

Pinpoint Defective Capacitors, Coils, And Special Components That All Other Testers Miss — Without Guesswork, Look-up Charts, Or Calculation Errors . . .

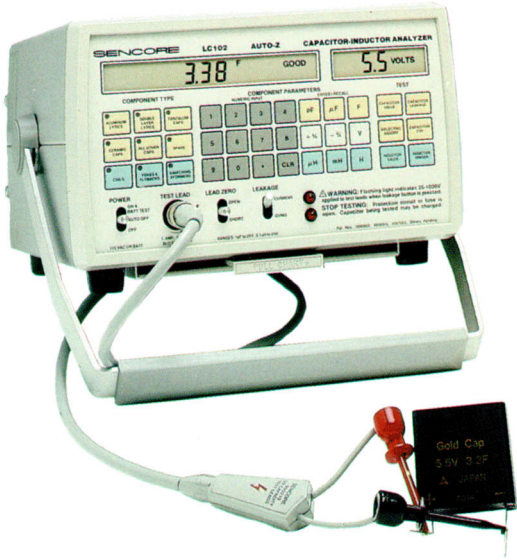


LC102 "AUTO-Z"TM
Capacitor/Inductor
Analyzer 5 Patents



SENCORE

... with the LC102 "AUTO-Z"TM



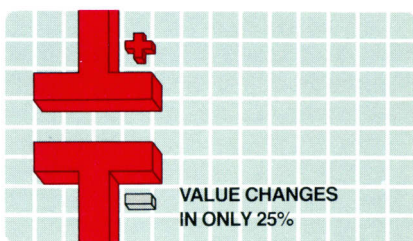
Introducing The LC102 AUTO-Z

by Terry Cook, IEEE
LC102 Design Team Leader

There are many LC testers on the market today. Some do an adequate job in certain applications. However, they all have two things in common: they do not test capacitors and inductors for all the ways they fail and they are prone to interpretation and calculation errors.

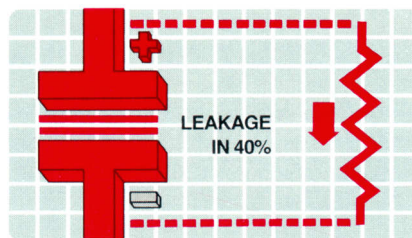
How Do Capacitors Fail?

Conventional testers check for value; but our research shows that only 25% of all capacitor problems are related to value change. Conventional testers miss the other 75% that fail because of leakage, dielectric absorption or equivalent series resistance (ESR).



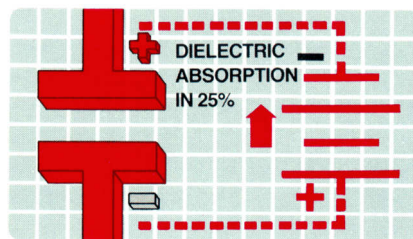
Value. Testing for value is easy; you simply push a button and read the display. The problems start when you try to determine if the reading is within tolerance. You usually

have to grab your calculator and figure the percentage of variation which takes time and can introduce errors. To make matters worse, most value testers read out in nanofarads and millifarads forcing you to make more calculations to convert to standard values.



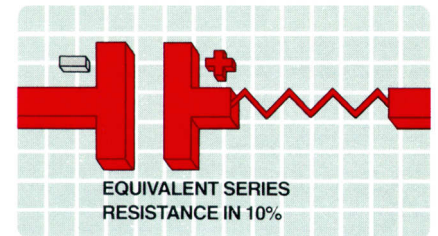
Leakage. Leakage develops when the capacitor has an internal parallel resistance that bypasses current through the dielectric. Excessive leakage may cause problems in filtering and high impedance circuits.

Finding leaky capacitors is difficult because it requires a complex set-up and the test must be made at the capacitor's working voltage. Plus the leakage reading may be meaningless unless you reference a standards table. For example: how much leakage can a 2,200 uF, 950 V electrolytic have before it causes problems in the circuit?



Dielectric Absorption. Dielectric absorption (D/A) is the capacitor's inability to completely discharge. D/A in a capacitor acts as a battery that changes the circuit's bias voltage, and it changes the capacitor's value "in-circuit". We found that 25% of the capacitors tested in our study failed because of excessive D/A.

A conventional D/A test procedure requires an electrometer and takes several hours to complete. Plus, once again, you have to interpret the reading to determine if it's going to work in the circuit.

