical formula has been added, as well as Note 2 to entry.]

3.3
AVAR of fractional frequency fluctuation
Allan variance of fractional frequency fluctuation
unbiased estimate of the preferred definition in the time domain of the short-term stability characteristic of the oscillator output frequency

Note 1 to entry: The preferred measure of fractional frequency fluctuation is:

$$\sigma_y{}^2(\tau) \cong \frac{1}{2(M-1)} \sum_{k=1}^{M-1} (Y_{k+1} - Y_k)^2$$

where

Y_k are the average fractional frequency fluctuations obtained sequentially, with no systematic dead time between measurements;

τ is the sample time over which measurements are averaged;

M is the number of measurements.

Note 2 to entry: The confidence of the estimate improves as M increases.

[SOURCE: IEC 60679-1:2017, 3.2.37, modified – The term "Allan variance AVAR of fractional frequency fluctuation" has been deleted. And AVAR of fractional frequency fluctuation has been replaced as the preferred term.]

3.4
amplitude modulation distortion
non-linear distortion in which the relative magnitudes of the spectral components of the modulating signal waveform are modified

Note 1 to entry: The test procedure is provided in 4.5.22.3 of IEC 62884-1:2017.

[SOURCE: IEC 60679-1:2017, 3.2.42, modified – Three entry terms except amplitude modulation distortion have been deleted.]

3.5
crystal cut
orientation of the crystal element with respect to the crystallographic axes of the crystal

Note 1 to entry: It can be desirable to specify the cut (and hence the general form of the frequency/temperature performance) of a crystal unit used in an oscillator application. The choice of the crystal cut will imply certain attributes of the oscillator which may not otherwise appear in the detail specification.

[SOURCE: IEC 60679-1:2017, 3.2.3]

3.6
fall time
decay time
time interval required for the trailing edge of a waveform to change between two defined levels

Note 1 to entry: These levels may be two logic levels V_{OH} and V_{OL} or 90 % to 10 % of its maximum amplitude (V_{HI} – V_{LO}), or any other ratio as defined in the detail specification as shown in Figure 1.

Note 2 to entry: The test procedure is provided in 4.5.16.2 of IEC 62884-1:2017.

[SOURCE: IEC 60679-1:2017, 3.2.48, modified – The term "fall time" has been replaced as the first preferred term.]

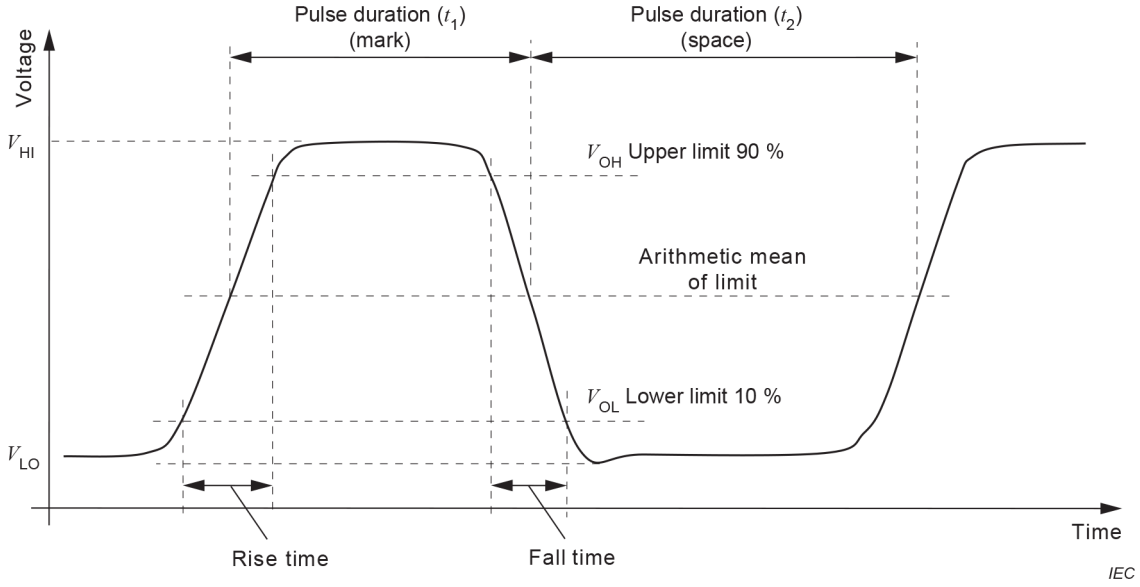

Figure 1 – Characteristics of an output waveform

3.7
DIXO
digital interfaced crystal oscillator
crystal oscillator, the frequency and the functions of which can be controlled, by application of an external digital signal

Note 1 to entry: The prefix "DI" is applied to TCXO and OCXO as DI-TCXO and DI-OCXO, respectively.

