



Agilent AN 1305-1

Contact Resistance and Insulation Resistance Measurements of Electro-Mechanical Components

Application Note

Agilent 4338B Milliohm Meter and 4339B High Resistance Meter



Introduction

With increased requirements for size reduction and higher reliability design standards, it has become necessary to evaluate the contact resistance and insulation resistance of electro-mechanical components such as relays, switches, and connectors, employed in electronic equipment. We will discuss the solutions offered by the Agilent Technologies 4338B milliohm meter and the 4339B high resistance meter which let these measurement requirements be realized.

Contact Resistance Measurement

1. It is troublesome to determine the proper measurement range for a device whose value is unknown.
2. The device can't be evaluated at its actual working level (e.g., $1 \mu\text{A}$) because the test signal level is a function of the measurement range selected.
3. It's impossible to measure high valued contact resistance (e.g., 500Ω of the rubber key).
4. Total throughput isn't improved, due to the slow measurement speed and inadequate control interfacing to available automatic handlers.
5. Existing test fixtures can't be used to measure small and large diameter lead components.

Agilent 4338B Solution

1. Auto measurement function

The Agilent 4338B has an auto measurement function which allows you to automatically select the range and test current. So you can obtain measurement results just by pressing the "Auto Meas" key, even if a device's resistance value is unknown.



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2. Five selectable test currents

The 4338B can be set to one of five selectable test signal levels (1 μ A, 10 μ A, 100 μ A, 1 mA, 10 mA) independent of the measurement range selected.¹ So you can measure a device under its actual operating conditions.

3. Wide measurement range

The 4338B has a wide measurement range from 10 $\mu\Omega$ to 100 k Ω , and it can evaluate from the ultra low resistance typical of a connector to the high valued contact resistance typical of rubber key.

4. Higher throughput

The 4338B's measurement speed is 34 ms (in the SHORT integration time mode). In addition, the 4338B has a built-in comparator function (HI/IN/LO), and a handler interface which makes for easy system integration, and effectively realizes higher throughput.

5. Various types of test fixtures available

There are various types of test fixtures available for the 4338B, as listed in Table 1. Especially important for the increasingly used narrow pitch components, connectors, and micro switches, the 16005-60012/14 IC clip leads offers the measurement solution.

Table 1. Agilent 4338B Fixtures

Agilent 16338A	Test Lead Set
Agilent 16143-60011	Mating Cable
Agilent 16005-60011	Kelvin Clip
Agilent 16005-60012/14	Kelvin IC Clip
Agilent 16006-60001	Pin Probe
Agilent 16007-60001/2	Alligator Clip

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Insulation Resistance Measurement

Current problem

1. The DC charge time for a device must be measured using a clock, and the time measurement accuracy is dependent on the operator.
2. The measurement result is unstable and can easily be affected by external noise.
3. There are no test fixtures available for measuring the insulation resistance of small components.

Agilent 4339B Solution

1. Test sequence program

The Agilent 4339B has a test sequence program which allows you to automatically perform the required sequential measurement steps, charge/measure/discharge, by entering the measurement requirements for each step.

2. Stable measurement

The 4339B's triaxial input terminal configuration offers stable measurement by minimizing the influence of external noise. More stable measurement results can be obtained using the averaging function (averaging factors of 1 through 256).

Table 2. Agilent 4339B Fixtures

Agilent 16339A	Component Test Fixture (SMD, Axial, Discrete Comp.)
Agilent 16117B	Low Noise Test Leads (Alligator)
Agilent 16117C	Low Noise Test Leads (Handmade)
Agilent 16118A	Tweezer Test Fixture



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3. Variety of test fixtures available

There are new test fixtures for the 4339B, as listed in Table 2.

Conclusion

The combined use or solitary use of the Agilent 4338B milliohm meter and the 4339B high resistance meter offers you the further improvements in measurement and testing reliability and efficiency for electro-mechanical component evaluation.

1. The measurement range for each level has limitations.

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