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INTERNATIONAL STANDARD

Measurement and test methods for tuning fork quartz crystal units in the range from 10 kHz to 200 kHz and standard values

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MEASUREMENT AND TEST METHODS FOR TUNING FORK QUARTZ CRYSTAL UNITS IN THE RANGE FROM 10 kHz TO 200 kHz AND STANDARD VALUES

FOREWORD

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International Standard IEC 60689 has been prepared by IEC technical committee 49: Piezoelectric and dielectric devices for frequency control and selection.

This second edition cancels and replaces the first edition published in 1980. This edition constitutes a technical revision.

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

a) The title of the first edition is *Measurements and test methods for 32 kHz quartz crystal units for wrist watches and standard values*. The title is modified and the frequency range of this second edition is extended to the range from 10 kHz to 200 kHz.
b) The Lissajous method is defined in the first edition as the standard measurement method. The PI network and bridge method are used in this second edition.
c) The PI network has a transformer for impedance matching. This composition differs from that of IEC 60444-1.

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

FDIS	Report on voting
49/809/FDIS	49/815/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 maintenance result date indicated on the IEC web site 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- withdrawn;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.

A bilingual version of this publication may be issued at a later date.

MEASUREMENT AND TEST METHODS FOR TUNING FORK QUARTZ CRYSTAL UNITS IN THE RANGE FROM 10 kHz TO 200 kHz AND STANDARD VALUES

1 Scope

This International Standard applies to measurements and test methods for tuning fork quartz crystal units in the range from 10 kHz to 200 kHz and standard values for frequency control and selection.

2 Normative references

The following referenced documents are indispensable for the application 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 – Chapter 561: Piezoelectric devices for frequency control and selection*

IEC 60122-1, *Quartz crystal units of assessed quality – Part 1: Generic specification*

IEC 60122-3, *Quartz crystal units of assessed quality – Part 3: Standard outlines and lead connections*

IEC 60444 (series), *Measurement of quartz crystal unit parameters by zero phase technique in a π-network*

IEC 60617, *Graphical symbols for diagrams*

ISO 1000:1992, *SI units and recommendations for the use of their multiples and certain other Units*

3 Overview

3.1 General

Units, graphical symbols, letter symbols and terminology shall, wherever possible, be taken from the following standards: IEC 60027, IEC 60050-561, IEC 60122-1, IEC 60617, and ISO 1000.

3.2 Applied frequency range

The frequency range is from 10 kHz to 200 kHz.

3.3 Measurement method

The measurement method is according to the IEC 60444 series.

It is permitted to use the bridge method as a simple measuring method.

NOTE Other methods like Lissajous-or oscillator methods are not recommended for measurement of equivalent circuit constants.

3.4 Load capacitance

Currently, defined values of load capacitance are 8 pF, 10 pF, 12 pF, 15 pF, 20 pF and 30 pF.

3.5 Recommended drive level

Currently, the recommended drive level is 0,1 μW.

3.6 Measurement conditions

Measurement conditions are given in 5.2.

3.7 Measurement of frequency-temperature characteristics

The measurement of frequency-temperature characteristics is given in Clause 5.

3.8 Load capacitance frequency characteristics

The present conditions of load capacitance and frequency characteristics are given in 5.3.4.

4 Measurement methods

4.1 Method A

The measurement method according to the IEC 60444 series gives a copy of a block diagram (including a load capacitance), test fixture (for Surface Mounted Device-units included) with additional values of the resistances for high impedance value (standard PI-network 25 Ω) and hardware requirements for a frequency range from 10 kHz to 200 kHz.

This measuring method is a standard measuring method in this document.

4.1.1 Vector network analyzer/vector impedance analyzer

The measurement method using the vector network analyzer or vector impedance analyzer is based on the following method.

4.1.2 Block diagram

Figure 1 is a block diagram of the measurement method using the vector network analyzer or vector impedance analyzer.

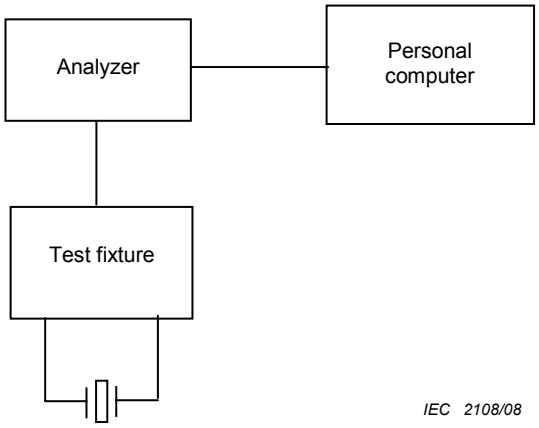

Figure 1 – Block diagram of the measurement method using the vector network analyzer or vector impedance analyzer

4.1.3 Specifications for vector network analyzer/vector impedance analyzer

Specifications for vector impedance analyzer are shown in Table 1.

Table 1 – Specifications for vector network analyzer/vector impedance analyzer

Item	Specifications
Frequency range	The measurement range of equipment shall be from 10 kHz to 200 kHz.
Frequency accuracy	1×10^{-6}
Series resistance accuracy	1 %
Signal level adjusted range	5 mV_{rms} – 1V_{rms} or 200 μA_{rms} – 20 mA_{rms}
Spurious	40 dB max.
Others	RC23C, LAN, etc.

4.1.4 Test fixture

A test fixture shall be used. This test fixture shall be electrically and mechanically compatible with the vector network analyzer or the vector impedance analyzer that is used.

Figures 2 and Figure 3 show the block diagrams of the equivalent circuit of the test fixture.