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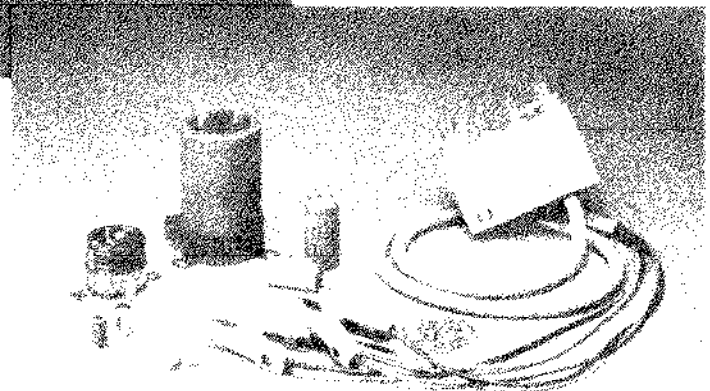
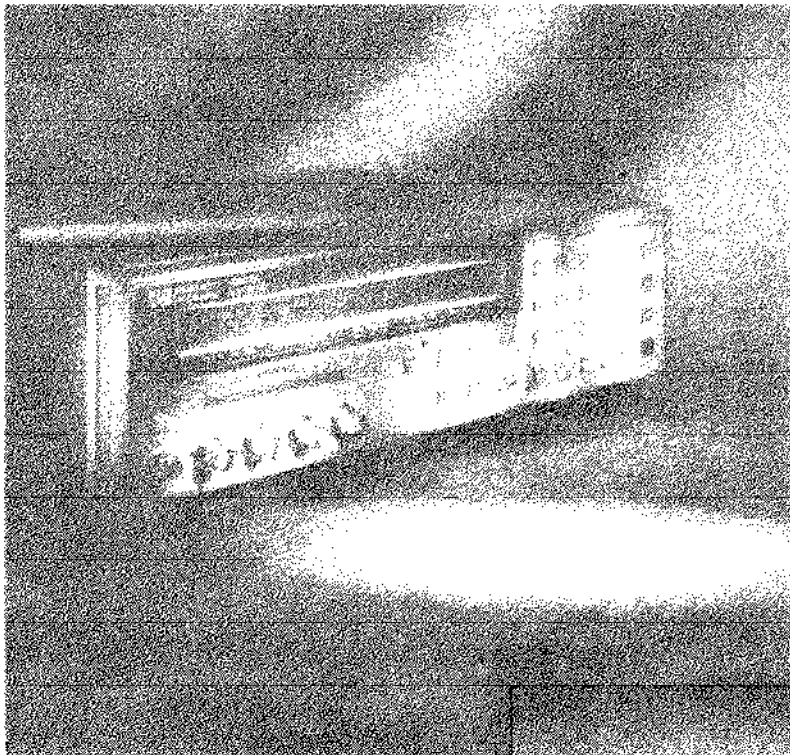
# Effective Electrolytic Capacitors Testing

Application Note 1224-4

HP 4263A

LCR Meter

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## INTRODUCTION

With increased requirements for size reduction and higher reliability design, it is becoming necessary to evaluate electrolytic capacitors employed in electronic equipment. Production volume has been increasing for circuit applications. Manufacturing and QA now have to improve their testing of electrolytic capacitors. Here are the solutions offered by the HP 4263A LCR Meter to meet these measurement requirements.

## CURRENT PROBLEMS IN ELECTROLYTIC CAPACITORS EVALUATION

When making electrolytic capacitor measurements using conventional LCR meters, there are quite a few shortcomings.

(1) Impedance value of the electrolytic capacitors is usually so low that an accurate measurement would be hard to be achieved. Some LCR meters cannot measure above 20 mF due to the lack of the measurement range.

(2) Electrolytic capacitors are currently tested at 100 Hz or 120 Hz. The measurement speed at those frequencies is quite slow, and higher throughput cannot be achieved by automatic measurement systems.

