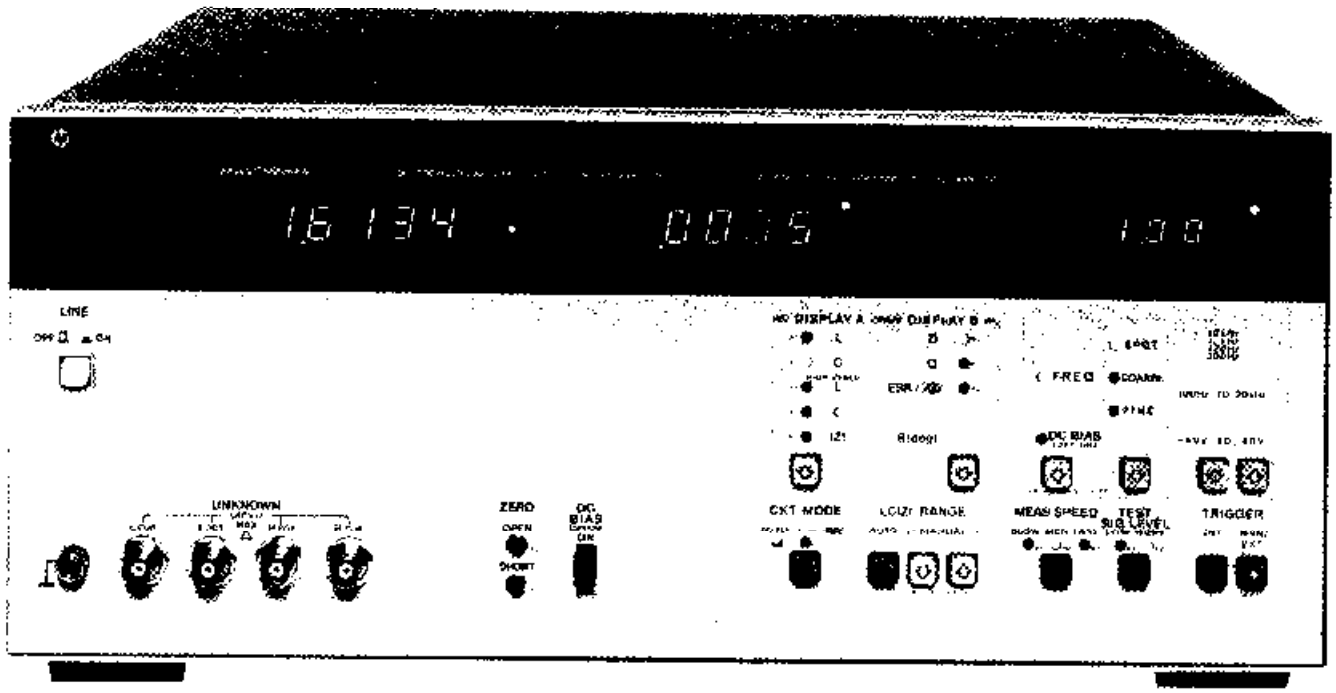
COMPONENT & SEMICONDUCTOR MEASUREMENT

LCZ Meters

Models 4276A & 4277A

Model 4276A

- 3-digit frequency setting: 100 Hz to 20 kHz (801 spots)
- High speed measurements (1 kHz): 95 ms/meas (4-digit display resolution); 60 ms/meas (3-digit display resolution)
- Measure L/C-D/Q/ESR/G, Z| - θ, high speed L/C
- 10-bin component sorting-comparator
- 0.1% basic accuracy over impedance range of 100 mΩ to 10 MΩ



HP 4276A

HP-IB SYSTEMS

Description

HP's 4276A and 4277A LCZ Meters are general purpose impedance measuring instruments designed to measure circuit components such as capacitors and inductors using frequency and dc bias conditions identical to those of the intended application. Both HP 4276A and HP 4277A feature variable test frequency (100 Hz – 20 kHz and 10 kHz – 1 MHz respectively), optional dc bias variable from 0 to ± 40 V, multiple parameters (L • C • |Z| • D • Q • ESR • G • θ) with fully automatic high speed measurements, and 4½ digit resolution. The HP 4276A has an impedance range of 100 mΩ to 10 MΩ and the HP 4277A 10 Ω to 1 MΩ.

