

Emulate your component's operating environment.

Out of ESI's 26 years of leadership in precision metrology and several years of automating measurement for capacitor production lines comes a premier impedance instrument that incorporates all of the manipulative power and convenience of today's most advanced microcircuits. Measurement capabilities have been extended on every front (with the exception of speed). The test condition menu has been greatly broadened. Automation in the measuring, storing and analyzing of all the subtle variables of impedance has been achieved to a higher degree than ever before in a benchtop instrument.

In the Model 2100 or the 2110, with its programmable cassette, ESI has maximized those capabilities made possible by microprocessor design:

- **Interactive input/display**
- **Programmable test conditions**
- **Programmed data manipulation**
- **Data acquisition/storage**
- **Extended performance in**
 - ... ranges
 - ... accuracy
 - ... resolution
 - ... function variables
 - ... measurement modes

Extended memory storage, data acquisition and factory programmed data manipulation are available through the Model 2110's tape attachment.

Out of this has come a synergy of sorts, a synergy of effects that enable a designer, researcher or Q/A analyst to set up test conditions that virtually emulate the actual conditions under which a component functions in a circuit. Almost endless are the number of variables he can control and read out, the type of evaluations he can automate and the various levels of operator interface.

Potential Applications

And the consequences? There are many applications in which this new capability will be found advantageous:

Capacitors: Evaluating capacitors requires a wide range of test conditions heretofore unavailable in one low cost instrument. Tantalums should be tested at 0.3 VRMS, while ceramics are specified at 0.5 and 1.0 VRMS. Electrolytics are tested as series components, for capacitance and effective series resistance. Micas require scrutiny for parallel capacitance and dissipation factor. Switching power supply capacitors should be checked for ESR at high frequency and computer grade capacitors at 120 Hz for C and at 10 kHz for total impedance (Z).

Inductors: Selectable current levels and direct measurement of inductance will enable manufacturers to measure just below saturation level of a coil. Others will be able to match the precise test level called out on a data sheet or to check compatibility with present test equipment.

Signal transformer and choke evaluation: Both test level and frequency can be varied greatly in the Model 2100, providing the operator with the ability to run a complete series of checks at several combined values. This feature will be appreciated also by those doing crossover network component evaluation.



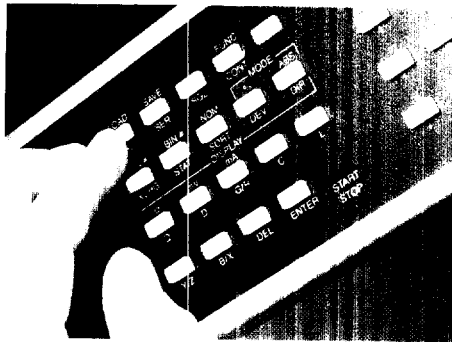
System-sized solutions from a single, simple source.

Standard deviation analysis:

With the Model 2110 and a special program for the memory cassette, the production control engineer will find it easy to plot variations in the product. He can even generate histograms with a wide variety of variables.

TC and high reliability analysis:

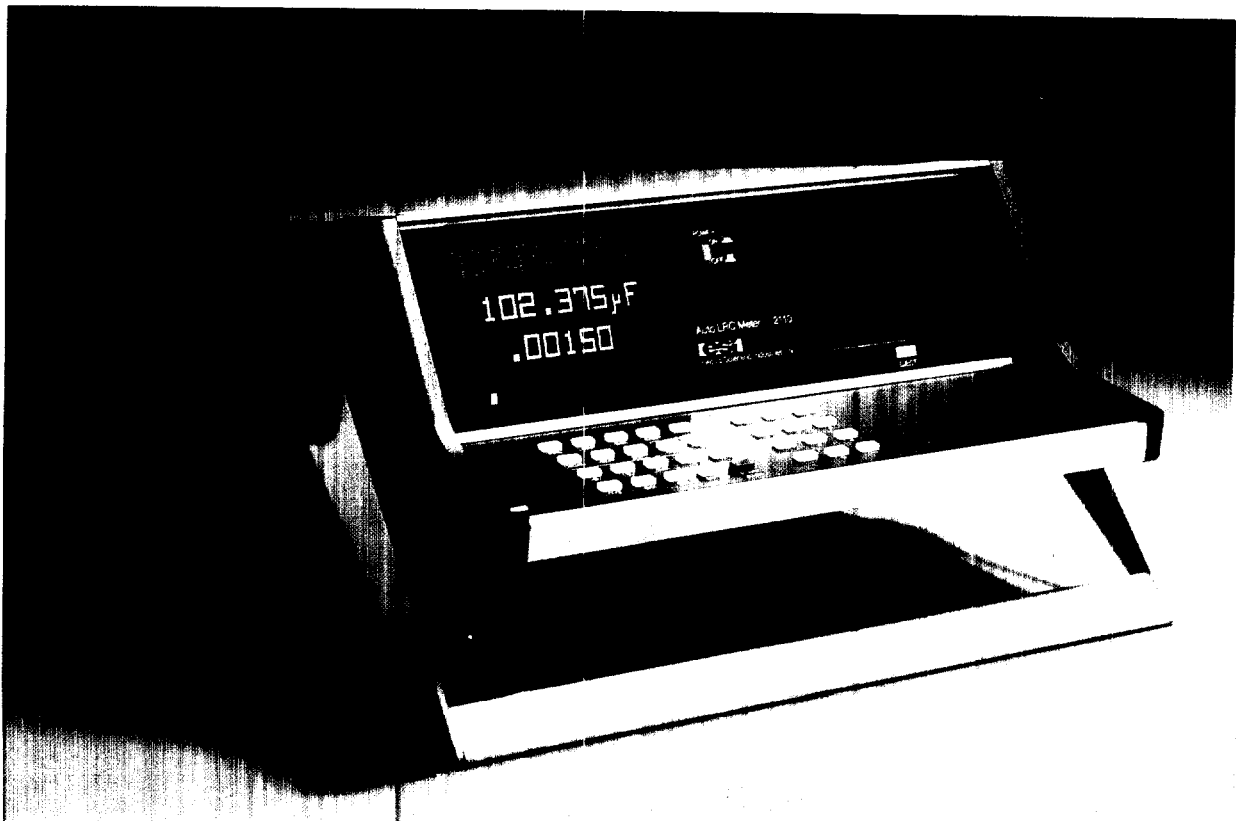
Programs will be available to document drift of components put under environmental or voltage stress, providing the storage and comparison of a large quantity of measurements.



An interactive RPN keyboard and CRT display are two of the most obvious advances to be found in this feature-laden LRC meter from ESI. Inside this one benchtop tester — at a benchtop price — are found virtually every passive measurement capability needed throughout the process of capacitor manufacturing:

- ... in the R/D lab for subtle measurements and data analysis.
- ... on the design bench for accuracy and

- every function of impedance.
- ... for automatic binsorting and counting.
- ... for thorough documentation, deviation statistics.
- ... for data acquisition — either through internal or external memory storage.
- ... even on the production line, when this machine's extraordinary combination of accuracy, wide ranges, multiple frequencies, and almost unlimited flexibility of test conditions, is more important than speed.



Extended test conditions on every parameter of impedance.

The Model 2100 is essentially a high performance LRC meter coupled with CRT and highly versatile software that permits user-oriented display readouts of test parameters, test results and video documentation such as the simultaneous display of 10 sorting bins. Its companion Model 2110 features a cassette memory storage with dedicated software packages to perform tasks usually requiring a controller-calculator.

Priced below all former impedance meters of extended capability, the Model 2100 stands by itself in its ability to make a wide range of highly accurate measurements, communicate effectively with the operator, manipulate the results mathematically, store data or direct computers or parts handling equipment.

