

# Keysight Technologies

## E4981A Capacitance Meter

Setting a new standard for ceramic capacitor production tests



## A New Standard for Ceramic Capacitor Production Tests

The Keysight Technologies, Inc. E4981A capacitance meter provides the best performance for

ceramic capacitor manufacturing test. Offering fast measurement speed and outstanding accuracy, the E4981A is the new standard in this industry.

### High-resolution LCD display

Full 7 digit display for clear and easy viewing

### Easy-to-use hardkeys and softkeys

Users can set the measurement parameters easily.

### USB interface (USB memory device only)

Users can save measurement state data logs, and screen captures easily to USB memory devices.



### Compact size

Small size to fit in an auto handler system

- 370 (W) x 105 (H) x 350 (D) mm (with front handle kit)
- 4.3 kg

### Wide range capacitance measurement

From small to large capacitance can be measured

## A Complete Solution that Replaces the 4268A and 4288A

### Key Features

**Fast measurement speed – 2 ms**  
(From trigger to EOM at 1 MHz)

**Accurate and repeatable measurements**

- Basic accuracy  
Capacitance:  $\pm 0.07\%$  (typical  $\pm 0.042\%$ )  
Dissipation Factor:  $\pm 0.0005$  (typical  $\pm 0.0003$ )
- Repeatable measurements, even small capacitance can be measured.

**Wide measurement range from small to large capacitance**  
0 F to 2.0 mF

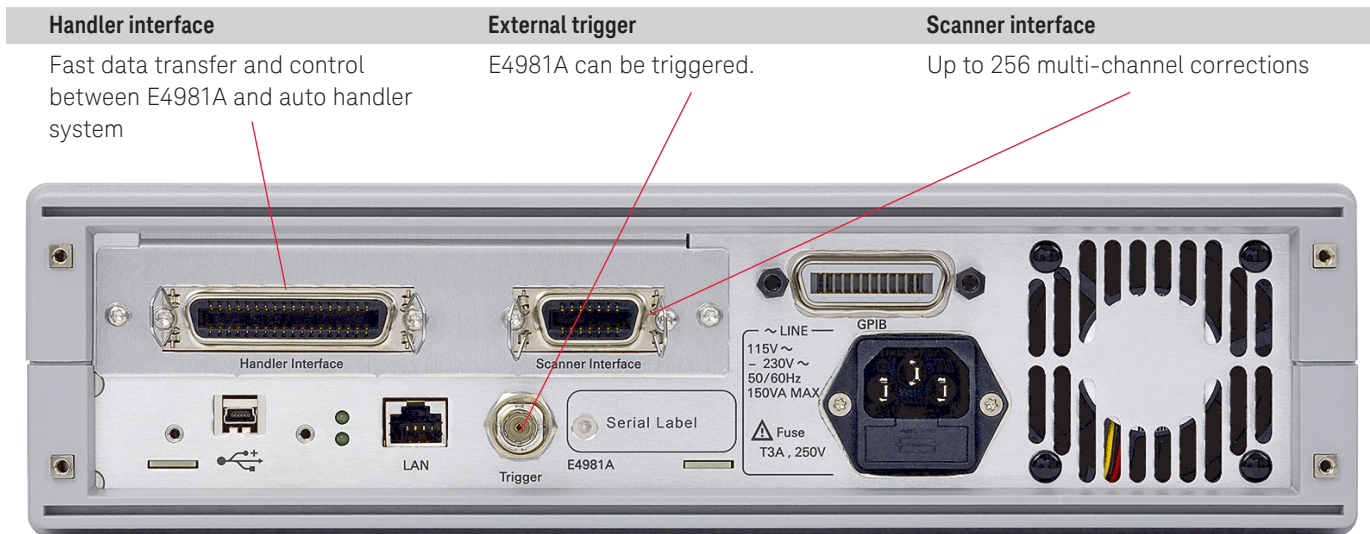
- (0 F to 1.5 nF/1 MHz)
- (68 pF to 200 nF/1 kHz)
- (6.8 nF to 2 mF/120 Hz)

**Compatibility with the 4268A and 4288A**

- SCPI commands
- Handler I/F
- Scanner I/F

**Enhanced functions for production test**

- Enhanced contact failure detections
- Synchronous source
- Frequency shift ( $\pm 1\%$ ,  $\pm 2\%$ ) at 1 MHz
- Faster data transfer



#### Handler interface

Fast data transfer and control between E4981A and auto handler system

#### External trigger

E4981A can be triggered.