[SOURCE: IEC 60679-1:2017, 3.2.17, modified – DIXO has been replaced as the most first preferred term and the note has been reworded.]

3.8
MEMS oscillator
microelectromechanical system oscillator
oscillator that uses a MEMS device as the main frequency controlling element

[SOURCE: IEC 60679-1:2017, 3.2.15, modified – The term “electrostatic micro electro mechanical system oscillator” has been deleted and MEMS oscillator has been replaced as the first preferred term.]

3.9
frequency adjustment range
range over which oscillator frequency may be varied by means of some variable element

Note 1 to entry: The purpose is as follows:

a) setting the frequency to a particular value, or;

b) to correct oscillator frequency to a prescribed value after deviation due to ageing, or other changed conditions.

Note 2 to entry: The test procedure is provided in 4.5.11 of IEC 62884-1:2017.

[SOURCE: IEC 60679-1:2017, 3.2.23, modified – The end of definition has been replaced by Note 1 to entry.]

3.10
frequency offset
frequency difference, positive or negative, which should be added to the specified nominal frequency of the oscillator, when adjusting the oscillator frequency under a particular set of operating conditions in order to minimize its deviation from the nominal frequency over the specified range of operating conditions

Note 1 to entry: In order to minimize the frequency deviation from nominal frequency over the entire temperature range, a frequency offset may be specified for adjustment at the reference temperature as shown in Figure 2.

