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The Sencore Z-Meter – the Gold Standard

Gold, the most precious of metals, symbolizes great value and performance. For example, the Olympic gold metal is awarded to the highest achiever, the one who performs above all the competition. In the field of capacitor and inductor testing, the Sencore Z-Meter gets the gold! Here's why.

Gold: Test All Capacitor Types and Values

Many different types of capacitors are used in electronic circuits. Each type has properties which make it desirable for particular applications. The type of capacitor also determines how it will go bad and what analyzing tests are needed to determine if the capacitor is good or bad.

Capacitors come in a variety of capacitance values. Ceramic capacitors generally offer the smallest values down to a fraction of 1 pico-farad. Aluminum electrolytics range in value from 0.1 μFd to 300,000 μFd. Topping the capacitance value range is the double layer electrolytic or "Gold Cap" which can be several Farads in value.

Figure 1. Capacitors come in many different types and values.

A capacitor analyzer must have a measuring range that permits testing of all types and values of capacitors. Many capacitor value testers claim this, but few deliver. Only the Sencore Z-Meter can test capacitors from 0.1 pico-farad to 20 Farads. Other capacitor value testers simply cannot measure below 1 pFd and/or above 200,000 μFd.

Capacitor types have different parameters that require different testing criteria. The Sencore Z-Meter divides capacitors into one of five different types for testing. Some capacitor types, such as the double layer electrolytic type, require a different and patented capacitance test to accurately determine the proper capacitance value. Other types simply have lesser or greater tolerances to the Z-Meter tests to be accurately determined good or bad.

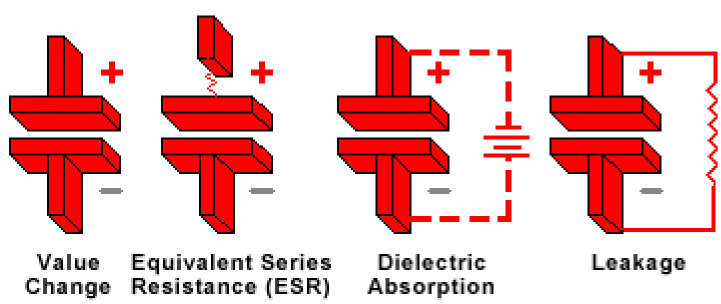
Figure 2. ***A capacitor analyzer must test all capacitor types accurately from 0.1 pFd ceramic cap to a 1 Farad double-layer electrolytic.***

Gold: Test Capacitors for all 4 Ways They Fail

Capacitors can fail in 4 different ways and cause improper circuit operation. Most testers only test for one or two ways in which a capacitor fails. Capacitor failures include:

1. Change in Value
2. Equivalent Series Resistance (ESR)
3. Dielectric Leakage
4. Dielectric Absorption

Figure 3. ***Capacitors can fail in four different ways.***



Capacitors can change in value due to changes in the dielectric or plate properties. Capacitors fail from a decrease in value only about 25% of the time. This means a capacitance value tester finds only 1 out of every 4 bad capacitors. A calculator is usually needed to calculate the percent of variation to determine if the value is within tolerance.

ESR testing capacitors above 1000 µFd requires 0.01 ohms of resolution for good/bad testing.

ESR is the small amount of resistance in a capacitor's leads and dielectric that worsens on aging tantalum or aluminum electrolytic capacitors. ESR testing requires a special testing method. Normal ESR limits vary between aluminum and tantalum types and their values. Small value electrolytic capacitors; 0.1, 0.22, 0.33, and 0.47 µFd are now common among electronic circuits. ESR on electrolytic capacitors above 1000 µFd is less than 0.5 ohms requiring 0.01 ohms of resolution for good/bad testing. Testers that only test ESR do not accurately test capacitors below 1 µFd and do not provide the resolution to good/bad test ESR on capacitors over 1000 µFd. Furthermore, they miss all other types of capacitor failures.

Capacitor leakage develops when the capacitor has an internal parallel resistance that permits current to flow between the capacitor plates. Some types of capacitors fail by arcing through the dielectric forming a carbonized leakage path. Electrolytic capacitors are especially prone to leakage problems as the dielectric or insulation is formed via a chemical reaction when voltage is applied to the capacitor. Most capacitor testers do not test for leakage and therefore miss a high number of capacitor failures.

The patented Z-meter dielectric absorption test determines a capacitor's D/A percentage in only a few seconds.