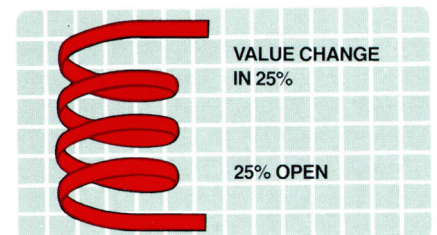


ESR. ESR is the Equivalent Series Resistance in a capacitor's leads and dielectric that worsens as the capacitor ages, and the connection between the leads and plates begin to fail. ESR can cause problems in high frequency circuits such as switching power supplies.

ESR is impossible to test with an ohmmeter, since you cannot connect across these internal resistances. If you do have an ESR test available, you're back to interpreting readings. Does a 30,000 uF electrolytic with 2.3 ohms of ESR need to be replaced or can it be used in the circuit?

How Do Inductors Fail?

Inductors fail in one of two ways. They change value, which includes an open, or they develop a shorted turn. How do these values affect your tests?



Value. Value changes in an inductor are easily located with a bridge or value tester, if you own one. But, how do you know if it's within tolerance? Do you pull out a calculator or do you call it "good enough" and toss it into your spare parts bin?

Automatically And Dynamically Analyze Any Capacitor From 1.0 pf To 20 Farads To EIA And Industry Standards.

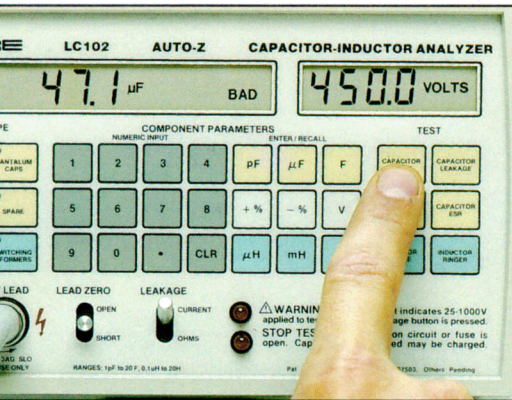
ENTER: The capacitor's type, value, tolerance, and working voltage.

Capacitor Value-Patented

The microcomputer in the LC102 compares the value to the tolerances you've entered. If the cap falls within tolerance, the display will show "GOOD". If it doesn't, the display will show "BAD". No interpretation or guesswork.

PUSH: The CAPACITOR VALUE button.

READ: CAPACITOR VALUE in picofarads, microfarads and farads plus "GOOD" or "BAD" according to the tolerance you've entered.

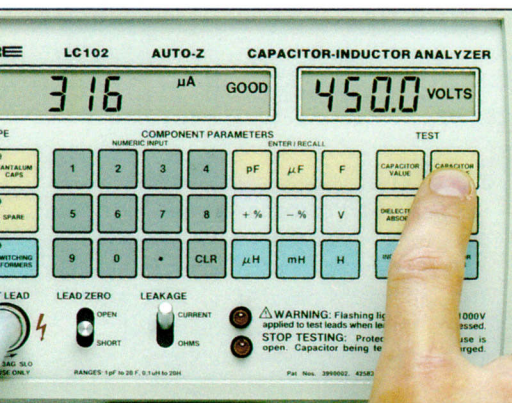


Capacitor leakage

The LC102 AUTO-Z tests the capacitor at its working voltage with up to 1,000 volts DC applied. The AUTO-Z's internal microcomputer compares the capacitor type, value and applied voltage to calculate the maximum allowable leakage as defined by EIA specifications programmed into its memory. The display shows "GOOD" or "BAD" according to the leakage reading. Finding leaky caps is as simple as pushing a button.

PUSH: The CAPACITOR LEAKAGE button

READ: LEAKAGE in microamps or milliamps plus "GOOD" or "BAD" according to EIA standards.

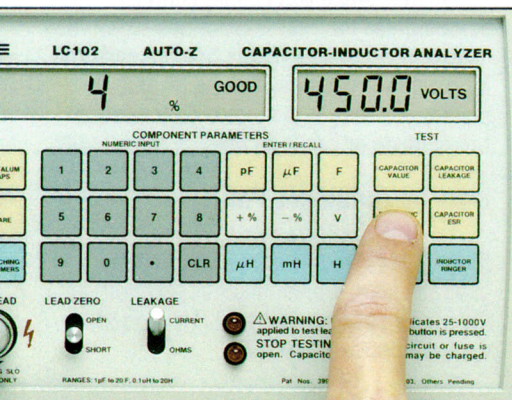


Capacitor Dielectric Absorption-Patented

The LC102 AUTO-Z automatically goes through the steps needed to measure the dielectric absorption. It then compares the reading to its internal standards tables based on type, value, and voltage and displays either "GOOD" or "BAD". You don't have to decide if the cap has excessive D/A - the AUTO-Z does it for you.