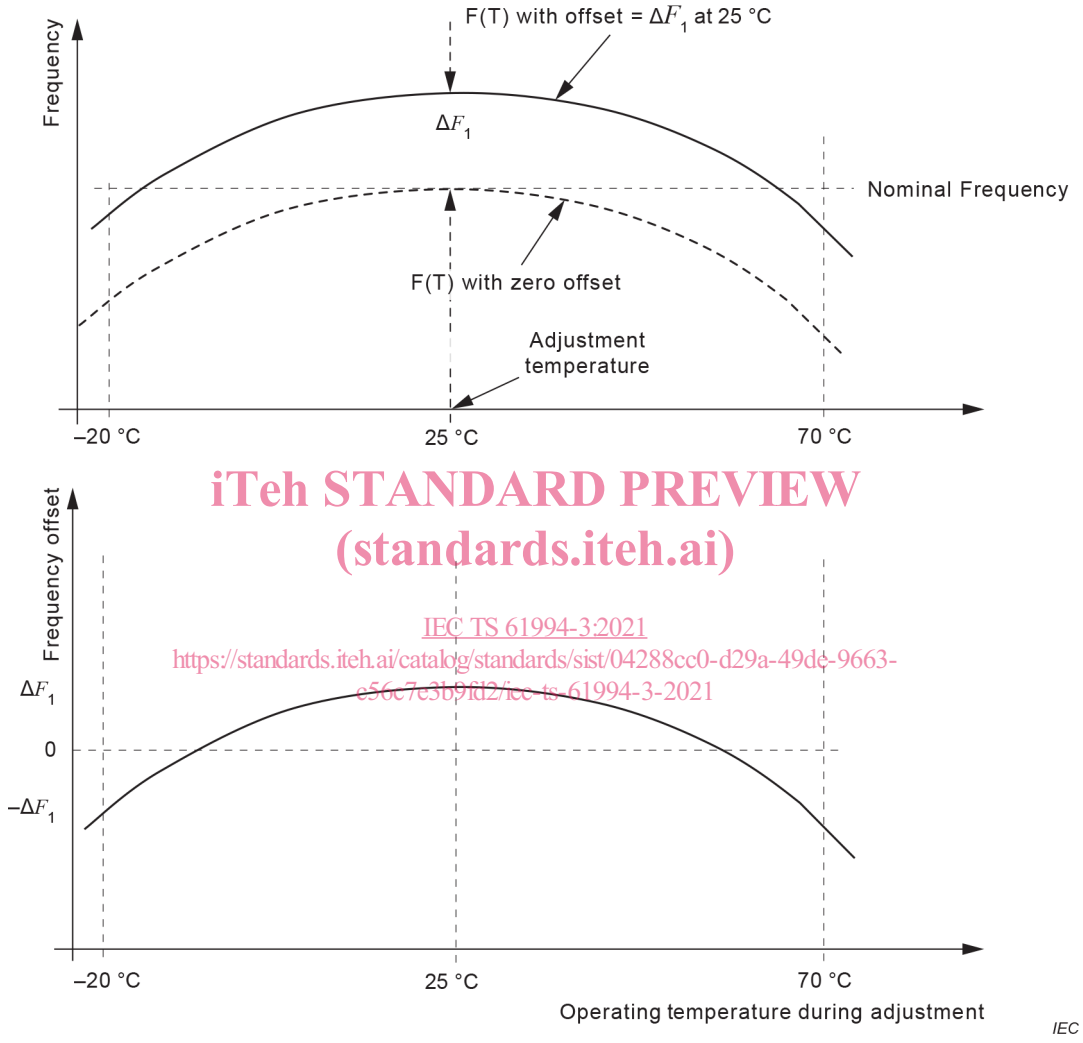

Figure 2 – Example of the use of frequency offset

[SOURCE: IEC 60679-1:2017, 3.2.21]

3.11
frequency tolerance
maximum permissible deviation from the specified nominal frequency from the specified value due to a specific cause, or a combination of causes

Note 1 to entry: Frequency tolerances are often assigned separately to specified ambient effects, namely electrical, mechanical and environmental. When this approach is used, it is necessary to define the values of other operating parameters as well as the range of the specified variable, that is to say:

– deviation from the frequency at the specified reference temperature due to operation over the specified temperature range, other conditions remaining constant;

– deviation from the frequency at the specified supply voltage due to supply voltage changes over the specified range, other conditions remaining constant;

– deviation from the initial frequency due to ageing, other conditions remaining constant;

– deviation from the frequency with specified load conditions due to changes in load impedance over the specified range, other conditions remaining constant.

In some cases, an overall frequency tolerance may be specified, due to any or all combinations of operating parameters, during a specified lifetime.

[SOURCE: IEC 60679-1:2017, 3.2.20, modified – “characteristic” of the definition has been replaced by “nominal”.]

3.12
frequency/load coefficient
fractional change in output frequency resulting from an incremental change in electrical load impedance, other parameters remaining unchanged

Note 1 to entry: The test procedure is provided in 4.5.6 of IEC 62884-1:2017.

[SOURCE: IEC 60679-1:2017, 3.2.34]

3.13
frequency/temperature characteristics
deviation from the frequency at the specified reference temperature due to operation over the specified temperature range, other conditions remaining constant

Note 1 to entry: The test procedure is provided in 4.5.5 of IEC 62884-1:2017.

[SOURCE: IEC 60679-1:2017, 3.2.31]

3.14
frequency/temperature stability
maximum permissible deviation of the oscillator frequency, with no reference implied, due to operation over the specified temperature range at nominal supply and load conditions, other conditions constant

Note 1 to entry: The test procedure is provided in 4.5.5 of IEC 62884-1:2017 .

[SOURCE: IEC 60679-1:2017, 3.2.32, modified – The mathematical formula has been deleted.]

3.15
frequency/voltage coefficient
fractional change in output frequency resulting from an incremental change in supply voltage, other parameters remaining unchanged

Note 1 to entry: In the case of OCXOs, a considerable time may elapse before the full effect of a supply voltage change is observed, as the temperature of the oven may drift gradually to a new value following the voltage perturbation.

Note 2 to entry: The test procedure is provided in 4.5.7 of IEC 62884-1:2017.

[SOURCE: IEC 60679-1:2017, 3.2.33]

3.16
harmonic distortion
non-linear distortion characterized by the generation of undesired spectral components harmonically related to the desired signal frequency

Note 1 to entry: Each harmonic component is usually expressed as a power ratio (in decibels) relative to the output power of the desired signal.

Note 2 to entry: The test procedure is provided in 4.5.15 of IEC 62884-1:2017.

[SOURCE: IEC 60679-1:2017, 3.2.44]