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3240/3245

Inductance Analyzers

Figure 1

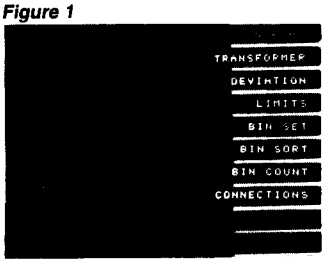


Figure 2

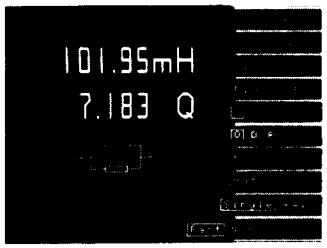


Figure 3

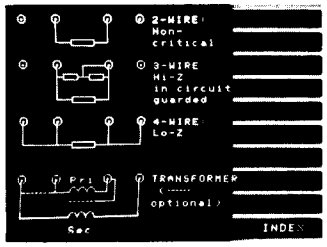


Figure 4

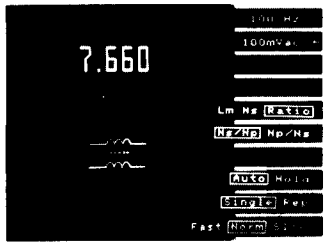


Figure 5

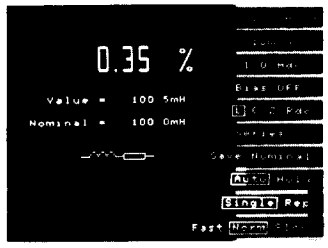
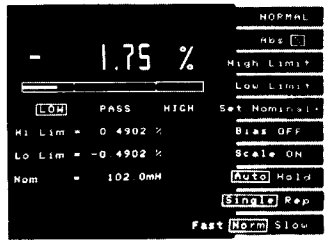
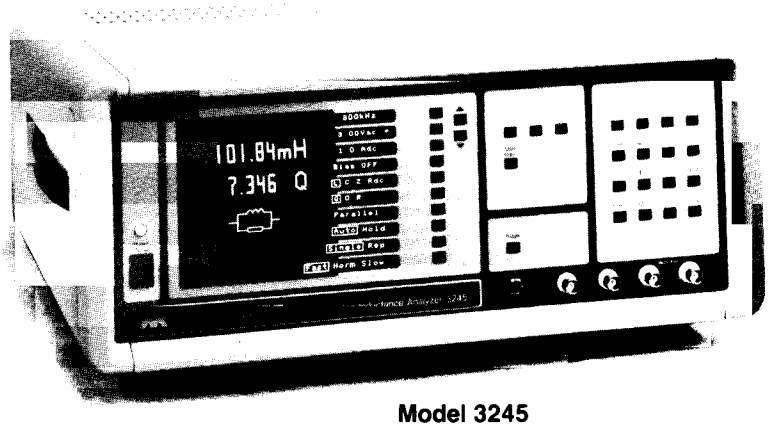


Figure 6





Model 3245

Note: For measurements above quoted ranges, accuracy is derated in proportion to the value. Below quoted ranges, accuracy is derated as the inverse of the value. For frequencies outside the quoted range, accuracy derates in a similar manner.

Model 3245 Optional Interfaces

A.	*IEEE 488*	for control of the 3245 by an IEEE controller such as a PC.
B.	*RS 232C*	for outputting the CRT data to a line printer or host computer for data logging and/or hard copy test results.
C.	*HANDLER INTERFACE*	for connecting the 3245 to an external component handler.
D.	*ANALOG OUTPUT*	for driving an external A/D convertor or a strip chart recorder (i.e., measure L over a period of time and temperature).

Simple to Operate

The front panel is set up in four parts:

1. The Display is a seven-inch CRT. The CRT displays up to six digits of resolution for both the main and the secondary parameters. Warnings, messages, and test information are also displayed here. The right-hand side of the CRT labels the ten 'soft' keys.
2. The Ten Soft Keys are located to the right of the display and their functions fall into three groups when the unit is used in the 'Normal' mode:
   a. The top four establish the measurement conditions: test frequency, test voltage (or current), bias level and bias on/off. To the right of these keys are two keys for increasing or decreasing the selected condition (indicated by an arrow).
   b. The next three keys allow the user to select the main parameter, the secondary parameter, and the equivalent measurement circuit. The major term can be inductance, capacitance, impedance, or RDC. The choice available for minor term depends on the major term selected. With C or L selected, the choice is D, Q, or R. With Z selected, the choice is phase angle or VAC/IAC.
   c. The lowest three keys determine the operating modes: auto range, or range hold; single shot, or repetitive measurements; and fast, normal, or slow speed.
3. The Master Controls consist of five keys with dedicated functions:
   a. 'Local' restores front panel control when operating in GPIB mode.
   b. 'Main Index' sets the display to list the operating modes available:
      - Normal
      - Transformer
      - Deviation
      - Limits
      - Bin Set
      - Bin Sort
      - Bin Count
      - Connections
   c. 'Trim O/C' and 'Trim S/C' activate the open and short circuit trimming procedure for any set of leads or attachment. The operation is fully automatic when O/C or S/C are selected and the 'Trigger' button is pressed. Once trimmed the analyzer stays trimmed for any further setting of frequency, AC level, or DC bias.
4. The Keypad offers experienced operators an alternative method of entering test setups. Instead of using the step-by-step method of the soft keys, the operator can enter data in one step.

   For example, using the keypad, 300kHz can be entered directly as a test frequency, whereas entering the same data on the soft keys would mean stepping through the entire 42 test frequencies.

   Functions not available via the labeled keys are accessed through the *code* facility. This would include functions such as the manual selection of ranges, locking/unlocking the keyboard, triggering the built-in self check diagnostics, enabling/disabling the printer output, and clearing the non-volatile memory.

Typical Operations

1. Inductance

Pressing the 'Main Index' control calls up the list of modes available ***(Fig. 1)***. Select 'Normal' mode and the previously entered measurement parameters will be recalled from the non-volatile memory ***(Fig. 2)***. After leads have been trimmed, changes can be made to the test parameters.

Soft key adjustment (in order of display from top down) is as follows:

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Frequency setting: adjustable from 20Hz to 300kHz in 42 steps.

AC drive level: adjustable from 10mV to 5V RMS or 1mA to 100mA RMS.

DC bias level: adjustable from 1mA to 1A (up to 100ADC available with external 3220 — 3245 only).

Bias on/off: switches bias as required.

L C Z RDC: selects Inductance measurement, Capacitance, Impedance or DC Resistance (Major terms).

Q D R: selects Q factor, Dissipation factor or AC Resistance (Minor terms).

Parallel/Series: selects equivalent measurement circuit.

Auto/Hold: sets the unit to the auto range mode. Range Hold speeds up measurement time.

Single/Rep: single-shot (triggered) or repetitive measurement conditions (continuous).

Fast/Normal/Slow: selects speed of measurement:
— Fast (8 readings per second) allows variable components to be adjusted.
— Normal (3 readings per second).
— Slow (1 reading per second) gives enhanced resolution.

Connecting the component at this point provides an instantaneous reading.

If there is any doubt as to the correct Kelvin clip connections to the inductor, press 'Main Index' soft key No. 8, 'Connections', and the display will guide you ***(Fig. 3)***.

2. Transformer Voltage Ratio *(Fig. 4)*
Pressing the 'Main Index' control and the second soft key, 'Transformer', sets the unit to measure turns ratio in terms of voltage. Winding phase reversal is indicated by a negative reading.

When 'Transformer' is selected, soft key adjustment (in order of display from top down) is as follows:

Frequency Setting: adjustable from 20Hz to 300kHz.

AC Drive Level: adjustable from 10mV to 5V RMS.

Set Np: set number of turns of primary setting if value of Ns is required (number of secondary turns).

Trim Lm: automatically compensates for measurement lead coupling where accurate measurements of Mutual Inductance are required.

Lm/Ns/Ratio: select Mutual Inductance/Ns/or turns ratio as required.

Ns/Np – Np/Ns: select ratio of secondary turns to primary turns up to 100:1 or the inverse to 1:100 at base accuracy.

Auto/Hold – Single/Rep – Fast/Normal/Slow: are as described above.

3. Deviation *(Fig. 5)*
Pressing the 'Main Index' control and the third soft key, 'Deviation', computes and displays the % deviation from a previously measured value of L, C, Z, or R. Other soft key settings are as described for Inductance measurement and the additional 'Save Nominal' allows the nominal value to be stored in memory.

4. Limits *(Fig. 6)*
After setting frequency and drive levels from the 'Normal' key, select the fourth soft key, 'Limits'. Selections for limit indication are:

Abs/%: Select absolute values or percentage deviation from the nominal.

High Limit – Low Limit – Set Nominal: Set and display values in absolute or percentage deviation terms.