#### Scanner interface

Up to 256 multi-channel corrections

#### Standard USB/LAN/GPIB interface

Flexible PC connectivity and fast transfer speed

- 10/100 Base-T LAN
- USB (USBTMC) interface
- GPIB

## Fast, Accurate, and Repeatable Measurement

### Faster measurement speed

- More than two times faster measurement speed than the 4268A and 4288A
- No additional time for bin-sorting, scanner and synchronous source

| Frequency | T1      | T2 (1*)                |         | T3<br>(Trigger wait time) | 4268A<br>T2 | 4288A<br>T2 |
|-----------|---------|------------------------|---------|---------------------------|-------------|-------------|
|           |         | Status register update |         |                           |             |             |
|           |         | On                     | Off     |                           |             |             |
| 1 MHz     | 1.3 ms  | 2.3 ms                 | 2.0 ms  | 0 ms                      | NA          | 6.5 ms      |
| 1 kHz     | 2.0 ms  | 3.0 ms                 | 2.7 ms  |                           | 22.5 ms     | 6.5 ms      |
| 120 Hz    | 10.0 ms | 11.0 ms                | 10.7 ms |                           | 22.5 ms     | NA          |

\*1 tolerance is  $\pm 0.5$ ms

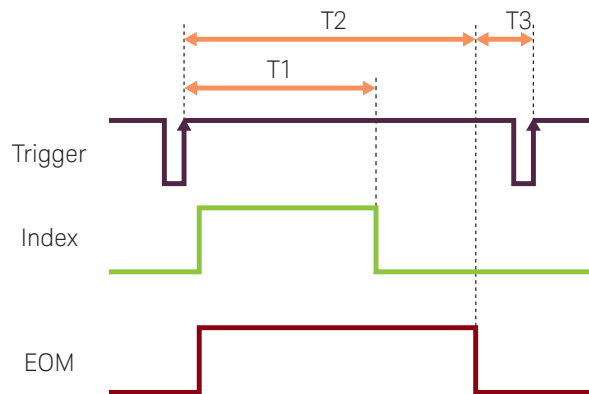


Figure 1. Measurement speed

### Repeatable measurements

- Smaller fluctuation, especially in 1 pF range measurement.

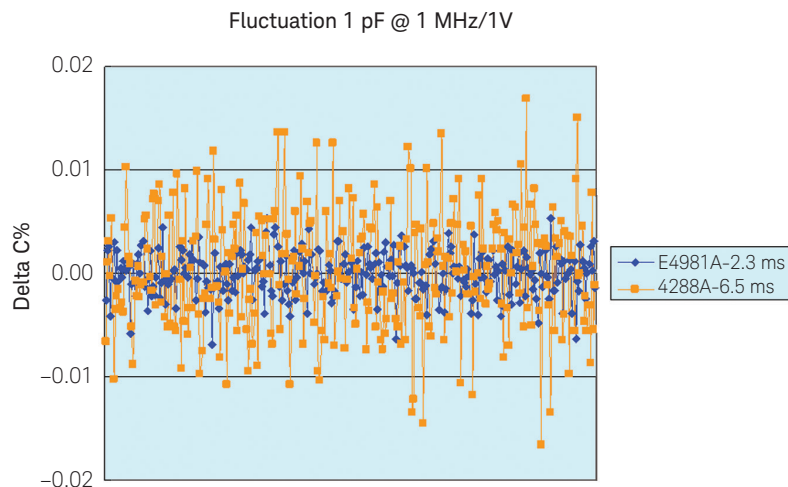


Figure 2. Measurement fluctuation comparison (Supplemental information)