PUSH: The DIELECTRIC ABSORPTION button

READ: DIELECTRIC ABSORPTION as a percentage plus "GOOD" or "BAD" according to internal D/A standards.

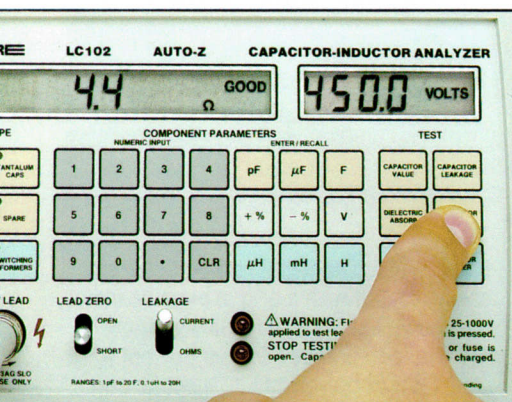


Capacitor ESR-Patented

The LC102 AUTO-Z measures the capacitor's ESR and compares this reading to internal EIA Capacitor Tables and industry standards. If the ESR is within tolerance, the LC102 displays "GOOD" and if not, it displays "BAD". You have positive proof the capacitor will work in the circuit.

PUSH: The CAPACITOR ESR button

READ: ESR in ohms and either "GOOD" or "BAD" according to internal EIA tables.



LC102 "AUTO-Z" Capacitor/Inductor Analyzer

Actual Size

Capacitor & Inductor Characteristics

Measure capacitor value, leakage, dielectric absorption, and ESR as well as inductor value and patented ringing test.

GOOD/BAD Test

Eliminates guesswork as it automatically compares the parameters of the component under test to internal EIA and industry standards tables.

DC Voltage

Applies DC from 1 volt to 1000 volts in programmable 0.1 V steps. (For capacitor leakage & hi-pot tests.)

SENCORE LC102 AUTO-Z CAPACITOR-INDUCTOR ANALYZER

19.99 F GOOD 1.50 VOLTS

Component Parameters

Program in the parameters and the LC102 determines if the component falls within its specified tolerance.

Component Type

Enter capacitor or inductor type (the LC102 references internal EIA tables according to component type).

Portable, Battery Operated

Provides 9 hours of capacitor and inductor testing in the field or in the factory.

COMPONENT TYPE			COMPONENT PARAMETERS						TEST		
			NUMERIC INPUT			ENTER / RECALL					
ALUMINUM LYTICS	DOUBLE LAYER LYTICS	TANTALUM CAPS	1	2	3	4	pF	μF	F	CAPACITOR VALUE	CAPACITOR LEAKAGE
CERAMIC CAPS	ALL OTHER CAPS	SPARE	5	6	7	8	+ %	- %	V	DIELECTRIC ABSORP	CAPACITOR ESR
COILS	YOKES & FLYBACKS	SWITCHING TRANSFORMERS	9	0	.	CLR	μH	mH	H	INDUCTOR VALUE	INDUCTOR RINGING

Capacitor And Inductor Tests

Delivers all the market proven Z Meter tests at the push of a button.

New Alert System

New audible and visual alert warns you if your Z Meter's fuse is open, and potential remains on the component under test.

POWER ON & BATT TEST AUTO OFF OFF 115 VAC OR BATT

TEST LEAD

LEAD ZERO OPEN SHORT

LEAKAGE CURRENT OHMS

WARNING: Flashing light indicates 25-1000V applied to test leads when leakage button is pressed STOP TESTING: Protection circuit or fuse is open. Capacitor being tested may be charged.

115 VAC OR BATT RANGE SLO USE ONLY RANGES: 1pF to 20F & 1μH to 20H

Pat. Nos. 3990002, 4258215, 4251103, Others Pending

Automatic Lead Zero

Removes stray lead inductance, capacitance, and resistance, and assures accurate readings.