Auto/Hold – Single/Rep – Fast/Normal/Slow: Options as described for Inductance measurement.

When a component is connected to the unit, 'LOW', 'PASS', or 'HIGH' is indicated with the value or % deviation displayed.

5. Bin Set *(Fig. 7)*
This soft key allows an operator to set the acceptable upper and lower limits of each bin. Both the high and low limits of each bin can be set as either a ± percentage of the nominal value, or as absolute values. (Example: Bin 1 = −5% to +5% of expected value or Bin 1 = 95pF to 105pF.) In the bin set mode, the soft key labels become:
Bin No. — Bins 0 to 8 are allocated high and low limits.
Next — In order to avoid using the keypad to select Bin number, the operator can simply press this key to move the indicator to the next bin.
Note — Bin 9 is reserved for rejects in all categories and Bin 0 for minor term assessment.

6. Bin Sort *(Fig. 8)*
Once the bin limits have been set, the operator presses this key to enable the sorting mode.

7. Bin Count *(Fig. 9)*
Pressing this key causes the CRT to display an analysis of the test results. Two deletion keys are available to reset all counts to zero ('Delete all') and remove last measurement ('Delete last').

The 'Print' key is offered when the RS 232 option interface is installed (3245 only).

8. Capacitance *(Fig. 10)*
In addition to the measurements of interwinding and shield capacitances of transformers, this accurate measurement function can also be used for incoming inspection of capacitors, utilizing the 'Limits' or 'Binning' modes of operation.

9. Impedance *(Fig. 11)*
The display of impedance magnitude with phase angle is invaluable where a polar measurement format is required. The alternative minor term display (VAC) monitors the component voltage when an impedance below 10Ω has caused the automatic selection of constant current drive.

Figure 7

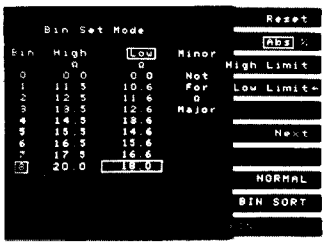


Figure 8



Figure 9

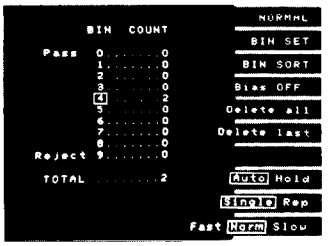


Figure 10

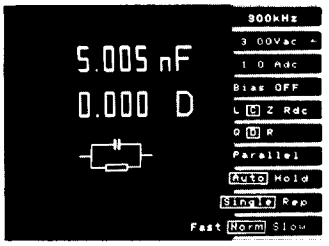
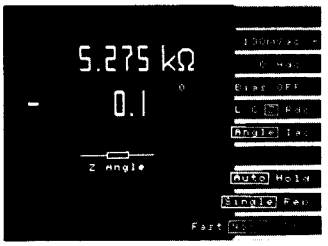


Figure 11

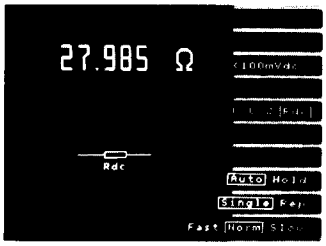


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3240/3245

Inductance Analyzers

Figure 12



10. DC Resistance *(Fig. 12)*

The measurement of DC resistance is often required in transformer and coil specifications. The simple and rapid determination of the value by the 3245 enables this parameter to be measured without changing test connections. Principal uses in product development are:

- The measurement of primary resistance to establish a correction factor to transformer primary/secondary turns ratio. The resistance causes an energy loss which is significant at very low frequencies.
- The calculation of the temperature rise of a winding (from a measurement of the DC resistance immediately after a heat run).

Specifications

Functions:
- L with Q, D or R (series or parallel equivalent circuit)
- C with Q, D or R (series or parallel equivalent circuit)
- Z with ∠θ, VAC/IAC
- DCR
- Lm
- Transformer turns ratio (measured as voltage ratio)
- Transformer secondary turns (user specifies primary)

When the main parameter is L, C, Z, or DCR, the 3245 can operate in the following modes:

Deviation: absolute or % deviation from nominal.

Binning: sorts into 10 bins. 8 for different values, 1 for major term rejects, 1 for minor term rejects.

Limits: absolute or % limits for GO/NOGO testing.