## Increased accuracy

Accurate capacitance measurement across all frequencies.

| Range          | Measurement speed  |  |         |
|----------------|--|--|---------|
|                | 1 MHz  | 2.3 ms   | 9.3 ms  |
| 1 pF           | C: $0.055 + 0.070 \times K$<br>D: $0.00035 + 0.00070 \times K$ | C: $0.055 + 0.030 \times K$<br>D: $0.00035 + 0.00030 \times K$ |         |
| 2.2 pF         | C: $0.055 + 0.045 \times K$<br>D: $0.00035 + 0.00045 \times K$ | C: $0.055 + 0.020 \times K$<br>D: $0.00035 + 0.00020 \times K$ |         |
| 4.7 pF - 1 nF  | C: $0.055 + 0.030 \times K$<br>D: $0.00035 + 0.00030 \times K$ | C: $0.055 + 0.015 \times K$<br>D: $0.00035 + 0.00015 \times K$ |         |
|                | 1 KHz  | 3.0 ms   | 10 ms   |
| 100 pF         | C: $0.055 + 0.070 \times K$<br>D: $0.00035 + 0.00070 \times K$ | C: $0.055 + 0.030 \times K$<br>D: $0.00035 + 0.00030 \times K$ |         |
| 220 pF         | C: $0.055 + 0.045 \times K$<br>D: $0.00035 + 0.00045 \times K$ | C: $0.055 + 0.020 \times K$<br>D: $0.00035 + 0.00020 \times K$ |         |
| 470 pF - 10 uF | C: $0.055 + 0.030 \times K$<br>D: $0.00035 + 0.00030 \times K$ | C: $0.055 + 0.015 \times K$<br>D: $0.00035 + 0.00015 \times K$ |         |
|                | C: $0.4 + 0.060 \times K$<br>D: $0.004 + 0.00060 \times K$     | C: $0.4 + 0.030 \times K$<br>D: $0.004 + 0.00030 \times K$     |         |
|                | 120 Hz   | 11.0 ms  | 69.1 ms |
| 10 uF - 100 uF | C: $0.055 + 0.030 \times K$<br>D: $0.00035 + 0.00030 \times K$ | C: $0.055 + 0.015 \times K$<br>D: $0.00035 + 0.00015 \times K$ |         |
| 220 uF - 1 mF  | C: $0.4 + 0.060 \times K$<br>D: $0.004 + 0.00060 \times K$     | C: $0.4 + 0.030 \times K$<br>D: $0.004 + 0.00030 \times K$     |         |

$K = 1/V_s \times Cr/C_x$

$V_s$ : Signal level

Cr: Measurement range

Cx: Measured value

## Useful Functions for Production Test

### Bin sorting

- Up to 9 bins for C-D/Q/R/G pass/fail

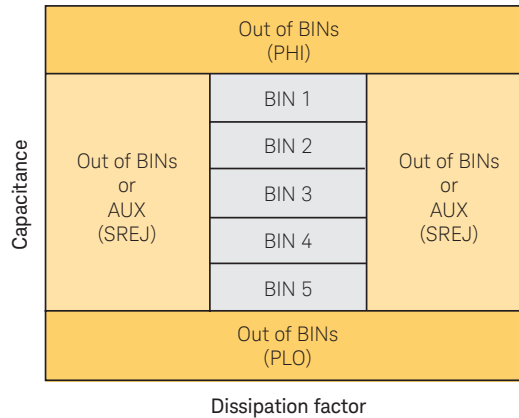


Figure 3. Bin sorting

### Scanner interface

- Open/Short/Load channel-by-channel error correction up to 256 channels

### Contact check function

The contact check function permits detection of possible contact failure. No additional time is required to perform it.