Leakage In Current Or Ohms

Tests capacitor leakage up to 1000 volts DC applied or insulation leakage (Hi-Pot Tester) to 1,000,000,000 ohms.



Call 1-800-SENCORE
(736-2673)

Dynamically Test Any Inductor From .1 uH To 20 Henrys 100% Automatically, Plus Test Special Components, Anytime, Anywhere.

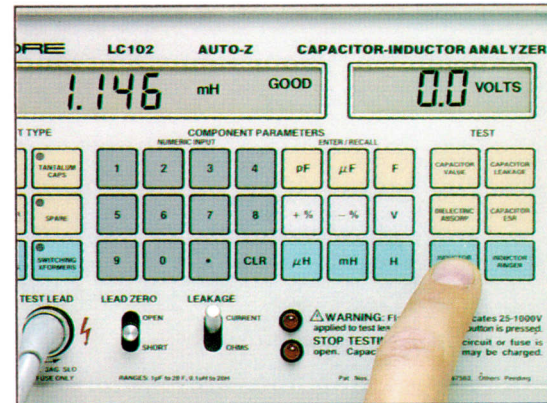
ENTER: The inductor type, value, and tolerance.

Inductor Value-Patented

The LC102 AUTO-Z measures true inductance, not inductive reactance. The microcomputer in the LC102 compares the value and the percentage difference from its specified value. If the inductor falls within tolerance, the display shows "GOOD". If it doesn't, the display shows "BAD". It's that simple.

PUSH: The INDUCTOR VALUE button

READ: INDUCTOR VALUE is displayed plus a "GOOD" or "BAD" reading depending on the tolerance you've entered.

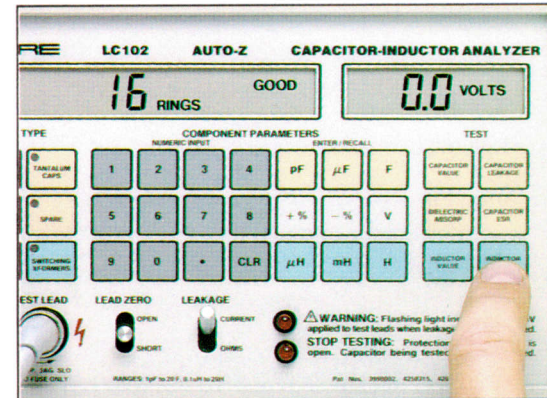


Inductor Ringing-Patented

The LC102 strikes the coil with a sharp waveform and counts the number of resulting resonant rings. According to extensive studies completed at Sencore, a 'good' coil will ring more than 10 times. The Ringing Test is an industry standard that has been used in more than 60,000 Sencore instruments and it works every time

PUSH: The INDUCTOR RINGER button.

READ: The number of "RINGS" is displayed plus "GOOD" if the number is greater than 10 and "BAD" if it's less than 10

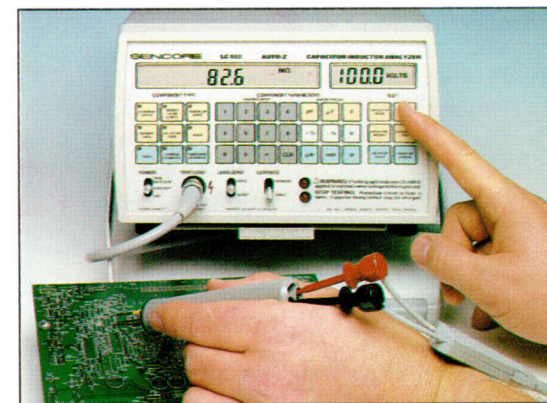


Resistance Test (1,000 megohm hi-pot tester)

The LC102 is sensitive enough to detect as little as .01 microamp of leakage current in connectors, PC boards, and switches. With the flip of a switch the LC102 becomes a hi-pot tester that measures resistance up to 1,000 megohms with up to 1,000 volts DC applied. *Enter DC test voltage*

PUSH: The CAPACITOR LEAKAGE button

READ: LEAKAGE in microamps or milliamps. Flip the switch and read RESISTANCE in ohms, kilohms or megohms.



