SLOVENSKI STANDARD
SIST EN 60444-4:2002

01-september-2002

Measurement of quartz crystal unit parameters by zero phase technique in a pi-network - Part 4: Method for the measurement of the load resonance frequency fL, load resonance resistance RL and the calculation of other derived values of quartz crystal unit (IEC 60444-4:1988)

Measurement of quartz crystal unit parameters by zero phase technique in a pi-network -- Part 4: Method for the measurement of the load resonance frequency fL, load resonance resistance RL and the calculation of other derived values of quartz crystal units, up to 30 MHz

Messung von Schwingquarz-Parametern nach dem Null-Phasenverfahren in einem Pi-Netzwerk -- Teil 4: Verfahren zur Messung der Lastresonanzfrequenz fL, des Lastresonanzwiderstandes RL und Berechnung anderer hergeleiteter Werte von Schwingquarzen bis 30 MHz

Mesure des paramètres des quartz piézoélectriques par la technique de phase nulle dans le circuit en pi -- Partie 4: Méthode pour la mesure de la fréquence de résonance à la charge fL et de la résistance de résonance à la charge RL et pour le calcul des autres valeurs dérivées des quartz piézoélectriques, jusqu'à 30 MHz

Ta slovenski standard je istoveten z: **EN 60444-4:1997**

ICS:

31.140	Piezoelektriļ ne in dielektriļ ne naprave	Piezoelectric and dielectric devices

SIST EN 60444-4:2002 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60444-4

April 1997

ICS 31.140

Descriptors: Quartz crystal units, measurement of parameters, zero phase technique in a pi-network, load resonance frequency and resistance, measuring circuit, method of measurement

English version

Measurement of quartz crystal unit parameters by zero phase technique in a pi-network
Part 4: Method for the measurement of the load resonance frequency f_L, load resonance resistance R_L and the calculation of other derived values of quartz crystal units, up to 30 MHz
(IEC 444-4:1988)

Mesure des paramètres des quartz piézoélectriques par la technique de phase nulle dans le circuit en pi
Partie 4: Méthode pour la mesure de la fréquence de résonance à la charge f_L et de la résistance de résonance à la charge R_L et pour le calcul des autres valeurs dérivées des quartz piézoélectriques, jusqu'à 30 MHz
(CEI 444-4:1988)

Messung von Schwingquarz-Parametern nach dem Null-Phasenverfahren in einem Pi-Netzwerk
Teil 4: Verfahren zur Messung der Lastresonanzfrequenz f_L, des Lastresonanzwiderstandes R_L und Berechnung anderer hergeleiteter Werte von Schwingquarzen bis 30 MHz
(IEC 444-4:1988)

This European Standard was approved by CENELEC on 1997-03-11. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of the International Standard IEC 444-4:1988, prepared by IEC TC 49, Piezoelectric and dielectric devices for frequency control and selection, was submitted to the formal vote and was approved by CENELEC as EN 60444-4 on 1997-03-11 without any modification.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1997-12-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annex A is informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 444-4:1988 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 122-1	1976	Quartz crystal units for frequency control and selection Part 1: Standard values and test conditions	-	-
A1	1983		-	-
IEC 122-2	1983	Part 2: Guide to the use of quartz crystal units for frequency control and selection	-	-
IEC 302	1969	Standard definitions and methods of measurement for piezoelectric vibrators operating over the frequency range up to 30 MHz	-	-
IEC 444-1	1986	Measurement of quartz crystal unit parameters by zero phase technique in a pi-network Part 1: Basic method for the measurement of resonance frequency and resonance resistance of quartz crystal units by zero phase technique in a pi-network	EN 60444-1	1997
IEC 444-2	1980	Part 2: Phase offset method for measurement of motional capacitance of quartz crystal units	EN 60444-2	1997

RAPPORT TECHNIQUE

TECHNICAL REPORT

CEI
IEC
60444-4

Première édition
First edition
1988-06

Mesure des paramètres des quartz piézoélectriques par la technique de phase nulle dans le circuit en π

Partie 4: Méthode pour la mesure de la fréquence de résonance à la charge f_L et de la résistance de résonance à la charge R_L et pour le calcul des autres valeurs dérivées des quartz piézoélectriques, jusqu'à 30 MHz

Measurement of quartz crystal unit parameters by zero phase technique in a π-network

Part 4: Method for the measurement of the load resonance frequency f_L, load resonance resistance R_L and the calculation of other derived values of quartz crystal units, up to 30 MHz

International Electrotechnical Commission
3, rue de Varembé Geneva, Switzerland
Telefax: +41 22 919 0300
e-mail: inmail@iec.ch
IEC web site http: //www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE
M

Pour prix, voir catalogue en vigueur
For price, see current catalogue

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MEASUREMENT OF QUARTZ CRYSTAL UNIT PARAMETERS BY ZERO PHASE TECHNIQUE IN A π-NETWORK

Part 4: Method for the measurement of the load resonance frequency f_L, load resonance resistance R_L and the calculation of other derived values of quartz crystal units, up to 30 MHz

FOREWORD

1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This report has been prepared by IEC Technical Committee No. 49: Piezoelectric Devices for Frequency Control and Selection.

