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Test-fixture of surface mounting quartz crystal units

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ELECTROTECHNICAL
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電子情報通信学会規格
The Institute of Electronics, Information and Communication
Engineers Standard

Test-fixture of Surface Mounting Quartz
Crystal Units

表面実装水晶振動子の測定用具基準

IEICE/Std-0003

2001 年 2 月
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The Institute of Electronics, Information and
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

TEST-FIXTURE OF SURFACE MOUNTING
QUARTZ CRYSTAL UNITS

FOREWORD

A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public and established in an organization operating under given procedures.

IEC-PAS 62277 was submitted by the Japanese Institute of Electronics, Information and Communication Engineers and has been processed by IEC technical committee 49: Piezoelectric and dielectric devices for frequency control and selection.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document.

Draft PAS	Report on voting
49/505/PAS	49/514/RVD

Following publication of this PAS, the technical committee or subcommittee concerned will investigate the possibility of transforming the PAS into an International Standard.

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FOREWORD

The role of the communication systems is becoming greater and greater in the recent information age. Mobile communication systems are bursting globally and small quartz crystal resonators with high frequency stability are playing very important roles as key components in such communication systems. This comes from the fact that the crystal resonators can reduce the size of oscillators and filters drastically. Recently, the leadless crystal resonators are widely used for further miniaturization.

International Electrotechnical Commission located in Geneva is actively working for the international standardization in the electrotechnical field. Among many Technical Committees (TCs) in IEC, TC 49 is working on the Piezoelectric and Dielectric Devices for Frequency Control and Selection. TC 49 has ten Working Groups (WGs), and the Working Group 6 (WG 6) is working for the preparation and deliberation of the IEC standard on the measurement method for crystal resonators.

This document is a standard for the test-fixture of surface mounting quartz crystal units and should be issued as IEC 60444-4 amendment 1: Standard for the Test-fixture with Load-capacitance of Surface Mounting Quartz Crystal Units, and IEC 60444-4: Standard for the Test-fixture of Surface Mounting Quartz Crystal Units, as amendments of IEC Publication 60444-4: 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. The Japanese National Committee for IEC/TC 49 proposed new work item proposals for these documents. These proposals, however, were not approved, because only two countries; Germany and Japan, nominated experts to participate in these projects. According to the IEC rule for the New Work Items Proposal, it is required that four P-member countries should nominate the name of experts and these proposals failed. But, the Japanese National Committee for IEC/TC 49 decided to continue the work to draft these standards, even though they were not approved, because these standards are very fundamental, useful and mandatory documents in the field of crystal resonators, and asked the Measurement Method Working Group of the Quartz Industry Association of Japan. The Working Group has completed a document "Standard for the Test-fixture of Surface Mounting Quartz Crystal Units" merging two documents into one. Now, this document is published as a standard of the Institute of Electronics, Information and Communication Engineers.

This standard is a product of collected wisdom in the field of advanced technology in Japan and it is open to the public as a standard of the Institute of Electronics, Information and Communication Engineers. And it is expected that this standard will contribute to the development of technology in this fast growing field. This standard will be submitted to the IEC in the track of IEC PAS (Publicly Available Specification) for international circulation.

Finally, I would like to express my sincere appreciation to Dr. Mitsuaki Koyama, Chairman, and all members of the Measurement Method Working Group of the Quartz Industry Association of Japan for their efforts develop this standard.

Mikio Takagi

Chairman

The Japanese National Committee for IEC/TC 49
in the Standard Committee of the Institute of
Electronics, Information and Communication Engineers.

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Standard for the Test-fixture of Surface Mounting Quartz Crystal Units

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Standard for the Test-fixture of Surface Mounting Quartz Crystal Units

1. Introduction

This standard is only for the test-fixture applied to leadless surface mounting quartz crystal units. The document is the specification for the test-fixture [1] that allows the accurate measurement of resonance frequency, resonance resistance, and electrical equivalent circuit constants of leadless surface mounting quartz crystal units. Measurement method using an automatic network analyzer is based on IEC 60444 [2] and IEC 60444-5 [3].

The measuring frequency range is from 1 MHz to 150 MHz when the load capacitance is not used, and is from 1 MHz to 30 MHz when the load capacitance is used. The use of the test-fixture with the measurement method yields measurement accuracy about 10^{-6} over the range of the frequency range. And, the accuracy for resonance resistance is ± 2 ohm or ± 10 %.