Portability

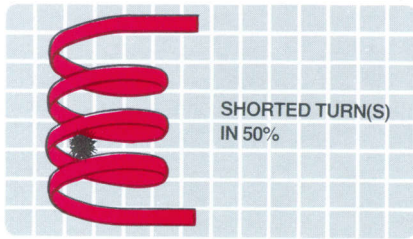
The LC102 AUTO-Z operates on 120 VAC or optional battery pack so you can take it wherever you do capacitor and inductor testing. Take the LC102 along with you to service large main frame computers, industrial machines, or remote antenna networks. The LC102 works all day on one charge.

PLUS:

- 1 *Automatically pinpoint transmission line opens and shorts by measuring line capacitance or inductance.*
- *Test SCRs and triacs for leakage, latching and gate operation.*
- 1 *Automate repetitive cap and coil analyzing with computerized testing.*



Capacitor/Inductor Analyzer



Shorted turns. Shorts in inductors are difficult to locate even with the most expensive testers. Detecting a shorted turn with an ohmmeter is useless, since the resistance change is so small. You could check for a change in the inductance value, but often with a single shorted turn the value change will be very slight. You might have better results with a Q test, but you still have to interpret the readings to find out if the coil is "good" or "bad."

What About Extra Large Value Components?

Today, capacitors larger than 4 Farads and coils as high as 10 Henrys are showing up in various applications and isolating troubles with large components is tough to do. Do you test those large components or since they are often the most expensive part on the board, do you assume they won't fail?

How Do You Eliminate Interpretations And Guesswork?

As you probably know, testing capacitors and inductors often involves a lot of inaccurate interpretation, guess-work and error. Determining if a component is "good" or "bad" can be an aggravating process. It takes time to calculate if a component's value falls within tolerance. Plus, without standards tables you don't have access to the exact characteristics of each capacitor and inductor you test.

What About Tests In Remote Areas?

More and more often troubleshooting and testing takes you to places where 120 VAC power isn't readily available. For

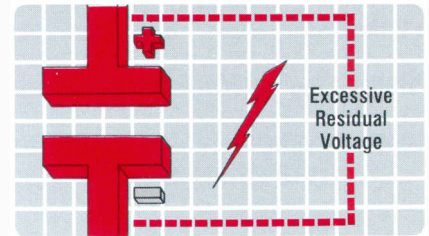
example, how do you measure the capacitance of transmitter phasing network at the top of a mountain or how do you check a capacitor of a controller motor on the factory floor when the only power available is 220 V?

How Do You Test Resistance To 1000 Megohms?

One of the most difficult faults to locate is leakage between sections of a wafer, slide or push button switch. Ohmmeters don't work well for checking leakage because they don't read high enough resistance to detect a few microamps, plus the voltages don't go high enough to force the leakage. How do you make resistance readings to 1 gigohm at 1000 volts without investing in and expensive hi-pot tester?

How Do You Test Special Components?

SCRs and Triacs are becoming more and more popular. But, dedicated test fixtures are complex and expensive. There has to be a better way to test these components accurately and easily.



What about testing large value capacitors with high operating voltages?

Super large capacitors (found in photo flash systems), may be dangerous to test because they must also be charged to their full potential when dynamically testing for leakage. If not discharged properly, they become a possible safety hazard to the user and his test instruments.

Discover The Z Standard. It's the future of LCR analyzing technology, that's here now.



Tests and Specifications for the LC102 "AUTO-Z"

Capacitor Value: RANGE: 1.0 pF to 19.99 F fully autoranged.
ACCURACY: $\pm 1\% \pm 1$ digit up to 1990 uF.
 $\pm 5\% \pm .1\%$ of range fullscale for 2000 uF to 19.99 F.
Resolution: .1 pF on lowest range to .01 F on highest range: 12 ranges total.
Automatically reads GOOD or BAD according to tolerance selected on keypad.
Double layer lytics test patented.

Capacitor Leakage Voltage: VOLTAGE RANGE: 1 .0V to 999.9V in 0.1V steps.
VOLTAGE ACCURACY: +0% -5%
POWER: Short circuit current limited to < 900 mA. Continuous power limited to 6 watts $\pm 10\%$. Selected on keypad.

Capacitor Leakage (current): RANGE: 0.01 uA to 19.99 mA fully autoranged
ACCURACY: $\pm 5\% \pm 1$ digit.
RESOLUTION: 0.01 uA to .01 mA for 0.01 uA to 19.99 mA in four ranges.
VOLTAGE: Maximum reading determined by voltage setting.

As A Dynamic Ohmmeter: RANGE: 100 ohms to 999 megohms depending on voltage setting.
ACCURACY: $\pm 5\% \pm 1$ digit.