Both instruments are ideal for production line, quality control, and circuit design applications, and are versatile enough for stand-alone use or systems use under HP-IB control (standard). An optional comparator for 10-bin sorting with measurement time of less than 100 ms make the HP 4276A/4277A a good choice for production line testing of discrete components.

Variable Test Parameters: Frequency, Bias, Signal Level

HP's 4276A and 4277A offer variable test frequency, optional internal dc bias, and selectable test signal level (HIGH and LOW). This makes it possible to measure components under conditions almost identical to those of the intended circuit.

The HP 4276A (100 Hz to 20 kHz) and the HP 4277A (10 kHz to 1 MHz) provide 801 and 701 test frequencies, respectively. Test frequencies of both instruments are linearly spaced along a logarithmic scale. The most commonly used test frequencies for production line measurements–100 Hz, 120 Hz, 1 kHz and 1 MHz, all of which are specified in MIL/IEC standards are included. Frequency setting resolution is 3 digits.

Both instruments feature selectable test signal levels: 1 V/50 mV (Cp) (HP 4276A) and 1 V/20 mV(Cp) (HP 4277A)–and both can be equipped with an optional internal dc bias source that is variable from 0 to + 40 V in 10 mV (0 to 10 V) or 100 mV (10 to 40 V) steps. Thus, bias conditions that suit the measurement and the DUT can be selected, an important consideration for semiconductor C/V measurements.

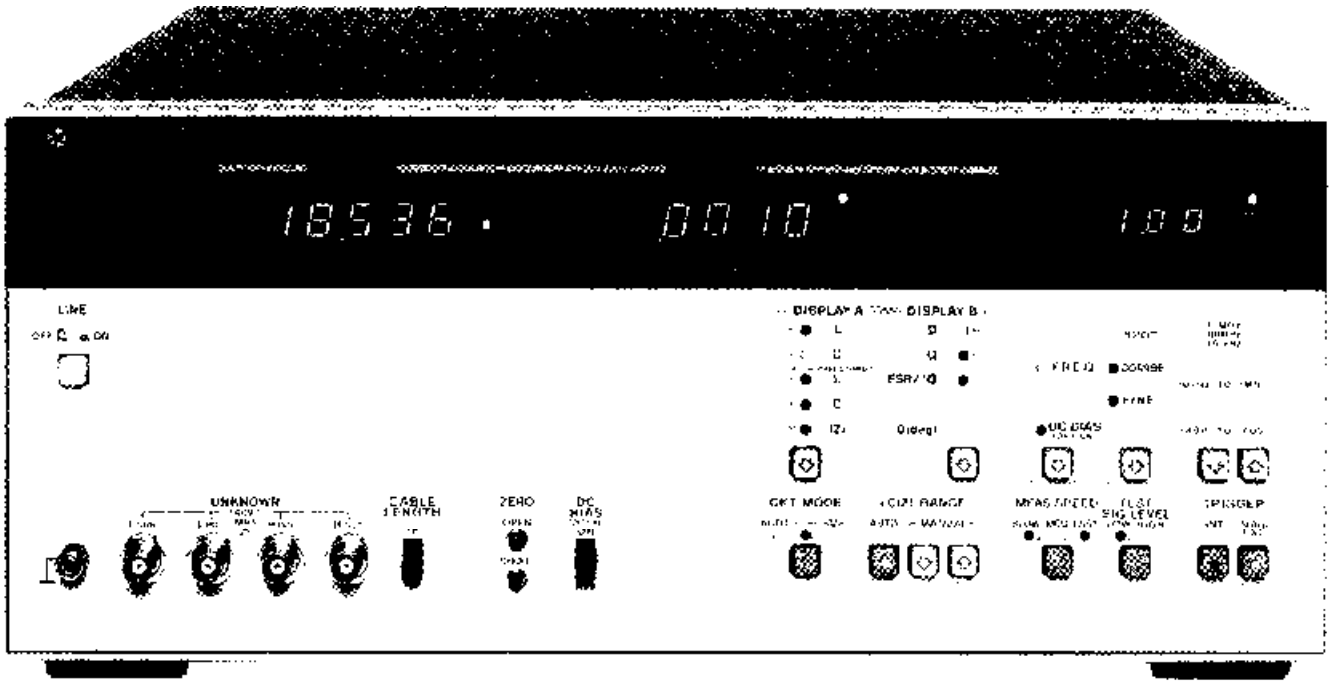
The features described above satisfy most impedance measurement requirements for component development and circuit design. HP-IB enhances these features.

