Series 7000 Precision LCR Meters

CE Marked Impedance Analyzer

USES:

- Production Testing of LCR Components
- Frequency Response Characterization of Components
- Component Screening
- Material Testing
- Quality Assurance Testing
- Measuring Dielectric Constant Using Standard Test Cell

FEATURES:

- Frequency Range 10 Hz to 2 MHz (7600), 500 kHz (7400)
- 0.05% Basic Measurement Accuracy
- 7 Digit Measurement Resolution
- Programmable Test Voltage and Current
- Auto Ranging
- Test Setup and Measurement Data Storage
- Four-Terminal Kelvin Connections
- IEEE-488, RS-232, Handler, and Parallel Printer Interfaces
- Graphical and Tabular Display of Swept Frequency, Voltage and Current Measurements
- Sequence Testing of Up To 6 Individual Tests
- Load Correction
- Binning (15)
- Built-in Automatic Calibration Routine

Introduction

The 7000 LCR Meter is designed to perform precision impedance measurements over a wide frequency range, 10 Hz to 500 kHz for the model 7400 and 10 Hz to 2 MHz for the 7600. The instrument is capable of measuring 14 different parameters with 0.05% accuracy to meet today's requirements for component and material testing. The ease of use and user friendly menu programming makes the 7000 Series ideal for applications in product development, incoming inspections, or production line testing.

Description

14 Different Impedance Parameters Measure and display any two parameters simultaneously to achieve coverage and flexibility not previously available.

Automatic Test Sequencing Run up to six different tests in sequence with a single push of the start button. Each test can have different conditions and limits.

Swept Measurements Fast and accurate swept parameter measurements, graphical or tabular, for verification of component and material response to changes in AC test frequency, AC test voltage or AC test current, without the need for complex programming or an external controller.

Program and Data Storage Test setups can be stored and recalled from either internal memory or from standard DOS formatted 3 1/2" floppy disks. The front panel can be locked out, with password protection, to ensure procedures are run the same way every time. Measured data can be stored on a floppy disk and then transferred to PC for data reduction and analysis.

Load Correction Substantially improves instrument accuracy by performing measurements on a known standard and applying correction to subsequent measurements. Ideal for repetitive testing of identical devices at like test conditions.

Automatic Calibration Procedure The 7000 can be calibrated without returning the unit to the factory using the NIST traceable QuadTech Calibration Kit, reducing downtime and calibration costs.

Easy to Use Large LCD graphics display and user friendly menu driven interface allows the 7000 to be put on line fast, providing useful measurements by operators with little or no training.

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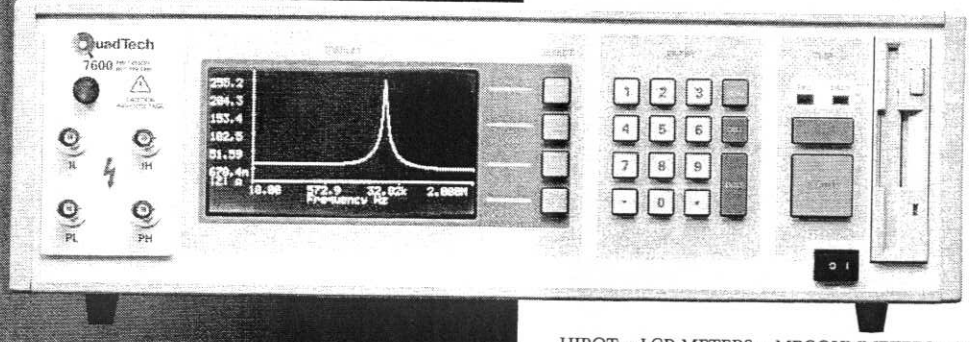

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Product Specifications

7400/7600

Measured Parameters: Any two of 14 parameters measured and displayed simultaneously, user selectable

Parameter	Measurement Range	Basic Measurement Accuracy*		
		Speed		
		Fast	Medium	Slow
Cs, Cp	00000.01 fF to 9.999999 F	±0.5%	±0.25%	±0.05%
Ls, Lp	0000.001 nH to 99.99999 H	±0.5%	±0.25%	±0.05%
D	.0000001 to 99.99999	±0.005	±0.0025	±0.0005
Q	.0000001 to 999999.9	±0.005	±0.0025	±0.0005
|Z|, Rs, Rp, ESR, Xs	000.0001 mΩ to 99.99999 MΩ	±0.5%	±0.25%	±0.05%
|Y|, Gp, Bp	00000.01 µS to 9.999999 MS	±0.5%	±0.25%	±0.05%
Phase Angle	-180.0000 to +179.9999 degrees	±1.8°	±0.9°	±0.18°

*At optimum test signal levels, frequencies, DUT values and without calibration uncertainty.

