



## Characterizing Electromagnetic MEMS Optical Switch Actuators Using the Agilent E4980A Precision LCR Meter

- Application Note
- ▶ Exceptional accuracy and repeatability
  - ▶ Impedance and DC resistance measurements (Option 001)
  - ▶ High test throughput with scanner interface (Option 301)



Figure 1. Agilent E4980A Precision LCR Meter



## Introduction

This application brief describes how the Agilent E4980A improves the test efficiency of electromagnetic MEMS optical switch actuators.

## Agilent E4980A Precision LCR Meter

The Agilent E4980A Precision LCR Meter, with extremely high accuracy and speed, is the ideal tool for research and development, as well as manufacturing test.

## Electromagnetic MEMS Optical Switch Actuators

For MEMS optical switches as well as other devices, the electromagnetic actuator is often used as the actuator of the movable part. A micro coil and magnetic material operate the object. The basic principal of operation is the same as that of a mechanical relay.

## High-Accuracy Measurement of Switch Actuator Coil Inductance

Characteristic of a coil can be obtained by measuring its impedance, the electric characteristic of a coil. As DC is used for the coil in a switch, inductance and DC resistance are the important parameters. As the coil of the electromagnetic MEMS optical switch is created by micromachining, precise measurements are required to determine its characteristics. Measurement of impedance, therefore, requires an instrument with high measurement accuracy and repeatability.

The Agilent E4980A Precision LCR Meter, which provides 0.05% basic impedance accuracy and superior repeatability, is ideal for evaluating the impedance of a MEMS electromagnetic actuator.

## Simultaneous Measurements of DC Resistance and Inductance

One of the most important parameters of the coil is DC resistance. In addition, the failure mode of the switch actuator coil is generally open and DC resistance measurement is helpful to detect that failure. The DC resistance meter, however, can measure only DC resistance and to evaluate inductance, another measurement instrument is required. The Agilent E4980A is a compact solution and with Option 001, also provides the DC measurement capability. Simultaneous measurements of inductance and DC resistance ( $L_s-R_{dc}$ ) can be performed without re-routing AC and DC test signals to different instruments.

## High-Speed Measurement Maximizes Manufacturing Test Throughput

Throughput is always a major issue in the manufacturing test process. The Agilent E4980A Precision LCR Meter achieves a measurement speed that is five times as fast as the legacy Agilent 4284A, which improves test productivity in both design and manufacturing. In addition, the 128-channel scanner interface option (Figure 2) maximizes the test throughput without sacrificing the measurement accuracy. The instrument has all compensated data up to 128 channels so it can quickly get the corrected measured data inside the instrument. This also dramatically improves the total throughput because users will not need to take extra time transferring measured data and corrected data back and forth between an external controller and the instrument.

## Summary

The Agilent E4980A Precision LCR Meter, which provides highly accurate, repeatable, and high-speed measurements, is the ideal measurement instrument for testing MEMS electromagnetic actuators. Using the DC parameter measurement function (Option 001) and 128-channel scanner interface (Option 301) together can improve test productivity in both design and manufacturing.

For more information, please refer to the following literature and websites:

- ▶ Agilent E4980A Brochure (P/N 5989-4235EN)
- ▶ Agilent E4980A Data Sheet(P/N 5989-4435EN)
- ▶ Agilent Technologies Impedance Measurement Handbook (P/N 5950-3000)
- ▶ MEMS/NEMS Device Measurement Solution: [www.agilent.com/find/mems](http://www.agilent.com/find/mems)
- ▶ Agilent E4980A Precision LCR Meter: [www.agilent.com/find/e4980a](http://www.agilent.com/find/e4980a)



Figure 2. Agilent E4980A scanner interface

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