High Speed Measurements

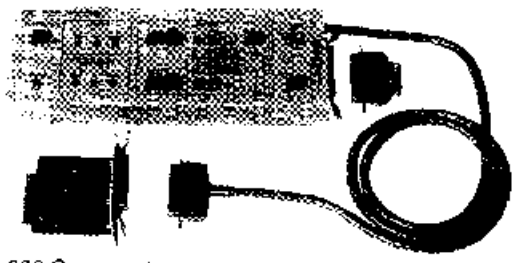
The HP 4276A and HP 4277A provide high speed measurements with 3½ to 4½ digits resolution. The time required for a C-D measurement, for example, is 95 ms (4-digit) or 60 ms (3-digit) at 1 kHz, and 70 ms (4-digit) or 60 ms (3-digit) at 1 MHz. Even at 120 Hz, a measurement time of 170 ms (4-digit) or 150 ms (3-digit) is possible. Also, when the instrument is set to high speed L or high speed C measurement mode, measurement time is 45 ms (4-digit) or 35 ms (3-digit) at 1 kHz (if D is less than 0.002), and 40 ms (4-digit) or 30 ms (3-digit) at 1 MHz (if D is less than 0.01).

Model 4277A

- 3-digit frequency setting: 10 kHz to 1 MHz (701 spots)
- High speed measurements (1 MHz): 70 ms/meas (4-digit display resolution); 60 ms/meas (3-digit display resolution)
- Measures L/C-D/Q/ESR/G, Z - θ, high speed L/C
- 10-bin component sorting-comparator (optional)
- 0.1% basic accuracy over impedance range of 10 Ω to 1 MΩ



HP 4277A



Option 002 Comparator

Such high speeds considerably improve the efficiency and increase the throughput of high volume measurements such as outgoing inspection on the production line and incoming inspection by component end users. If an HP-IB system is configured, measurement efficiency is further improved because HP-IB is capable of packed binary data output format, which can be processed much faster than the usual ASCII format. Even when the HP-IB capability is not used, the HP 4276A/4277A can increase production line throughput if the optional comparator is used.

Optional Ten-Bin Component Sorting

A 10-bin comparator (option 002) is available. Nine sets of bin limits (high and low) can be input for L, C or |Z|. Also, high and low limits for D,Q,ESR, or G can be set to provide go/no-go testing.

Multiple bin sorting is especially beneficial on the production line and in incoming inspection. Test costs can be significantly reduced using the HP 4276A/4277A's high speed measuring capability. When the optional handler interface is used for automatic component sorting, measurement efficiency is better than that when using HP-IB. This is because time for data handshake is not needed.

Output data from the handler interface is at TTL or open collector level, which improves system noise immunity. Particularly, three lines-external trigger and measurement complete signals are photo-isolated, so a reliable sorting system free from noise can be constructed.

Measurement reliability is improved by other comparator features such as front panel lock-out and auto zeroing of fixture residuals.

Plus, all comparator functions can be HP-IB controlled. So a fully automatic component sorting system can be constructed for use in outgoing/incoming inspection.

Specifications (Refer to data sheet for complete specifications)

(Common to HP 4276A and HP 4277A)

Parameters measured: C·D•Q•ESR•G
L·D•Q•ESR•G
high speed L, high speed C
|z|-Θ and Δ(deviation for any parameter)

Display: 4½ digits (max), maximum display 19999

COMPONENT & SEMICONDUCTOR MEASUREMENT

LCZ Meters

Models 4276A & 4277A (cont.)

Measurement circuit modes: Auto, Parallel, and Series
Frequency control modes: SPOT (100 Hz, 120 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz), COARSE (10 freq./decade), and FINE (max. freq. resolution).