Capacitance (Cs/Cp), Inductance (Ls/Lp), Resistance (Rs/Rp), Dissipation (D) and Quality (Q) Factors, Impedance |Z|, Admittance |Y|, Phase Angle (θ), Equivalent Series Resistance (ESR), Conductance (Gp), Reactance (Xs), Susceptance (Bp)

Note: s = series, p = parallel, ESR equivalent to Rs

Test Frequency:
7400 Range: 10 Hz to 500 kHz, continuous
Resolution: 0.1 Hz from 10 Hz to 10 kHz, 5 digits>10kHz
Accuracy: +/-(0.002% + 0.02Hz)
7600 Range: 10 Hz to 2 MHz, continuous
Resolution: 0.1 Hz from 10 Hz to 10 kHz, 5 digits>10kHz
Accuracy: +/-(0.25% + 0.02Hz)

Measurement Speed:
7400 Basic: 40 meas/sec
Enhanced: 8 meas/sec
Extended: 1 meas/sec
7600 Fast: 25 meas/sec
Medium: 8 meas/sec
Slow: 1 meas/sec

Ranging: Automatic, Range Hold or user selectable

Trigger: Internal (automatic), External (RS-232, IEEE-488.2 or Handler interfaces) and Manual

AC Test Signal:
Voltage: 20 mV to 5.0 V (open circuit) up to 500kHz in 5 mV steps
7600 20 mV to 1.0 V (open circuit) 500kHz-1MHz in 5 mV steps
20 mV to 0.5 V (open circuit) >1MHz in 5 mV steps

Current: 250 µA to 100 mA (short circuit) in 50 µA steps
(Max. Compliance 3V < 500kHz.

Source Impedance: 25Ω, 400Ω, 6.4kΩ, or 100kΩ, range dependent

DC Bias Voltage:
Internal: 2.0 V
External: 0 to +/-200V
0 to +/-500V on 7400A/7600A

Display: LCD Graphics with back light and adjustable contrast

Result Formats:
Engineering or scientific notation
% Deviation from nominal of primary parameter
Deviation from nominal of primary parameter
Pass/Fail
Binning summary
No Display for maximum throughput

Sweep Result:
Primary parameter vs. frequency, voltage or current
Graphical or Tabular Format
Up to 200 measurement points per sweep

Sequencing Result: Displays up to 6 sequential test results, primary and/or secondary

AutoAcc: Automatic calculation and display of overall instrument accuracy for selected settings, test conditions and device under test

Standard Interfaces: IEEE-488.2, RS-232, Handler, Printer Port, 3.5" Disk Drive

Charged Capacitor Protection: $\sqrt{8/C}$ for Vmax ≤ 250 V; $\sqrt{2/C}$ for Vmax ≤ 1000V
C = Capacitance in farads of the device under test
Additional Fuse Protection on 7400C

Measurement Delay: Programmable from 0 - 1000 ms in 1 ms steps

Averaging:
Programmable from 1 - 1000
Median value mode

Data Storage:
40,000 measurements/disk
ASCII format DOS compatible

Program Storage:
125 per disk 25 setups internal
Password protected ASCII format

Calibration:
Recommended Calibration Interval 1 year
Complete NIST Traceable Calibration using QuadTech 7000-09 Cal Kit
Built-in automatic calibration procedure

Usage & Cal Data: Displays last calibration date, standard values used in calibration and # of hours operation

Self-Test Routine: Verifies critical instrument operation at power-up or when selected from menu

Contact Check: Time to detect, 2ms

Test Terminals: Front panel, four terminal (BNC) guarded

Mechanical:
Bench mount with tilt bail
Dimensions: (w x h x d): 16 x 6 x 14in (410 x 150 x 360mm)
Weight: 17 lbs (8kg) net, 23 lbs (10.5kg) shipping

Environmental:
Meets MIL-T-28800E, Type 3, Class 5, Style E & F
Operating: 0 to + 50° C
Humidity: <75% for 11 to 30° operating
Storage: - 40 to + 71° C

Power:
• 90 - 250Vac • 47/63Hz
• 100W max

Ordering Information

7400/7600 Precision LCR Meters
7600 LCR Meter
7600-CE LCR Meter, CE Marked
7600A LCR Meter, +/-500V External Bias
7600A-CE LCR Meter, +/-500V External Bias, CE Marked
7400 LCR Meter
7400-CE LCR Meter, CE Marked
7400A LCR Meter, +/-500V External Bias
7400A-CE LCR Meter, +/-500V External Bias, CE Marked

7400C LCR Meter, Charged Capacitor Protection
7400C-CE LCR Meter, Charged Capacitor Protection, CE Marked

Includes:
Instruction Manual
Power Cord
Calibration Certificate Traceable to NIST

Optional Accessories:
7000-00 Rack Mount Kit
7000-01 BNC Cable Set, 1 meter
7000-02 BNC Cable Set, 2 meters
7000-03 Kelvin Clip Leads
7000-04 Alligator Clip Leads
7000-05 Chip Component Tweezers
7000-06 Axial/Radial Lead Component Test Fixture
7000-07 Chip Component Test Fixture
7000-08 High Voltage Test Fixture
7000-09 Calibration Kit

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Addendum Sheet to 7400-9004 Precision LCR Meter

Introduction

The 7400-9004 is a modified 7400 which includes automatic level control and excludes other standard features.