(3) When a charged capacitor is connected to the measurement terminals of the LCR meters, the circuit is easily damaged by the discharge energy.

(4) When a shorted device is measured, the internal circuit of a conventional LCR meter is

latched up, and it needs a long recovery time.

(5) Some low cost LCR meters do not range up to 100 kHz, and the equivalent series resistor of the electrolytic capacitors need to be evaluated at 100 kHz.

(6) Most LCR meters cannot detect whether or not the contact between the fixture's electrodes and the device's electrode is good, thus decreasing the reliability of a measurement.

(7) There are no test fixtures for the terminals (for example, big screw electrodes) of the big electrolytic capacitors.

## HP 4263A LCR METER SOLUTION

### (1) Accurate Low Impedance Measurement

The HP 4263A LCR Meter employs a 4-terminal pair configuration and an advanced low noise design so that it makes accurate measurements up to 1 F. For example, when 10 mF is measured at 120 Hz, the HP 4263A's accuracy, 0.57% can be achieved. Also, the measurement cable can be extended up to 4 m while maintaining the measurement accuracy.

### (2) High System Throughput

The measurement speed of the HP 4263A LCR Meter at 100 Hz/120 Hz is 25 ms (Meas.Time: SHORT). This is approximately 6 times as fast as the HP 4276A. Furthermore, the fluctuation of the accuracy of the measurement values is much greater. Figure 1 shows you the fluctuation of the 22 mF Aluminum Electrolytic Capacitor Measurement by SHORT mode, and 120 Hz of the HP 4263A.

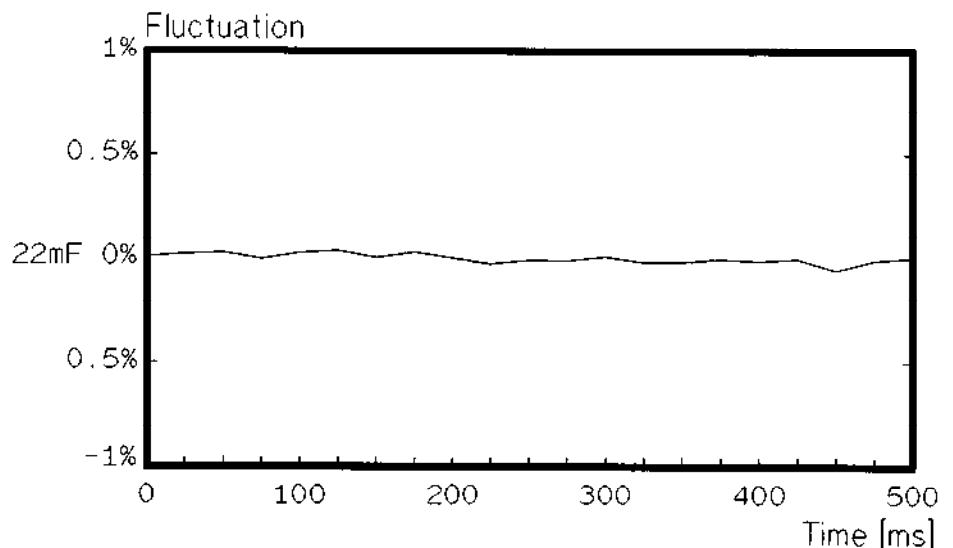


Figure 1. Fluctuation of the measurement value at SHORT

In addition, the HP 4263A has the following features which make for easy system integration, and improve measurement throughput.

- \* HP-IB Interface
- \* Handler Interface
- \* Built-in Comparator
- \* Trigger Delay Function

The HP 4263A, also, has miniaturized for the contribution of the system downsizing (320 (W) x 100 (H) x 300 mm (D), 4.5 kg).