Dielectric Absorption (D/A) is the capacitor's inability to completely discharge. D/A acts as a battery disrupting the circuit bias and changing the capacitors effective value in the circuit. In various electrolyte type capacitors, D/A accounts for 1 out of 5 bad capacitors. While a conventional D/A test requires up to 30 minutes to complete, a patented Z-meter method determines a capacitor's dielectric absorption percentage in only a few seconds. No other capacitor tester checks for D/A.

Figure 4. *A capacitor analyzer must be able to test and detect all 4 capacitor defects.*

Gold: Test Leakage at the Capacitor's Rated Working Voltage

An important test of aluminum and tantalum electrolytic capacitors is testing for leakage. Leakage is a common defect in these capacitor types. A myth is that leakage can be detected with an ohmmeter or low voltage power supply. Nothing could be farther from the truth.

Leakage failures often exhibit a zener diode effect. At low voltage potentials, below the zener voltage, the capacitor has little or no leakage. To an ohmmeter the capacitor looks good or quickly charges to high resistance. As higher voltages are applied to the capacitor the zener voltage is exceeded and high leakage current flows. Therefore, it is essential to test the capacitor for leakage at its rated working voltage. Electrolytic capacitors range in working voltage from a few volts to nearly 500 volts.

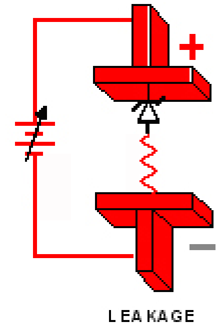


Figure 5. ***Leakage current can zener-on at higher voltage potentials. Testing leakage at the capacitor rated working voltage insures leakage defects are detected.***

The Z-Meter tests leakage by applying the rated working voltage to the capacitor using a programmable leakage power supply. Upon entering the capacitor's working voltage with the numeric keypad the leakage test button is pressed. After a few seconds the capacitor is fully charged and the leakage current is displayed.

Figure 6. ***The Z-Meter's programmable leakage power supply tests leakage on any capacitor at its working voltage up to 1000 volts.***

Gold: Reference EIA Standards for Automatic Good/Bad Test Analysis

Determining a capacitor good or bad is difficult with most testers. Capacitance testers typically require a calculator to determine the tolerance limits. ESR meters typically have a one limit fits all capacitors which causes interpretation errors. Component curve tracers require delicate interpretation of lines, circles, or oval shapes. Capacitor dissipation factor or power factor measurements require a manufacturer rating for comparison. Commonly there is no conclusive good/bad determination. You are left guessing if the measurement value indicates the capacitor is good or bad.

The LC103 "ReZolver" takes the guess work out of determining if the capacitor is good or bad. Value measurements are automatically compared to the capacitor's rated value and +/- tolerance limits entered into the Z-Meter with the numeric keypad. The capacitor value measurement is accompanied by a good or bad indication. No calculation is required.

Maximum ESR, Leakage and D/A values vary with capacitor type, value and working voltage. Limits have been established by the Electronic Industry Association (EIA) through the consensus of capacitor manufacturers. Memory tables within the LC103 contain this reference good/bad data limits. The limits provide a good/bad reference for each capacitor tested with the LC103.

Simply enter the capacitor type, value, tolerance and working voltage. Each Z-meter analyzing test accompanies an automatic good or bad readout, referenced to industry standards.