Test Signal Level (unknown terminal open)

	HIGH	LOW
HP 4276A	1 Vrms ± 10%*	50 mV ± 20%*(Cp or y)
HP 4277A	1 Vrms ± 10%	20 mV ± 15%

*at 1 kHz only
Output impedance: 100 Ω
Ranging modes: Auto and Manual (up-down)
Trigger: Internal, External or Manual
Measurement terminals: 5-terminal (HP 4276A)
4-terminal pair (HP 4277A)
Measurement speed modes: FAST, MED, and SLOW
Offset adjustments: front panel OPEN and SHORT adjustments to compensate for residual impedance and stray admittance of the test fixture.
Test frequencies: **HP 4276A** - 100 Hz to 20 kHz ± 0.01% (801 points)
HP 4277A - 10 kHz to 1 MHz ± 0.01% (701 points)

Step Frequency

Test Frequency	Step Frequency
100 Hz–200 Hz	1 Hz
202 Hz–500 Hz	2 Hz
505 Hz–1 kHz	5 Hz
1.01 kHz–2 kHz	10 Hz
2.02 kHz–5 kHz	20 Hz
5.05 kHz–10 kHz	50 Hz
10.1 kHz–20 kHz	100 Hz
20.2 kHz–50 kHz	200 Hz
50.5 kHz–100 kHz	500 Hz
101 kHz–200 kHz	1 kHz
202 kHz–500 kHz	2 kHz
505 kHz–1 MHz	5 kHz

Compensation Frequencies

HP 4276A: 100, 200, 500, 1k, 2k, 5k, 10k, 16k, 20 kHz
HP 4277A: 10k, 20.2k, 50.5k, 100k, 202k, 505k, 700k, 900k, 1 MHz
Compensation at other frequencies is automatically done using second degree interpolation.

Offset Ranges

	HP 4276A	HP 4277A
OPEN	C ≦ 20 pF G ≦ 0.2 μS	C ≦ 20 pF G ≦ 2 μS
SHORT	|Z| < 2 Ω	L ≦ 2 μH R ≦ 2 Ω

HP-IB Interface
Remote control: all front panel control settings and HP 16064A (comparator) settings can be controlled using HP-IB.
Data output: parameter measured, equivalent circuit, display status, measured values and decision output of comparator.
Output format: ASCII and packed binary.
Self test: checks HP 4276A/4277A's basic operation.

Measurement accuracy and range: specified at the front panel unknown connectors when all of the following conditions are satisfied:
(1) warmup time ≧ 30 min.
(2) test signal level is set to HIGH (1 Vrms)
(3) measurement speed mode: MED or SLOW
(4) ambient temperature is 23°C ± 5°C
(5) cable length switch is set to 0m (HP 4277A)
(6) OPEN and SHORT adjustments have been made
(7) D ≦ 0.1 (L-D•Q, C-D•Q, and $|Z| - \theta$ measurements)
D ≦ 0.002 (HP 4276A) high speed L/C measurement
D ≦ 0.01 (HP 4277A)
Accuracies given in Tables 1 through 6 are read as ±(% of reading + number of counts) for L, C, and |Z|, and ±(number of degrees + number of counts) of θ.
C-D/C-Q (1/D) measurement accuracy: accuracies for C measurements are given in Table 1 (frequencies other than 100, 120, 1k, and 1 MHz) and Table 2 (100, 120, 1k and 1 MHz only). The HP 4277A's C accuracies in the tables are for the full scale value of each C range.
High Speed C Measurements can be made under the following conditions

	Test Frequency	Measurement Range	D
HP 4276A	All frequencies	All ranges except for the two highest ranges at each frequency	≦ 0.002
HP 4277A	1 MHz	1 pF – 10 nF	≦ 0.01