### (3) Input Protection

The HP 4263A input protection is improved over existing products. When a charged capacitor (250 V, 120  $\mu$ F) is connected to the UNKNOWN terminals, the HP 4263A can stand its discharge energy (4J) so that the front panel terminals are not damaged.

### (4) Quick Recovery for shorts

The quick recovery system of the HP 4263A improves throughput. Normal operation is resumed the instant a shorted DUT is removed from the handler, so the handler can always be operated at its full speed so only good DUT's are retained.

### (5) Wide Frequency Range

The HP 4263A has 5 selectable frequencies that allow you to simulate testing under the correct conditions: 100, 120, 1 k, 10 k, and 100 kHz. ESR can be evaluated at 100 kHz. 20 kHz might be required for testing aluminum electrolytic capacitors used in switching power supply circuits. When Option 002 is installed, 20 kHz is added to the other 5 test frequencies.

### (6) Contact Check Function

The HP 4263A LCR meter has a contact check function which checks contact conditions between the test terminals and the electrodes of the device shown in Figure 2. This function ensures the reliability of the PASS/FAIL testing in the automatic handlers in production.

### (7) Various Test Fixtures

The HP 4263A employs the 4-terminal pair configuration. You can choose from many types of the 4-terminal pair test fixtures shown in Figure 3. The HP 16089A Kelvin Clip Leads has two large clips which can accept device electrodes with a diameter of 15 mm. Figure 4 shows a big capacitor measurement using the HP 16089A.

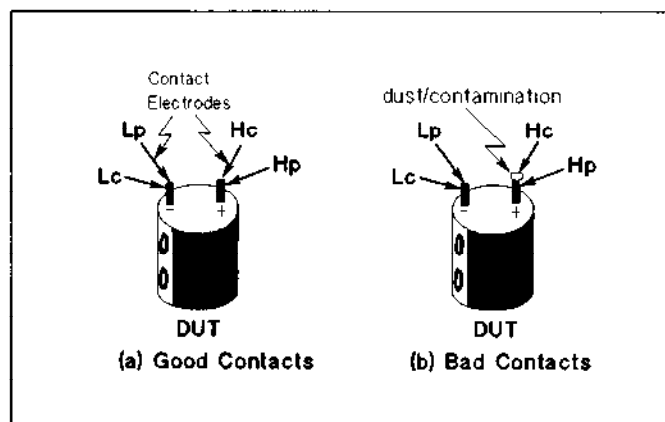


Figure 2. Contact Check Function

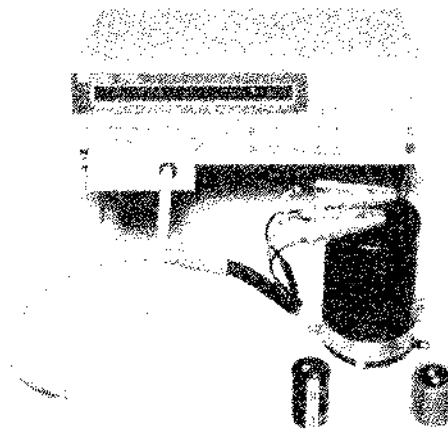


Figure 4. Big Electrodes Electrolytic Capacitors Measurement using the HP 16089A

For more information call your local HP sales office listed in your telephone directory or an HP regional office listed below for the location of your nearest sales office.

**United States:**  
Hewlett-Packard Company  
4 Choke Cherry Road  
Rockville, MD 20850

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Rolling Meadows, IL 60008

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2015 South Park Place  
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29-21, Takaido-Higashi 3-chome  
Suginami-ku, Tokyo 168

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Latin American Region Headquarters  
Monte Pelvoux Nbr. 111  
Lomas de Chapultepec  
11000 Mexico, D.F. Mexico

## CONCLUSION

The HP 4263A is a compact LCR Meter which maintains a high measurement speed (25 ms) with high accuracy at 100 Hz/120 Hz. The input protection circuit prevents charged capacitors from damaging the front panel circuitry. Therefore the HP 4263A offers more stable and reliable electrolytic capacitor testing.