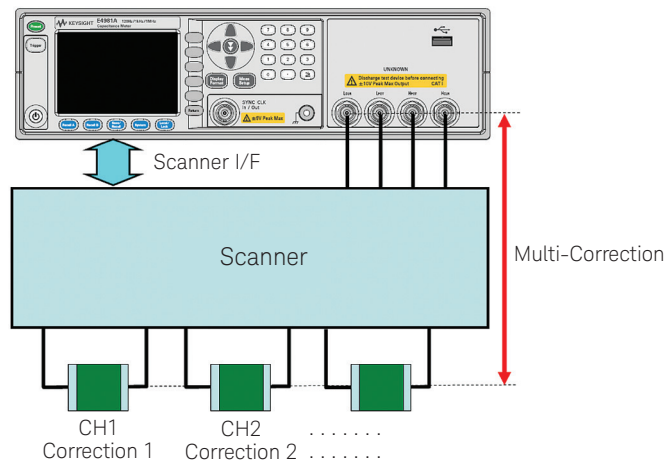


Figure 4. Scanner interface

### Synchronous source

The test signal can be applied while a measurement is performed. This function reduces contact pin abrasion due to large test current, because the test signal is not applied at the moment the device is contacted and removed.

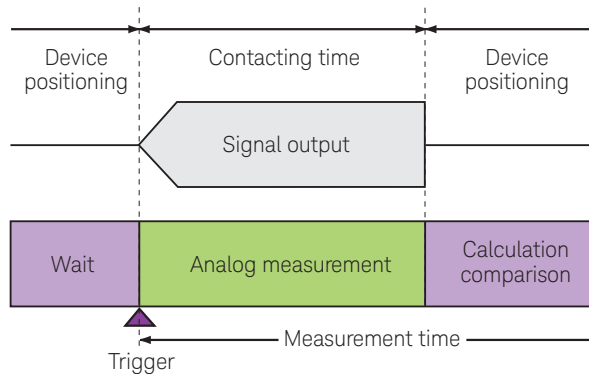


Figure 5. Synchronous source

## Faster data transfer

- Faster GPIB/USB data transfer

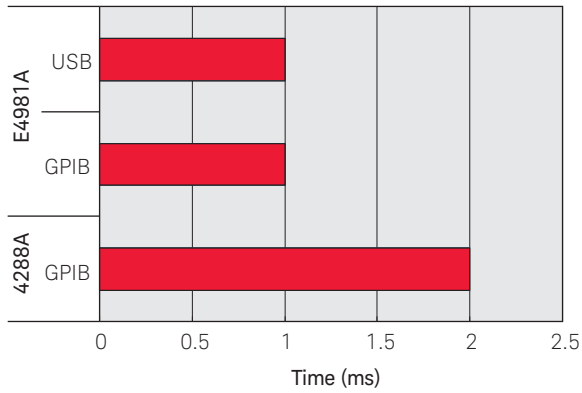


Figure 6. Data transfer speed comparison (4288A vs. E4981A)

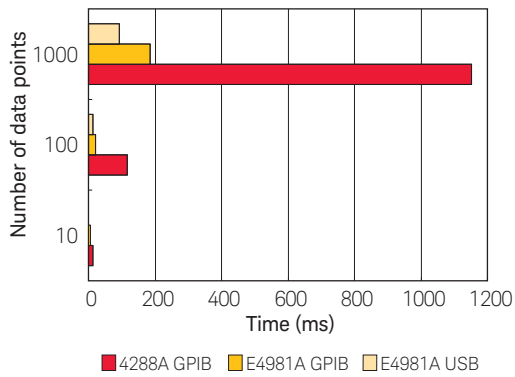


Figure 7. Buffered data transfer speed comparison (4288A vs. E4981A)

## Test frequency shift at 1 MHz

- Frequency shift -2%, -1%, +1% and +2% is available. When two or more capacitance meters are needed to integrate into an auto handler system, such as the array-type capacitor test system, this function eliminates the interference between adjacent measurement terminals. The fluctuation in measurements can be reduced.