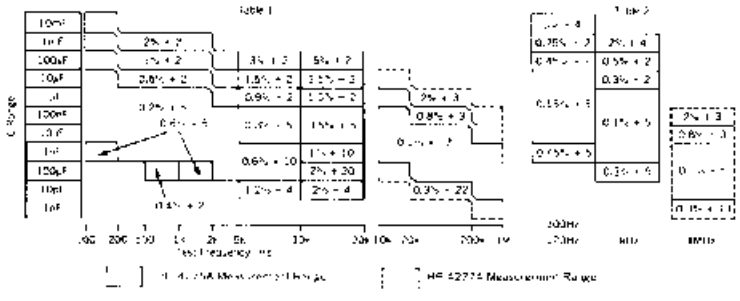
(Refer to the HP 4276A/4277A data sheet for complete accuracy specifications, including D/Q accuracies)
L-D/L-Q (1/D) Measurement: accuracies for L measurements are given in Table 3 (for frequencies other than 1k, 10k, 100k, and 1 MHz) and Table 4 (for 1k, 10k, 100k, and 1 MHz). The HP 4276A's L accuracies given in the tables are for the full scale value of each L range.
High Speed L Measurement can be made under the following conditions

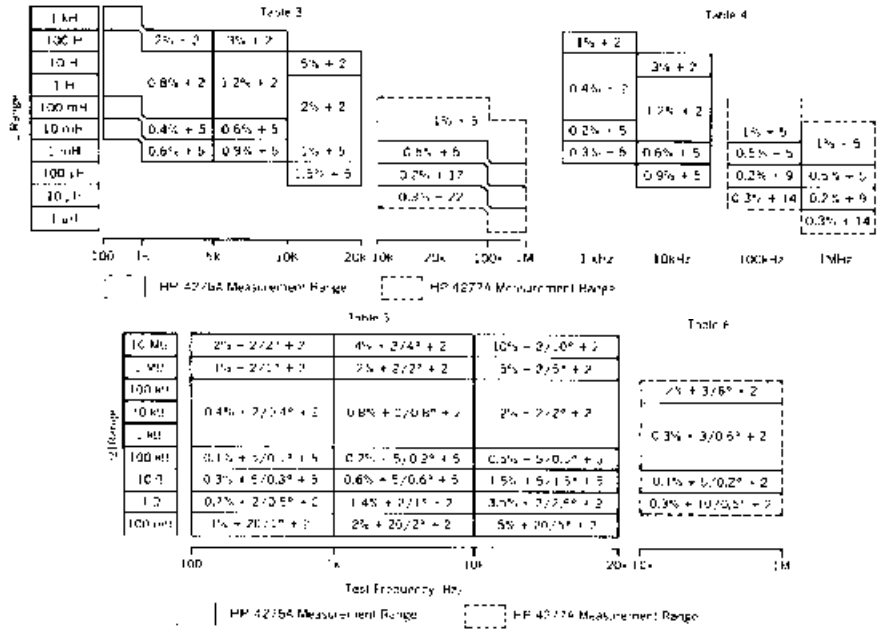
	Test Frequency	Measurement Range	D
HP 4276A	All frequencies	All ranges except for the two highest ranges at each frequency	≦ 0.002
HP 4277A	1 MHz	1 μH – 100 μH	≦ 0.01

(Refer to the HP 4276A/4277A data sheet for complete accuracy specifications, including D/Q accuracies)
$|Z| - \theta$ Measurement: accuracies for $|Z|/\theta$ measurements are given in Table 5 (HP 4276A) and Table 6 (HP 4277A). Accuracies given in the tables are for the full scale value of each |Z| range.
DC Bias
Internal dc bias (opt.): 0 to ±40 V

Bias Voltage	Voltage Step	Accuracy (at 23 ± 5°C)
–40.0 to –10.0 V	0.1 V	±(1% of reading + 35 mV)
9.99 to –0.01 V	0.01 V	±(1% of reading + 10 mV)
0.00 to 9.99 V	0.01 V	±(0.3% of reading + 10 mV)
10.0 to 40.0 V	0.1 V	±(0.5% of reading + 35 mV)

Output resistance: 1020 Ω ± 10% (HP 4276A)
1040 Ω ± 10% (HP 4277A)
Control: front panel or via HP-IB
External dc bias via rear panel: 0 to ± 40 V
Continuous Memory (approx. two weeks)
Memory contents: all front panel key settings, excluding BIAS, offset values, reference for deviation and comparator limit data.