Capacitor Dielectric Absorption Test: RANGE: 1 to 100%
ACCURACY: $\pm 5\%$ of reading, ± 1 digit.
CAPACITOR RANGE: 0.01 uF to 19.99 F. Automatically reads GOOD or BAD on electrolytics at 15 percent variation in reading after charge and discharge; less for other capacitors.
U.S. patent number 4,267,503.

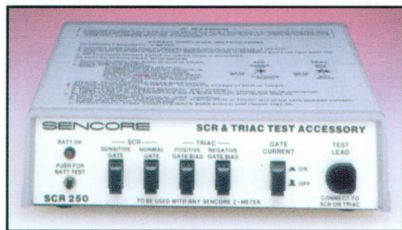
Capacitor Equivalent Series Resistance (ESR): RANGE: 0.10 ohm to 1999 ohms fully autoranged.
ACCURACY $\pm 5\% \pm 1$ digit.
RESOLUTION, .01 ohms to 1 ohm on high end in three ranges.
CAPACITOR RANGE: 1 uF to 19.99 F. U.S. patent number 4,795,966.

Inductor Value: RANGE: 0.10 uH to 19.99 H fully autoranged.
ACCURACY $\pm 2\% \pm 1$ digit
RESOLUTION, .01 uH for 20 uH range to .01 H for 19.99 H range. 9 automatic ranges.
U.S. patent number 4,258,315.

Ring Test: Excites inductor with sharp wavefront of 5 volts peak amplitude, 60 Hz.
ACCURACY ± 1 count from readings of 8 to 13: 10 rings or more automatically indicated as GOOD. Automatically selects correct impedance match to produce maximum rings.
RESOLUTION, ± 1 digit U S patent number 3,990,002

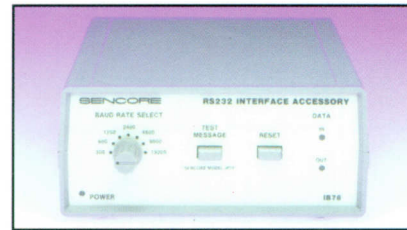
General: TEMPERATURE: Operating range 32 to 104 degrees F (0-40 degrees C).
Specified accuracy range 50 to 86 degrees F (10-30 degrees C).
HUMIDITY: To 90% RH, no condensation.
DISPLAY: 6 digit LCD: auto decimal placement: leading zero suppression: pF, uF, F, uA, mA, %, $k\Omega$, $M\Omega$, ohms, uH, mH, H, V, RINGS, SHORT, OPEN, WAIT, GOOD, and BAD annunciators, overranged indication.
POWER: 105-135 VAC 60 Hz with supplied PA251 power adapter. Battery with optional BY234, 2.0 AH battery for 9 hours continuous typical battery life. Auto off approximately 20 minutes after use. Auto off overridden when using external AC power.
SIZE AND WEIGHT: 6" x 9" x 11.5" HWD (15.2 x 22.6 x 29.2 cm.). 6 lbs. (2.7 kg) without battery 7.6 lbs. (3.5 kg) with battery.

Accessories for the LC102 "AUTO-Z"



SCR250: SCR and Triac Test Accessory™ The SCR250 tests all SCRs and triacs for turn-on capability and leakage, even in high current industrial SCRs and triacs. It's isolated and has a separate controlled supply to protect sensitive gates.

IB78 RS232 Interface Accessory
Use to operate the "AUTO-Z" with an RS232 computer or controller for automated testing.



FC221: Field Calibrator Accessory
Test your "AUTO-Zs" calibration quickly with this handy LC standard.

BY234: Battery Pack Accessory
Go anywhere for up to 9 hours with this optional battery pack.

CC254: Z Meter Carrying Case
Protect your "AUTO-Z" with this waterproof and stylish padded case.

CH255: Component Holder
Test radial and axial lead components quickly with this convenient accessory.

CH256: Chip Component Test Lead
Test surface mount components quickly with this tweezer-like accessory.

39G85 Touch-Test Probe
Save time with in-circuit inductor testing. No need to unsolder leads.

Here's How to Order

Call **1-800-SENCORE (736-2673)** and we'll help you discover dynamic LC analyzing and what it will do for you.

*"AUTO-Z" is a trademark of Sencore, Inc.



It's like having your own Standards Engineer with you at all times.