## Modern Storage Device and PC Connectivity

### Measurement setup/data save

- 10 measurement setups can be saved in internal memory and external USB memory
- Measurement result log can be saved in an external USB memory



Figure 9. USB memory

### PC connection

- GPIB/LAN/USB Interfaces are standard
- Interactive remote operation using web browser through LAN is available.



Figure 10. Interactive remote operation using web browser



## The E4981A Provides Even Greater Value

Not only does the E4981A provide increased performance, transitioning to the E4981A is seamless as the 4268A and 4288A functions and SCPI commands are compatible with the E4981A. For detailed migration information, refer to the migration guide available on our web site.

### Key specification and function compatibility

| Item                                 | E4981A   | 4288A                         | 4268A                         |
|--------------------------------------|--|-------------------------------|-------------------------------|
| Measurement parameter                | Cs-D, Cs-Q, Cs-Rs<br>Cp-D, Cp-Q, Cp-Rp, Cp-G   | <—                            | <—                            |
| Frequency                            | 120 Hz, 1 kHz, 1 MHz   | 1 kHz, 1 MHz                  | 120 Hz, 1 kHz                 |
| Frequency shift @ 1 MHz              | 2%, 1%, -1%, -2%   | 2%, 1%, -1%                   | NA                            |
| Sync source                          | Yes  | No                            | Yes                           |
| Signal level                         | 0.1 V to 1 V   | <—                            | <—                            |
| Measurement time<br>(Trigger to EOM) | 2.3/3.3/5.3/7.3/9.3 ms @ 1 MHz<br>3.0/4.0/6.0/8.0/10.0 @ 1 kHz<br>11.0/19.3/35.9/52.5/69.1 ms @ 120 Hz | 6.5/16.5 ms @ 1 k/1 MHz       | 22.5/40.5/56.5 ms @ 120/1 kHz |
| Measurement accuracy                 |  |                               |                               |
| 120 Hz (@ 100 uF, 0.5 V)             | C: 0.085%, D: 0.00065  |                               | C: 0.440%, D: 0.0018          |
| 1 kHz (@ 10 nF, 1 V)                 | C: 0.07%, D: 0.0005  | C: 0.07%, D: 0.0005           | C: 0.440%, D: 0.0018          |
| 1 MHz (@ 10 pF, 1 V)                 | C: 0.07%, D: 0.0005  | C: 0.07%, D: 0.0005           |                               |
| Compensation                         | OPEN/SHORT/LOAD  | <—                            | <—                            |
| Multi-compensation                   | Yes  | <—                            | <—                            |
| Contact check function               | Yes  | No                            | Yes                           |
| Cable length                         | 0 m, 1 m, 2 m  | <—                            | <—                            |
| Comparator                           | 9 bin  | <—                            | <—                            |
| Interface                            | GPIB, USB, LAN   | GPIB                          | GPIB                          |
| Handler F                            | Yes  | Yes                           | Yes                           |
| Scanner F                            | Yes (256ch)  | Yes (64ch)                    | Option (64ch)                 |
| Resume function                      | No (auto recall is available)  | Yes                           | Yes                           |
| Size                                 | 320 (W) x 90 (H) x 374 (D) mm<br>(without handle/front rear bumper)                                    | 320 (W) x 90 (H) x 300 (D) mm | 320 (W) x 90 (H) x 422 (D) mm |

## Ordering information

E4981A Capacitance Meter

### Frequency Option

E4981A-001 120 Hz/1 kHz/1 MHz  
E4981A-002 120 Hz/1 kHz

### Additional Option

E4981A-ABA Add hardcopy user's guide (English)  
E4981A-ABJ Add hardcopy user's guide (Japanese)  
E4981A-1CM Rack mounts kit  
E4981A-600 Delete front handle kit  
E4981A-A6J ANSI Z540 compliant calibration  
E4981A-1A7 ISO 17025 compliant calibration