2. Scope

This document describes the test-fixture that allows the accurate measurement of resonance frequency, resonance resistance, and electrical-equivalent-circuit constants of a leadless surface mounting quartz crystal units using the zero phase technique as specified in IEC 60444-4 [4] and IEC 60444-5. Then, an equivalent circuit constant and the application frequency range obtained by using the test-fixture are shown. In addition, this is applied to Enclosure shown with IEC 61240 [5] as crystal unit with no lead wire. An equivalent circuit of the test-fixture and an electric value are based on IEC 60444-1 [6] and IEC 60444-4. The range of load capacitance is 7 pF for 1 ppm accuracy or more. The calibration of measurement system and C_L adapter board is explained.

3. Application

This document shall be applied to the test-fixture that allows the accurate measurement of resonance frequency, resonance resistance, parallel capacitance C_0 , motional capacitance C_1 , and motional inductance L_1 of the crystal unit over the frequency range of 1 MHz to 30 MHz using an automatic network analyzer, based on IEC 60444-5.

4. General issue

The test-fixture and the method for measuring the resonance frequency, resonance resistance, and electrical-equivalent-circuit constants may be specified in the contract between the unit supplier and the user. The leadless crystal unit requires special consideration.

5. Leadless surface mounting quartz crystal units

5.1 Enclosure

No particular specification shall be made regarding the holder type. However, it is recommended those shown in IEC 61240 show be used.

5.2 Overtone and frequency range

No particular specification shall be made regarding the overtone. The frequency range is from 1 MHz to 150 MHz when the load capacitance is not used, and is from 1 MHz to 30 MHz when the load capacitance is used.

6. Specifications of measurement method, test-fixture

6.1 Specifications of measurement method

The measurement method is according to IEC 60444-5, using the admittance circle technique.

6.2 Specifications of test-fixture

An equivalent circuit of the test-fixture and an electric value are based on IEC 60444-1. The size and the structure are different in this proposal from IEC 60444-1. The size and the structure are more suitable for leadless crystal unit.

The test-fixture configuration is as specified in IEC 60444-1. Figure 1 and figure 2 shows the edge view, but maximum circuit stray capacitance (0.5 pF) between measurement terminals such as Ct1, Ct2 in Figure 1 of IEC 60444-1 are not specified. Figure 3 and figure 4 show a suggested 3-D view and dimensions for the test-fixture. Figure 5 is structure of the test-fixture. A mini-contact force of 2 N is required to ensure satisfactory connection.