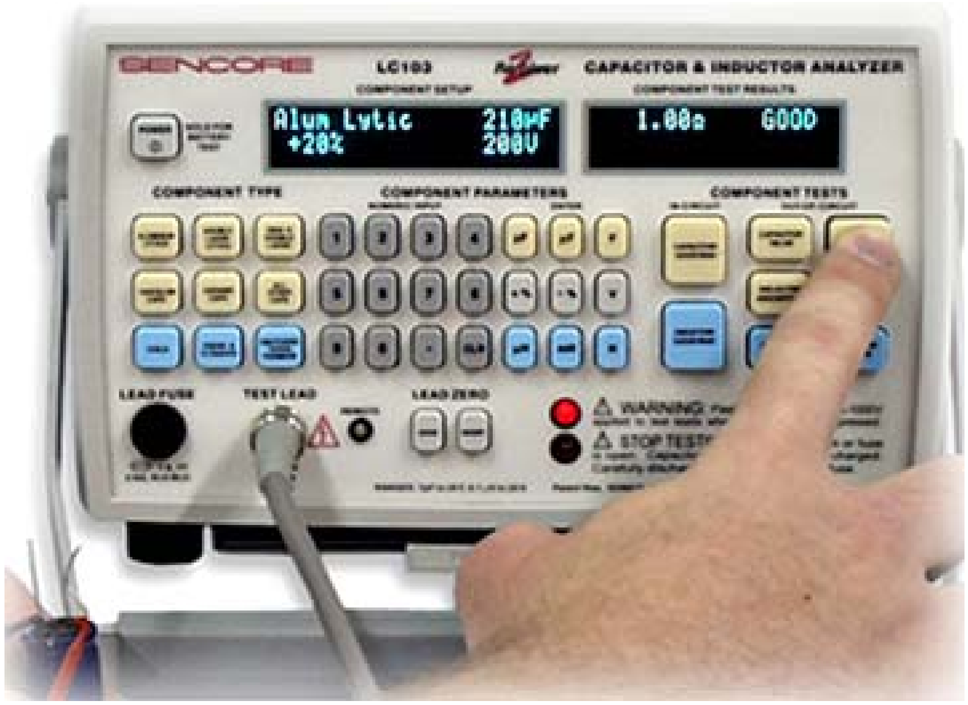


Figure 7. ***Each Z-meter test indicates good or bad, eliminating any chance of interpretation or calculation errors.***

Gold: Analyze Inductors for 4 Ways They Fail

Inductors can fail in 4 ways and cause improper circuit operation. Most testers check for value only. Inductor failures include:

1. Short (Many shorted turns)
2. Open
3. Value Change
4. A single shorted turn

The LC103 dynamically test any inductor from 0.1 µH to 20 Henrys automatically based upon the inductor type, value and tolerance entered via the numeric keypad. The patented inductor test measures the true inductance of the coil and detects when the coil is open or shorted. The value readout is accompanied by a good or bad indication eliminating any calculation errors.

The patented Ringer test energizes the coil in combination with selected capacitors within the Z-Meter and counts the number of resulting resonant oscillations or rings. A good coil having no shorted turn rings more than 10 times. A coil with a shorted turn rings less than 10.

Figure 8. ***The Z-Meter dynamically tests coils for all the ways they fail with two patented good/bad tests.***

Gold: Analyze Capacitors & Inductors In-Circuit

In circuit capacitor and inductor testing accuracy is plagued with many parallel components and circuit paths. In-circuit ESR only testers often miss bad capacitors in-circuit when they are reduced in value, shorted or leaky. This can add hours to a repair job.

The LC103 uses four analyzing tests to comprehensively determine the capacitor value and ESR in-circuit. Two tests are used to determine the capacitor value. An RC charge constant test checks the capacitor value and is compared to a second value test determined by applying several test frequencies. If the values are within 20% there are no parallel impedances influencing the test accuracy. Another test identifies parallel resistance by measuring the current needed to hold the capacitor charged following the RC charge value test.

The comprehensive in-circuit capacitor analyzing tests result in a display of the capacitor value and ESR for capacitors ranging from 0.02 µFd to 20,000 µFd. A value readout accompanied by "Suggest Removal" on the display readout indicates the Z-Meter detected parallel in-circuit paths and/or components affecting the measurement accuracy.

An adjustable in-circuit test probe makes connection to both small surface mount and large leaded capacitors and inductors. The probe is designed for one-handed use. Simply adjust the probe to the capacitor lead width, press the probe points to the leads, and press the test button on the probe body. You can concentrate on holding a good solid connection until you hear three short beeps from the Z-Meter indicating the test is complete. The Z-meter test results are frozen on the display for 3 seconds permitting easy viewing.

***Figure 9.** The LC103 in-circuit capacitor test indicates capacitor value and ESR after performing a series of in-circuit analyzing tests.*

Gold: Add an Accessory to Analyze Semiconductors

The STA260 Semiconductor Test Accessory teams with the LC103 to test semiconductor devices. The STA260 dynamically tests SCRS, transistors, triacs and IGBTs for "turn on" and leakage under normal operating voltage conditions.

***Figure 10.** The STA260 accessory analyzes semiconductors for 'turn-on' and 'turn-off' capability and leakage.*

Get the Gold!

Yes, the Sencore LC103 Z-Meter gets the gold! Join the winner circle with a Sencore Z-Meter and get your own little pot of gold. For more information visit the product section at http://www.sencore.com/products/products.htm or call 1-800 SENCORE.

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