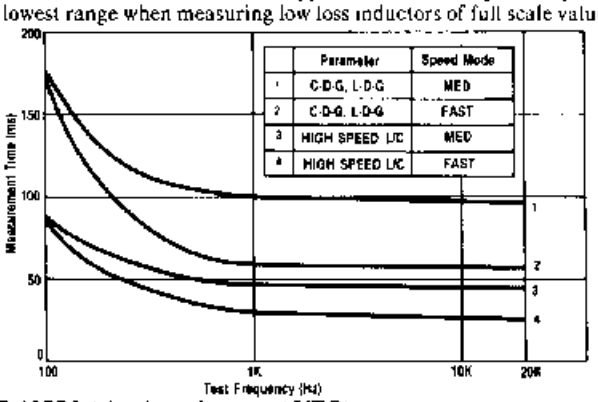
General

Measurement Time (Typical)

HP 4276A (circuit mode set to AUTO, and test signal level set to HIGH)

Capacitance measurement: applicable to all ranges except for highest range when measuring low loss capacitors of full scale value.

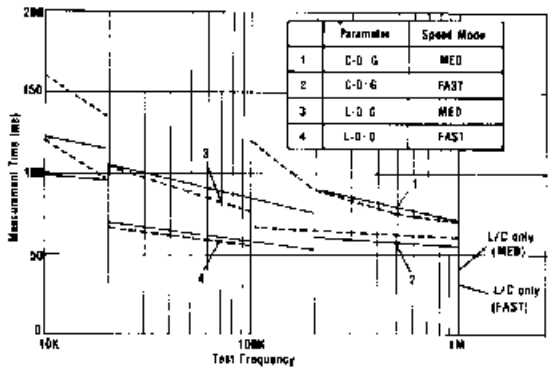
Inductance measurement: applicable to all ranges except for lowest range when measuring low loss inductors of full scale value.



HP 4277A (circuit mode set to AUTO)

Capacitance measurement: applicable to parallel C ranges when measuring low loss capacitors of full scale value.

Inductance measurement: applicable to series L ranges when measuring low loss inductors of full scale value.



Operating temperature and humidity: 0° to 55°C, ≤ 95% RH at 40°C.

Power requirements: 100/120/220 Vac ±10%, 240 V + 5% −10%; 48 to 66 Hz.

Power consumption: 65 VA max (HP 4276A); 75 VA max (HP 4277A).

Size: 188 mm H x 426 mm W x 422 mm D (7⅜" x 16¾" x 16⅝").

Weight: approx. 8.5 kg (18.7 lb).

Options

Opt 001: Internal dc bias, 0 to ±40 V, max resolution 10 mV/100 mV.

Opt 002: 10-bin sorting for L/C/|Z| and go/no-go testing for D/Q, interfaceable with component handler, usable only with HP 4276A/4277A.

Limit data input: high and low limits using comparator numerical keys or HP-IB

Limit setting range: 00000 to 19999

Decision output: BIN number, LED (high/in/low), or HP-IB

Handler interface (negative true)

Output signal (open collector or TTL)

Decision outputs: BIN number, high/in/low

Index: analog measurement complete, photo isolated

Measurement complete: full measurement complete, photo isolated

Input signal (open collector or TTL)

External trigger: photo isolated

Accessories	Price
Furnished accessories: HP 16047A Direct Coupled Test Fixture	N/C
Accessories Available	
HP 16034B: Tweezer Type Test Fixture for Chip Components	$245
HP 16047C: Test Fixture	$285
HP 16048A: Test Leads, BNC (1m)	$280
HP 16048B: Test Leads, RF Miniature (1m)	$280
HP 16048C: Test Leads, with Alligator chips (1m)	$330
HP 16048D: Test Leads, BNC (2m)	$360
HP 16064A: Retrofit Kit for Comparator (HP 4276A/HP 4277A, Opt 002)	$600
HP 16065A: External DC Bias Test Fixture (≤200 V)	$660
Options	
001: Internal DC Bias	$165
002: Comparator	$580

Ordering Information	Price
HP 4276A LCZ Meter	$3,850
HP 4277A LCZ Meter	$5,500