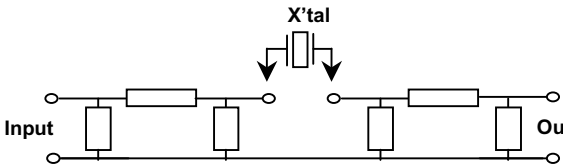


Figure 1 Equivalent circuit of the test fixture

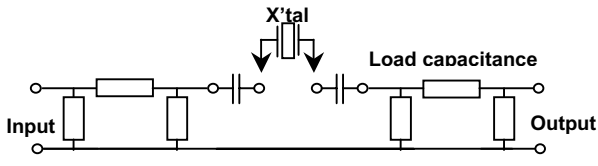


Figure 2 Equivalent circuit of the test fixture with load capacitance

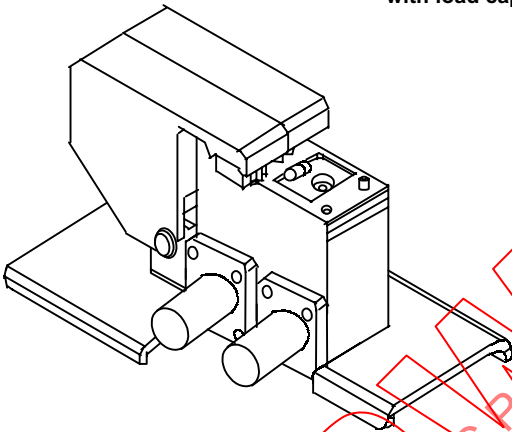


Figure 3 3-D for the test fixture

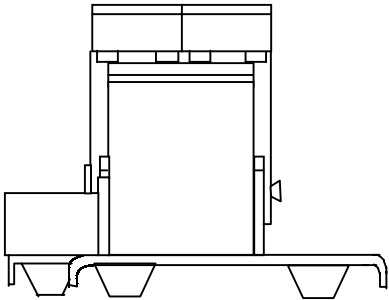
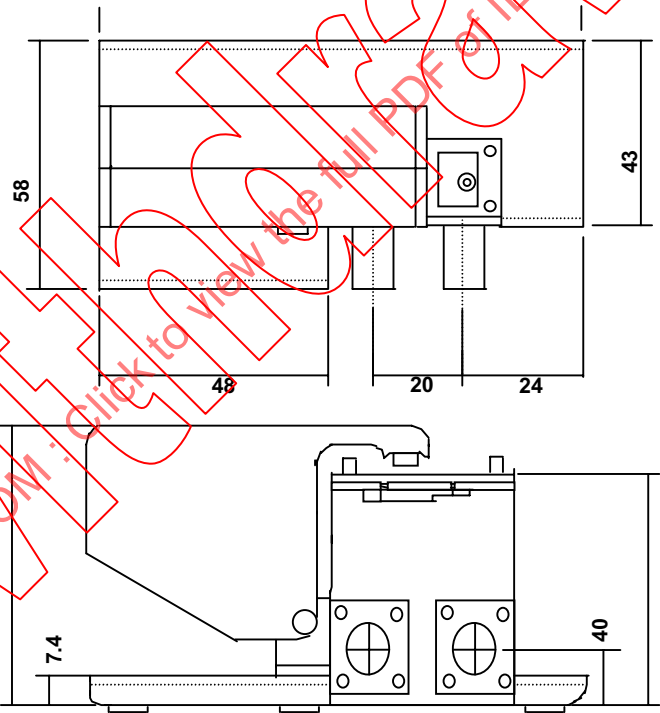


Figure 4 Design for the test fixture

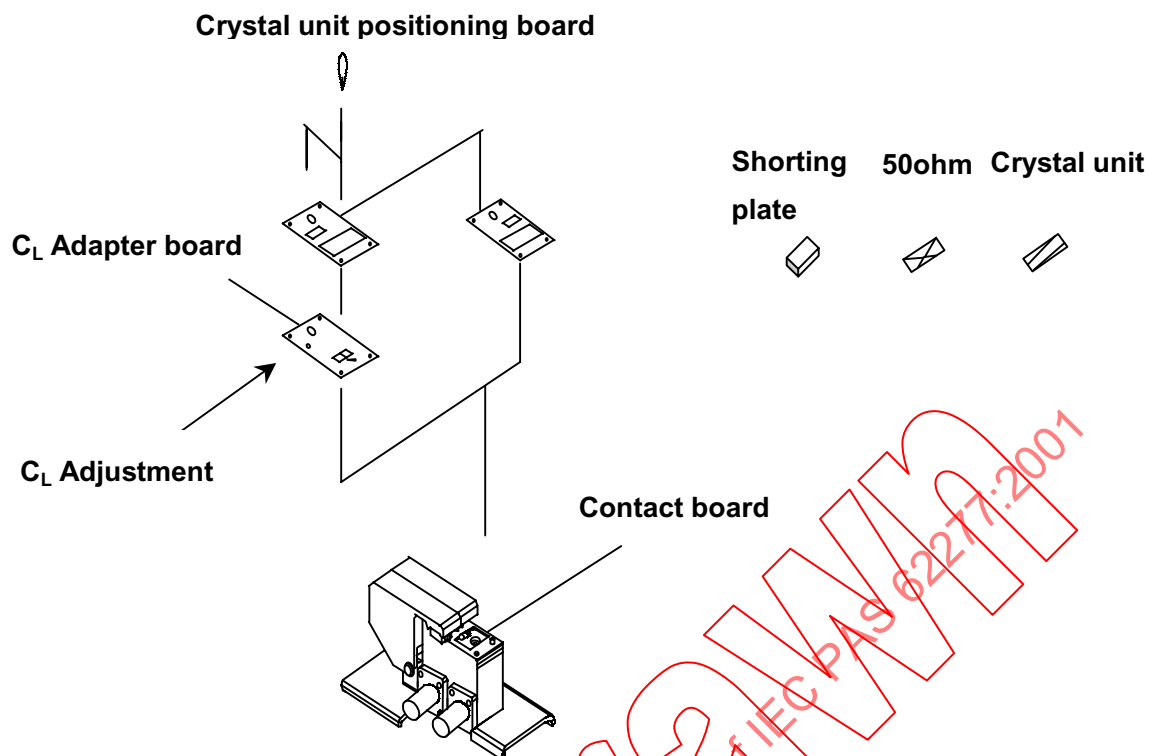


Figure 5 Structure of the test fixture

7. Calibration of measurement system and CL adapter board

7.1 Calibration of measurement system

The user must utilize at least 3 reliable standard impedance elements for calibration. Those are short circuit element, open and 50 ohm standard resistance. If there is significant stray capacitance between the measurement terminals of the measuring instrument, open calibration is necessary. The accuracy is as skit IEC 60444-5.

7.2 Calibration of CL adapter board

A capacitance meter is used for the calibration of CL adapter board. The permissible value is ± 0.002 pF.