It is capable of measuring 12 impedance characteristics, in series or parallel mode, at 3000 discrete frequencies from 20 Hz to 20 kHz, at a programmable voltage or current test level. With accuracy ranging from 0.02% this instrument has the versatility and flexibility to substantially aid the manufacturer of passive components in supplying the industry with parts compatible with today's precision active circuitry.

The instrument of course incorporates many operating features one would expect as standard: Auto ranging, 4-terminal shield connections, dual 5½-digit measure displays, input protection, external bias, % deviation display.

Some of the more outstanding advantages include:

Programmable Test Parameters

12 Functions Measured:

- L_S —series inductance
- L_P —parallel inductance
- R_S —series resistance
- G_P —parallel conductance
- C_S —series capacitance
- C_P —parallel capacitance
- D —dissipation factor
- Q —quality factor
- X —reactance
- B —susceptance
- Z —total impedance
- Y —admittance

High Accuracy: From 0.02% (depending upon speed, frequency, test level and range)

- Selectable voltages
- Selectable currents
- 3000 discrete frequencies to 20 kHz
- Capacitance range to 2 farads

Programmable Test Conditions

- Series or parallel
- Continuous, single or averaging
- Speed programmable
- 10 sorting limits
- Loss reject band
- Binning count to 64,000 per bin
- Direct or deviation measurement

Display Control

- Extra large measurement display
- Total test condition display
- Last two entries noted
- Parameter entry error displayed clearly

Electrical Design

- Input protection
- Keyboard lockout
- External bias
- External start jack
- Auto fixture calibration



Four terminal tweezers make binning of chip components easy work.

Interactive keyboard/display

Intelligent interplay between instrument and operator is the salient advance — coupled with its low cost — which sets the Model 2100 apart from all other passive test systems or instruments.

Linking the full RPN keyboard with effective software, memory and CRT puts an operator as close to the microprocessor bus as one can possibly get. For the first time in a benchtop instrument we have an information transfer system that is as advanced as our metrology. Here are some of the advantages:

Startup Status:

When you turn on the instrument it will be in a startup status for all normal test parameters and test conditions, as follows:

Powerup (Default) Mode

- C_p • 1 kHz
- G_p • 1 VRMS
- Averaging: 1 measurement
- Settling time: 0.02 sec.
- Integration (measurement) time: 0.05 sec.
- Continuous measure mode
- Autoranging

Data Entry:

As you enter new parameters for test conditions, the operator follows RPN procedure and all quantities are converted automatically to "engineering" notational display (i.e., in functions of three and the decimal point floats).

As you alter parameters you always know where you are, for your last two entries appear independently on the "communications" line at the bottom of the CRT.

Error Control:

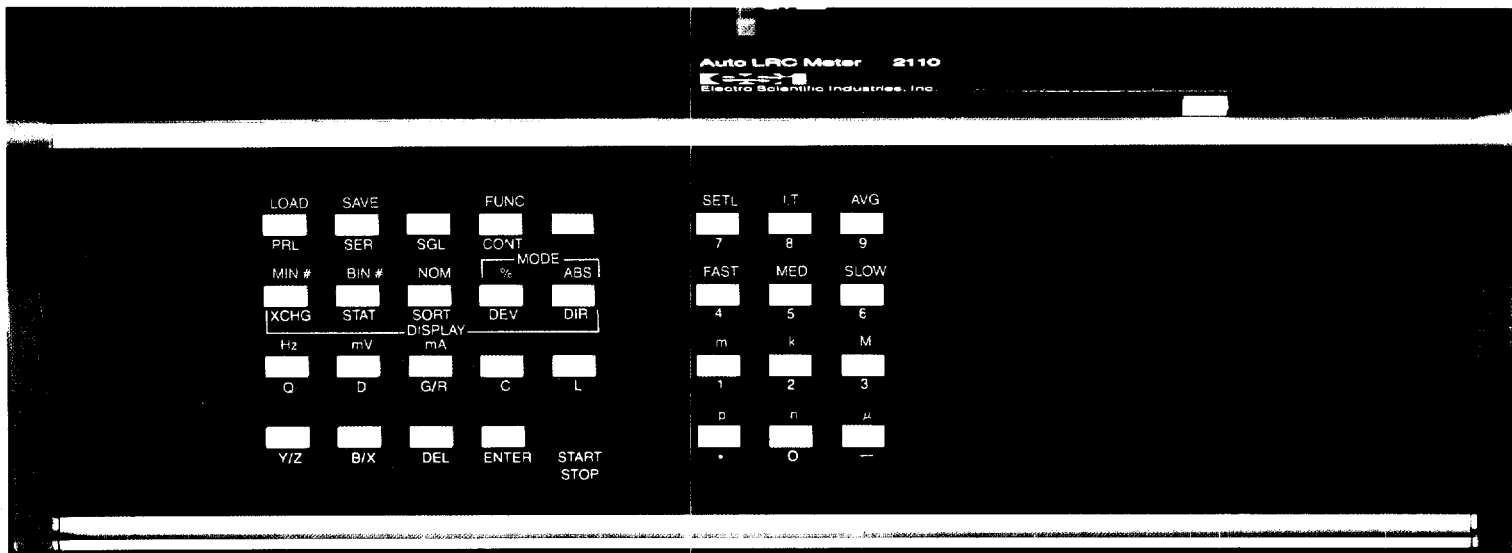
Overloads or unacceptable entries prompt an ERROR message also at the bottom of the screen.

Status Display:

The 2100 operates with full status conditions constantly on display (see Specifications); a supervisor can sight check test operations quickly to confirm what component is being tested, plus parameters. He also can see bin count at a glance.

Sorting/Binning:

Up to 10 independent sorting bins can be programmed on the 2100, each with a capacity of 64,000 units (which you can stretch with a memory cassette). All bins and their limits and count are displayed simultaneously.



Preload Programs:

Want to test a large batch of components with unskilled labor? With a factory preloaded cassette (Model 2110) you can teach an operator to follow instructions in minutes.

Data Acquisition, Evaluation:

Programs for the 2110 cassette system will enable you to run several evaluation procedures, including standard deviation analysis, TC drift analysis and the generation of histograms from sampling procedures. Custom programs also will be supplied.

Options

All ESI options are field installable and proven in use.** ESI Applications Engineering has extensive experience in interfacing to a wide selection of production and data acquisition systems. The following are standard options to the 2100/2110:

- Handler interface*
- IEEE interface*
- Printer*
- Calibration package
- Cassette reader/recorder

Special cassette programs

Non volatile memory

*Compatible with other ESI bridges.

**All service should be performed by qualified personnel.

Accessories

- 4-Terminal axial/radial lead test fixture
- 4-Terminal tweezers for chip components
- Rackmount kit

LOSS REJECT

NOMINAL

BIN POSITION

HIGH LIMIT %

LOW LIMIT %

PARTS
COUNT
PER BIN

SETTLING TIME
INTEGRATION TIME

PROGRAMMED
VOLTAGE

MEASUREMENT
MODES

FREQUENCY

NOMINAL

FUNCTION/
UNITS

BIN	LD	HI	COUNT
01	1.00	+ 1.00	00000
02	2.00	+ 2.00	00000
03	5.00	+ 5.00	00000
04	10.00	+ 10.00	00000
05	20.00	+ 20.00	00000
06	50.00	+ 50.00	00000
07	0.00	+ 50.00	00000
08	0.00	+ 0.00	00000
09	0.00	+ 0.00	00000

NOM=100.00 FREQ=100
RES=0.000

ERROR DISPLAY

NUMBER OF
MEASUREMENTS
FOR AVERAGING

CAPACITANCE
MEASUREMENT DIRECT

FUNCTION/
UNITS DISSIPATION FACTOR
D MEASUREMENT
COMMUNICATIONS

FREQUENCY	NOMINAL	FUNCTION/ UNITS
01000 Hz	NOM=100	CAPACITANCE
0500 MV	COUNT	DIRECT
SETL=0005MS INTGR=0020MS AVE=1		
102.375 μ F		
.00150		

ERROR MESSAGE

Preliminary Specifications

Complete specifications will be available after July 1, 1980.

