

# LCR & RESISTANCE METERS

## 1 kHz/1 MHz Capacitance Meter

### HP 4278A

- Measurement speed: 6.5 ms/10 ms/21 ms
- Measurement parameters: C-D,Q,ESR,G
- C-D measurement accuracy:  
0.07%, 0.0005 (1 kHz, 21 ms)  
0.05%, 0.0002 (1 MHz, 21 ms)
- High resolution: 6 digit, D:0.00001
- Intelligent built-in comparator: 10-bin sorting



HP 4278A

### HP 4278A Capacitance Meter



The HP 4278A 1 kHz/1 MHz capacitance meter is a high-speed, highly reliable, precision test instrument aimed at incoming/outgoing capacitor inspection applications on the production line and in quality control. The HP 4278A will improve test efficiency by performing comparative measurements of low to medium value capacitors (up to 200  $\mu\text{F}$ —a range that covers most ceramic and film capacitors).

The HP 4278A's standard measurement frequencies and oscillator output levels are 1 kHz/1 MHz and from 0.1 V to 1 V in 0.1 V steps, respectively.

The built-in comparator function of the HP 4278A gives you the ability to sort parts into ten bins. A high-speed HP-IB interface and an optional handler interface are available for combining the HP 4278A with an automatic handler and an external computer, to build a total solution for automatic testing and data acquisition and analysis.

#### Specifications (Refer to data sheet for complete specifications.)

**Measurement Parameters:** C-D,Q,ESR,G

**Display:** Dot-matrix LCD, 4, 5, 6 digits, selectable

**Measurement Circuit Modes:** Parallel and series

#### Test Signals

**Frequency:** 1 kHz and 1 MHz,  $\pm 0.02\%$

**Signal Level:** 0.1 to 1 V rms,  $\pm 10\%$  ( $C \leq 20 \mu\text{F}$ ), in 0.1 V rms steps

**Measurement Time Modes:** SHORT, MEDIUM, and LONG

#### Measurement Times

Mode	SHORT	MEDIUM	LONG
Time*	6.5 ms	10 ms	21 ms

\*Measurement time includes settling, integration (analog measurements), calculation, and comparison times.

#### Measurement Range

Measurement Parameter	1 KHz	1 MHz normal mode	
		1 MHz high accuracy	
C	0.001 pF to 200.000 $\mu\text{F}$	0.00001 pF to 1280.00 pF	0.00001 pF to 2663.00 pF
D	0.00001 to 9.99999	0.00001 to 9.99999	.000001 to .999999

- 1 kHz normal mode: 7 decade ranges 100 pF to 100  $\mu\text{F}$  full scale. 100% overranging on all ranges, (max. 200000 counts) when  $D \leq 0.5$ .
- 1 MHz normal mode: 11 binary ranges, 1 pF to 1024 pF full scale. 25% overranging on all ranges, when  $D \leq 1$ .
- 1 MHz high accuracy mode: Measurement range is  $\pm 30\%$  of the user-defined nominal value, maximum 2048 pF, when  $D \leq 0.05$ .

#### Measurement Accuracy

It is specified at the UNKNOWN terminals and at the end of standard 1- or 2-m test leads under the following conditions:

1. Warmup time:  $\geq 10$  minutes
2. Ambient temperature is  $23 \pm 5^\circ\text{C}$  and variance is less than  $0.2^\circ\text{C}/\text{minute}$
3. Test signal level is set to 1 V rms

4. Zero OPEN/SHORT compensation has been performed
5.  $D \leq 0.05$  for 1 MHz High Accuracy Mode,  
 $D \leq 0.1$  for 1 kHz and 1 MHz Normal Modes
6. Accuracies are only valid when the measured value is equal to the full scale of each range
7. Accuracy stated in the tables is given for LONG integration time
8. Accuracy equations are read as follows:  
C:  $\pm$  (% of reading + % of full scale)  
D:  $\pm$  (% of reading + absolute D value)  
(C:  $\pm$  (% of reading + absolute C value) for Table 3)

Table 1: 1 kHz Measurement Accuracy

C range	C	D
100 $\mu\text{F}$	0.07% + 0.025%	0.065% + 0.0025
100 pF to 10 $\mu\text{F}$	0.05% + 0.025%	0.05% + 0.0005

Table 2: 1 MHz Normal Mode Measurement Accuracy

C range	C	D
256 to 1024 pF	0.1% + 0.02%	0.1% + 0.0005
4 to 128 pF	0.05% + 0.02%	0.1% + 0.0005
2 pF	0.05% + 0.03%	0.1% + 0.0005
1 pF	0.05% + 0.06%	0.1% + 0.001

Table 3: 1 MHz High Accuracy Mode Measurement Accuracy

Nominal C + Open Circuit C	C	D
1024 to 2048 pF	0.11%	0.0004
256 to 1024 pF	0.07%	0.0003
4 to 256 pF	0.05%	0.0002
2 to 4 pF	0.06% + 0.0004 pF	0.0003
0 to 2 pF	0.08% + 0.0004 pF	0.0006

**Trigger Modes:** Internal, external, or manual

**Measurement Terminals:** Four-terminal pair, guarded

**Cable Length Compensation:** 0, 1, or 2 m

**Compensation Function:** Zero OPEN/SHORT, standard, offset

**Comparator:** Ten-bin sorting for capacitance, and go/no-go testing for D, Q, ESR, and G

**Self Test:** Checks the HP 4278A's basic operation

**Memory Card:** External memory for storing and recalling control settings and comparator limits

#### General Specifications

**Operating Temperature/Humidity:**  $5^\circ$  to  $45^\circ\text{C}$ , 95% RH @  $40^\circ\text{C}$

**Power:** 100, 120, 220 Vac  $\pm 10\%$ , 240 Vac  $+5 -10\%$ , 48 to 66 Hz, 200 VA max.

**Size:** Approximately 426 mm W x 177 mm H x 498 mm D (16.77 in x 6.97 in x 19.61 in)

**Weight:** Approximately 15 kg (33 lb, standard)

#### Key Literature

HP 4278A Capacitance Meter Data Sheet, p/n 5952-7882

#### Ordering Information

HP 4278A 1 kHz/1 MHz Capacitance Meter

Opt W30 Extended Repair Service (see page 592)

Opt 001 1 kHz Test Frequency Only

Opt 002 1 MHz Test Frequency Only

Opt 003 1% Frequency Shift: Prevents possible test signal interference when component test contacts are located close to those of other test units

Opt 101 HP-IB Compatibility

Opt 201 Handler Interface

Opt 202 Handler Interface

Opt 301 Scanner Interface

#### Accessories Available

HP 16270A Memory Card Set

HP 16334A Tweezer-Type Test Fixture for Chip Components

HP 16047A Direct-Coupled Test Fixture

HP 16047C Test Fixture

HP 16048A Test Leads, BNC (1 m)

HP 16048B Test Leads, SMC (1 m)

HP 16048D Test Leads, BNC (2 m)