It forms Part 4 of the series of IEC publications on phase measuring methods and contains the method for the measurement of load resonance frequency f_L, load resonance resistance R_L of quartz crystal units and for the calculation of load resonance frequency offset Δf_L, frequency pulling range $\Delta f_{L1, L2}$ and pulling sensitivity S up to 30 MHz.

Part 1, containing a basic method for the measurement of resonance frequency and resonance resistance of quartz crystal units by zero phase technique in a π-network, is issued as IEC Publication 444-1 (second edition, 1986).

Part 2, containing a phase offset method for the measurement of motional capacitance of quartz crystal units, is issued as IEC Publication 444-2 (first edition, 1980).

Part 3, containing a basic method for the measurement of two-terminal parameters of quartz crystal units up to 200 MHz by the phase technique in a π-network with compensation of the parallel capacitance C_o, is issued as IEC Publication 444-3 (first edition, 1986).

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

Six Months' Rule	Report on Voting	Two Months' Procedure	Report on Voting
49(CO)156	49(CO)175	49(CO)178	49(CO)183, 183A

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

The following IEC publications are quoted in this report:

Publications Nos. 122-1 (1976): Quartz crystal units for frequency control and selection. Part 1: Standard values and test conditions. Including Amendment No. 1 (1983).

122-2 (1983): Part 2: Guide to the use of quartz crystal units for frequency control and selection.

302 (1969): Standard definitions and methods of measurement for piezoelectric vibrators operating over the frequency range up to 30 MHz.

444-1 (1986): Measurement of quartz crystal unit parameters by zero phase technique in a π-network. Part 1: Basic method for the measurement of resonance frequency and resonance resistance of quartz crystal units by zero phase technique in a π-network.

444-2 (1980): Part 2: Phase offset method for measurement of motional capacitance of quartz crystal units.

MEASUREMENT OF QUARTZ CRYSTAL UNIT PARAMETERS BY ZERO PHASE TECHNIQUE IN A π-NETWORK

Part 4: Method for the measurement of the load resonance frequency f_L, load resonance resistance R_L and the calculation of other derived values of quartz crystal units, up to 30 MHz

---

1. Scope

This report specifies a simple method of measuring load resonance frequency f_L and load resonance resistance R_L in the frequency range up to 30 MHz. These measurements allow calculation of load resonance frequency offset Δf_L, frequency pulling range $\Delta f_{L1, L2}$ and pulling sensitivity S as described in Amendment No. 1 to IEC Publication 122-1.

The method uses the change in resonance frequency from f_r to f_L (i.e. Δf_L) which occurs when a load capacitance C_L is inserted in series with the crystal unit. The accuracy is determined mainly by the precision of the frequency measurement and the calibration of the load capacitor.

Measurement of load resonance frequency f_L with different load capacitances may be used for the determination of C_1 and L_1 as defined in IEC Publication 302.

It should be noted that when making measurements of the load resonance frequency of a quartz crystal unit, the accuracy obtainable is a function of the crystal unit design and the value of the load capacitance, as well as the method of measurement.

Useful information of general interest can be found in IEC Publication 122-2.

2. Measuring circuit

2.1 The measuring circuit consists of a zero phase π-network system as described in IEC Publication 444-1, in which a calibrated load capacitor can be inserted between the crystal unit terminals and the contact plates of the π-network, to obtain a specific load capacitance.

The load capacitors shall be removable and interchangeable, so that the measurements at resonance or at load resonance with one or more values of load capacitance can be made in the same network, without disturbing the measurement system.

2.2 An outline description of a typical design for the load capacitor and the method of insertion into the π-network together with measurement errors is given in Appendix A.

2.3 *Load capacitor specification*

2.3.1 The residual inductance of the load capacitors shall be less than 1×10^{-9} H.

2.3.2 The tolerance on the specified nominal value should be equal to or better than ± 0.1 pF at a frequency up to 1 MHz.

2.3.3 The cross-talk capacitance of the load capacitors shall be less than 0.05 pF. This can be measured as described in Appendix A.

2.3.4 The temperature coefficient at 25 °C shall be less than 30×10^{-6}/°C.