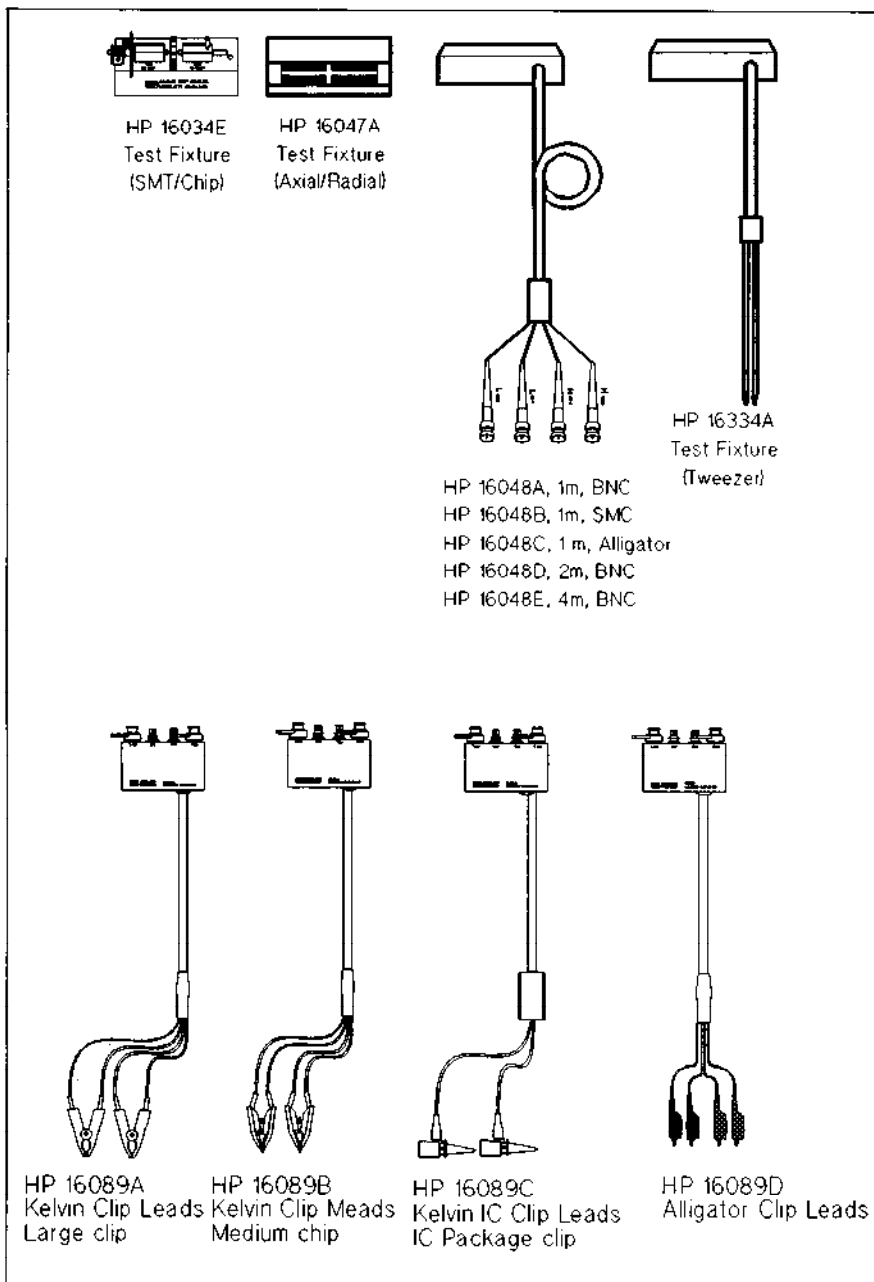


Figure 3. Major 4-terminal Pair Fixtures