Functions Measured and Combinations

Cp Lp Gp Y B D Q Cs Ls Rs Z X

Cp
Lp
Gp
Y
B
D
Q
Cs
Ls
Rs
Z
X

PARALLEL
EQUIVALENT
CIRCUIT

SERIES
EQUIVALENT
CIRCUIT

NOTE: Any of the dual combinations in the shaded areas may be displayed simultaneously. Series and parallel functions may not be mixed.

Ranges

C = 000.001pF to 2.00F D = .00001
L = 00.0001 μ H to 2000H Q = 10,000
R = 000.001m Ω to 100M Ω Z = 100M Ω

Accuracy:

0.02% to 0.1% at midrange, Z = (100 m Ω -20M Ω) dependent upon measurement speed.

Frequencies:

20Hz to 20 kHz in 3000 discrete frequencies derived from 60 kHz base frequency.

Measurement Speed:

Fast \approx 5.5 per sec.
Medium \approx 2 per sec. (includes line rejection)

Test Levels and Bias

Voltage to 1VRMS set by keyboard entry
Current to 75mA set by keyboard entry
Bias Capabilities to 40V

Display Modes

1. Measurement and status

- Direct reading
- Absolute deviation
- Percent deviation

2. Bin #'s — pass/fail

- Display bin # when component falls within programmed limits.
- Display fail when outside limits.

3. Limits display

- Major component %

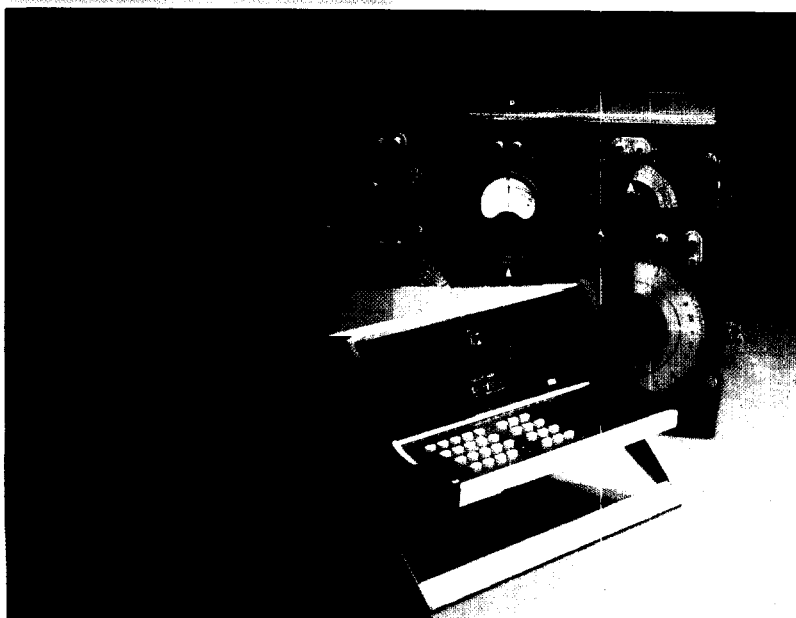
Bin #	Lo%	Hi%	Totals
01	+00.0	+00.0	64000

Absolute

Bin #	Lo	Hi	Totals
01	0000	0000	64000

- Loss component reject

Bin #
11 >.00000D



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A symbol of ESI's 26-year heritage in precision metrology is the Impedance Bridge shown behind the Model 2110.