Measurement Conditions (AC): Frequency (Hz): 20, 25, 30, 40, 50, 60, 80, 100, 120, 150, 200, etc., repeats each decade up to 60kHz, then 75, 100, 120, 150, 200, 300kHz (42 frequencies total).

Drive Level:

100mV – 500mV in 10mV steps 500mV – 1.0V in 20mV steps	Zu>10Ω
1V – 2.5V in 50mV steps 2.5V – 5.0V in 100mV steps	Zu > 80Ω
1mA – 50 mA in 1mA steps 50mA – 100mA in 2mA steps	Zu < 10Ω

Drive mode (current/voltage) is automatically selected.

DC BIAS: Internal programmable DC bias current to 1A. For requirements above 1A the 3245/3220 combination offers a current range of 200mA to 20A in 100mA steps, up to a frequency of 300kHz. By combining up to 5 of these units, the current range may be increased to 100A in 500mA steps.

DC Resistance: Drive level depends on value, but is always below 100mV or 16mVdc.

Measurement Modes: Single or continuous measurements.

Measurement Speed (at 1kHz):

Normal	3 readings/sec.
High Speed (reduced accuracy)	8 readings/sec.
Slow (improved resolution)	1 reading/sec.

Auto Trim: Automatically compensates for residual series impedance, mutual impedance or parallel capacitance of measurement leads, up to 1.5Ω or 150pF, mutual impedance, maximum. Trimmed value is retained in non-volatile memory.

Measurement Accuracy

Inductance

	Frequency	Ranges Minimum	Maximum
	100Hz	250µH	500H
Accuracy	1kHz	25µH	50H
± 0.1%	10kHz	4µH	5H
	100Hz	25µH	4000H
Accuracy	1kHz	2.5µH	400H
± 0.5%	10kHz	0.6µH	40H
	40kHz	0.6µH	1.8H
	10kHz	0.4µH	60H
Accuracy	50kHz	0.6µH	2.5H
± 1%	100kHz	0.9µH	40mH

Resolution 10kHz: 0.5nH

Q Factor

Accuracy ±0.1 (Q + 1/Q)%
*Maximum display with ± 5%
Resolution Q = 1300

Dissipation Factor
*Resolution 0.0002
Accuracy ± 0.001 (1 + D²)

Capacitance

	Frequency	Ranges Minimum	Maximum
Accuracy	100Hz	5nF	10mF
± 0.1%	10kHz	50pF*	50µF

Resolution 10kHz 0.01pF

Impedance

	Frequency	Ranges Minimum	Maximum
Accuracy	100Hz	0.16Ω	300kΩ
± 0.1%	10kHz	0.33Ω	330kΩ

Resolution 0.02m

Phase Angle

–180° to +180°
Accuracy 0.2°
Resolution 0.1°

Turns Ratio

Voltage ratio accuracy ± 0.1%
Over range 1:100 to 100:1

DC Resistance

Range	.2mΩ to 5kΩ
Accuracy	± 0.5%
Resolution	0.2mΩ
Level	100mV from 16Ω source

Operating Environment

Temperature Range:	Storage	–40°F to +158°F
	Operating	+32°F to +104°F
	Full Accuracy	+50°F to +86°F
Power Requirements:	115V ± 10% or 230V ± 10% AC 50/60Hz	
Power consumption:	70VA nominal	
Dimensions:	Width:	17 1/2 in.
	Height (incl. feet):	7 1/2 in.
	Depth (overall):	18 1/2 in.
	Weight:	35 lb.

Ordering Information:

3240 — **Inductance Analyzer**
3240U — **Factory upgrade 3240 to 3245**
3245 — **Inductance Analyzer**

Standard Accessories:
Line cord, spare fuses, 1505 alligator leads, 1605 kelvin leads, operator manual, maintenance manual

3240/3245 Optional Accessories:

1055 Cable kit	Cable, BNC to: BNC, Banana, Alligator
1005 Fixture	BNC Cable to remote fixture
1605 Kelvin leads	Shielded Kelvin leads
1505 Alligator leads	Cable, BNC to Alligator
1044 SMD Tweezers	Chip Component Tweezers
Rackmount	Rackmount kit
1456 Cal	Calibration to Mil. Std. 45662
Maintenance Manual	Manual
Operation Manual	Additional Operation Manual
3245 Options Only:	
RS 232	RS 232 Interface
IEEE-488	Interface
Handler	Handler Interface
Analog	Analog Output
1488 Cable	IEEE 488 Cable
1232 Cable	RS 232 Cable

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