## Related Products

The E4980A and E4981A for ceramic capacitor measurement

E4980A Precision LCR Meter

The E4980A Precision LCR meter is equipped with various frequencies, higher signal level and DC bias, and higher capacitance measurement capability.



| Items                                      | E4980A   | E4981A  |
|--|--|---|
| Frequency                                  | 20 to 2 MHz  | 120/1 k/1 MHz                                 |
| Measurement accuracy<br>1 kHz (@10 nF, 1V) | C: $\pm 0.08\%$<br>D: $\pm 0.0006$                   | C: $\pm 0.07\%$<br>D: $\pm 0.0005$            |
| Signal level                               | 0 to 2 Vrms (standard)<br>0 to 20 Vrms (Option 001)  | 0.1 to 1 V                                    |
| DC bias                                    | 0 V/1.5 V/2 V (standard)<br>0 V to 40 V (Option 001) | None  |
| Max measurement speed                      | 100 Hz: 100 ms<br>1 kHz: 20 ms<br>1 MHz: 5.6 ms      | 120 Hz: 11 ms<br>1 kHz: 3 ms<br>1 MHz: 2.3 ms |

## Web Resources

Visit our E4981A web site for additional product information and literature.

[www.keysight.com/find/E4981A](http://www.keysight.com/find/E4981A)

LCR meters

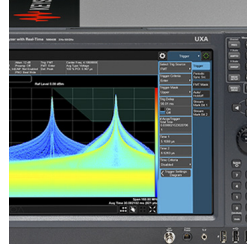
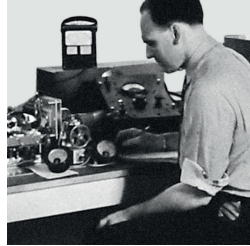
[www.keysight.com/find/lcrmeters](http://www.keysight.com/find/lcrmeters)

Impedance analyzers

[www.keysight.com/find/impedance](http://www.keysight.com/find/impedance)

## From Hewlett-Packard through Agilent to Keysight

For more than 75 years, we've been helping you unlock measurement insights. Our unique combination of hardware, software and people can help you reach your next breakthrough. **Unlocking measurement insights since 1939.**



1939

THE FUTURE

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

### Americas

|               |                  |
|---------------|------------------|
| Canada        | (877) 894 4414   |
| Brazil        | 55 11 3351 7010  |
| Mexico        | 001 800 254 2440 |
| United States | (800) 829 4444   |

### Asia Pacific

|                    |                |
|--------------------|----------------|
| Australia          | 1 800 629 485  |
| China              | 800 810 0189   |
| Hong Kong          | 800 938 693    |
| India              | 1 800 11 2626  |
| Japan              | 0120 (421) 345 |
| Korea              | 080 769 0800   |
| Malaysia           | 1 800 888 848  |
| Singapore          | 1 800 375 8100 |
| Taiwan             | 0800 047 866   |
| Other AP Countries | (65) 6375 8100 |

### Europe & Middle East

|                |               |
|----------------|---------------|
| Austria        | 0800 001122   |
| Belgium        | 0800 58580    |
| Finland        | 0800 523252   |
| France         | 0805 980333   |
| Germany        | 0800 6270999  |
| Ireland        | 1800 832700   |
| Israel         | 1 809 343051  |
| Italy          | 800 599100    |
| Luxembourg     | +32 800 58580 |
| Netherlands    | 0800 0233200  |
| Russia         | 8800 5009286  |
| Spain          | 800 000154    |
| Sweden         | 0200 882255   |
| Switzerland    | 0800 805353   |
|                | Opt. 1 (DE)   |
|                | Opt. 2 (FR)   |
|                | Opt. 3 (IT)   |
| United Kingdom | 0800 0260637  |

For other unlisted countries:  
[www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)  
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A personalized view into the information most relevant to you.

### Three-Year Warranty



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Keysight Infoline

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Unlocking Measurement Insights

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