Automatic level Contro

During the normal measurement process the instrument checks the voltage being applied to the device under test (DUT) and compares it to the programmed value, up to a maximum of 5 volts. If the difference exceeds a set tolerance (5%) the unit increases or decreases the source until the applied voltage is within limits. If the requested voltage can not be supplied a message will be placed on the display "Under Voltage" and the actual voltage obtained displayed. Under these test conditions binning assignment will be "No Contact".

Exchided 7400 Feature

Under Setup Menu:

Range Locked is not saved under stored setups

Range Locked can not be set from remote.

Under I/O Menu:

The unit is not compatible with some automatic handlers. Grounding HTC (pin 31) does not control EOT timing.

Print Results set to ON in the default setup can result in the unit rebooting and never completely powered up. Should this condition occur:

- Disconnect the printer cable from the unit.
- Power up the unit, which will display a printer error.
- Once powered up, set the Print Results to OFF in the I/O menu.
- Select Save Setup in the Utilities menu and save the current setup as default.

Under Analysis Menu:

Test Sequencing is non-functional

Parameter Sweep is non-functional

Under Utilities Menu:

Open/Short is always performed in ENHANCED measurement accuracy.

Screen saver function SAVE on the LCD backlite is non-functional

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Setup Accuracy

The AutoAcc calculation is based on the formulas below for C, X, and B with D < 0.1 and for L, R and G with Q < 0.1.

For C, X and B with D >= 0.1 multiply A% by $\sqrt{1+D^2}$.

For L, R and G with Q >= 0.1 multiply A% by $\sqrt{1+Q^2}$

For Basic Accuracy, R, L, C, X, G, B, |Z|, and |Y|

$$A\% = \pm\left[\frac{A_n}{2} + \left(\frac{A_n}{2} + \frac{0.125}{|Z_n|} + |Z_m| * 10^{-6}\right) * \left(1 + \frac{0.3}{V_s} + \frac{V_s^2}{4}\right) * \left(0.8 + \frac{F_m}{10^4} + \frac{500}{F_m}\right)\right]$$

$$* \left[1 + \left(0.22 * \frac{|Z_m|}{10 * Z_{RANGE}}\right) \Big/ \left(\frac{V_s}{1 + [(2 * V_{FS}) - V_s]}\right)\right] * K_t$$

A_n = nominal accuracy 0.5

For Enhanced Accuracy, R, L, C, X, G, B, |Z|, and |Y|

$$A\% = \pm\left[\frac{A_n}{2} + \left(\frac{A_n}{2} + \frac{0.05}{|Z_m|} + |Z_m| * 10^{-6}\right) * \left(0.8 + \frac{0.3}{V_s} + \frac{V_s^2}{4}\right) * \left(0.7 + \frac{F_m}{3 * 10^4} + \frac{400}{F_m}\right)\right]$$

$$* \left[1 + \left(0.22 * \frac{|Z_m|}{10 * Z_{RANGE}}\right) \Big/ \left(\frac{V_s}{1 + [(2 * V_{FS}) - V_s]}\right)\right] * K_t$$

A_n = nominal accuracy 0.25.

For Extended Accuracy, R, L, C, X, G, B, |Z|, and |Y|

$$A\% = \pm\left[\frac{A_n}{2} + \left(\frac{A_n}{2} + \frac{0.05}{|Z_n|} + |Z_m| * 10^{-7}\right) * \left(0.55 + \frac{0.3}{V_s} + \frac{V_s^2}{4}\right) * \left(0.7 + \frac{F_m}{5 * 10^4} + \frac{300}{F_m}\right)\right]$$

$$* \left[1 + \left(0.22 * \frac{|Z_m|}{10 * Z_{RANGE}}\right) \Big/ \left(\frac{V_s}{1 + [(2 * V_{FS}) - V_s]}\right)\right] * K_t$$

A_n = nominal accuracy 0.05.

V_S = Test voltage
Z_m = Impedance of DUT
F_m = Test frequency

K_t = 1 for 18° to 28°C, 2 for 8° to 38°C, and for 4 for 5° to 45°C

V_{FS} = 5 for test voltages >1V
1 for test voltage between 0.1V and 1V
0.1 for test voltages < 0.1V

Z_{RANGE} = 100k if Zm>25.6k
6k if Zm >1.6k & < 25.6k
400 if Zm > 100 & < 1.6k
25 if Zm < 100

continued

D Accuracy

$$D\ acc = \frac{A\%}{100} * \left(1 + \frac{|D|}{100}\right)$$

Q Accuracy

$$Q\ acc = \left[\frac{A\%}{100} + \frac{|Q|}{30}\right] * \left[1 + \sqrt{\frac{F_m}{5 * 10^4}}\right]$$

θ Accuracy

$$\theta\ acc = \frac{A\%}{10} * \left(\frac{180}{\pi}\right)$$

Note: Accuracy given by the equations is the measurement accuracy relative to calibration standards, total accuracy equals the relative measurement accuracy plus the calibration uncertainty of the calibration standards.

All AutoAcc calculations are incorrect in the current mode and Q is incorrect in voltage mode.

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