Migrating from an Agilent 4284A LCR Meter to an Agilent E4980A Precision LCR Meter

Technical Overview &
Product Comparison Guide

Setting a new standard for impedance measurements

TOP 3 reasons to migrate

- **Accuracy**
- **Speed**
- **Versatility**

Agilent Technologies

A New Standard for Low Frequency Impedance Measurements

Agilent is proud to introduce the Agilent E4980A precision LCR meter to our 4284A LCR customers. Based on the latest technology, this LCR meter provides the best combination of accuracy, speed, and versatility for a wide range of component measurements. The E4980A offers excellent cost/performance value, enhancing your test and measurement efficiency by providing fast measurement speed and outstanding performance at both low and high impedance ranges.

Contents

E4980A Precision LCR Meter Overview

The Agilent E4980A precision LCR meter (20 Hz to 2 MHz) provides the best combination of accuracy, speed, and versatility for a wide range of component measurements. Offering the fastest measurement speed in its class and outstanding performance at both low and high impedance ranges, the E4980A is the ultimate tool for general testing of leaded and surface-mount components and materials.

Superior accuracy provides design and test confidence

With basic impedance accuracy of 0.05%, minimized noise and extremely small residual impedance for both low and high impedance measurements, the E4980A LCR meter provides the measurement performance needed to meet the test requirements of the latest devices. Low measurement fluctuation results in extremely stable and accurate measurements for better design reliability and higher yields.

- Low impedance measurements: milliohm equivalent series resistance (ESR)
- High impedance measurement: femto-farad (fF) capacitance

Fast measurement speed reduces your cost of test

More than five times faster[1] than the 4284A LCR meter with the same or lower noise level, the E4980A LCR offers fast measurement speed and outstanding performance over a wide impedance range. The maximum speed at required signal-to-noise levels can be achieved using three measurement modes (SHORT/MED/ LONG compensation) and an average number up to 999.

- 5.6 ms/point (SHORT), the best speed in its class
- 88 ms/point (MED)
- 220 ms/point (LONG)

Versatile functions and features to meet all your impedance measurement needs

The E4980A can be used with over 30 fixtures[2] to meet all your evaluation needs from materials to SMD components. This light weight, compact instrument provides 16 impedance measurement parameters for your testing convenience. Other features include:

Measurement versatility

- 20 Hz to 2 MHz test frequency with 4-digit resolution at any frequency
- 100 µV to 2 Vrms, 1 µA to 20 mArms variable test signal
- Auto-level control
- 201 points of programmable list sweep

Option E4980A-001 power and DC bias enhancement

- 0 to 20 Vrms/100 mArms test signal
- Built-in 40 V DC bias with 0.33 mV resolution
- DC resistance, DC current, and DC voltage measurement capability

Option E4980A-002 bias current interface and the 42841A bias current source

DC current bias:

- 0.01 A to 20 A (with the 42841A and the 42842A)
- 0.02 A to 40 A (with the 42841A x 2ea., the 42842B and the 42843A)

Automated test system interface

- Option E4980A-201 handler interface
- Option E4980A-301 scanner interface

1. In SHORT mode.
2. Please refer to Agilent's "Accessories Selection Guide for Impedance Measurements" (literature number: 5965-4792E), available on our Web site: **www.agilent.com/find/lcrmeters**

Advantages of the E4980A

Accuracy:

Excellent performance for low and high impedance measurements

The E4980A LCR meter provides impedance measurements with excellent performance across all frequency ranges to meet the test requirements of the latest devices. Compared to the 4284A LCR meter, the E4980A provides a wider measurement range and increased data fluctuation to increase test quality and reduce cost of test.

100 mohm measurement range for ultra-low impedance test

Option E4980A-001 can provide a 100 mohm measurement range for ultra-low impedance measurements,[1] while option 4284A-001 only provides a 1 ohm measurement range.[2]

Wider measurement range, same accuracy

E4980A extends the test frequency range up to 2 MHz and enhances the accuracy capability to meet the stringent requirements of today's devices. Figures 1 and 2 shows the calculated measurement range graph for both the 4284A and E4980A LCR meters based on their specifications. The measurement range of the E4980A is wider than 4284A with the same accuracy across frequency ranges making this instrument more suitable for both low and high impedance measurements.

Condition:
Test signal: 1 Vrms
Test time: MED
Cable length = 0 m
At room temperature

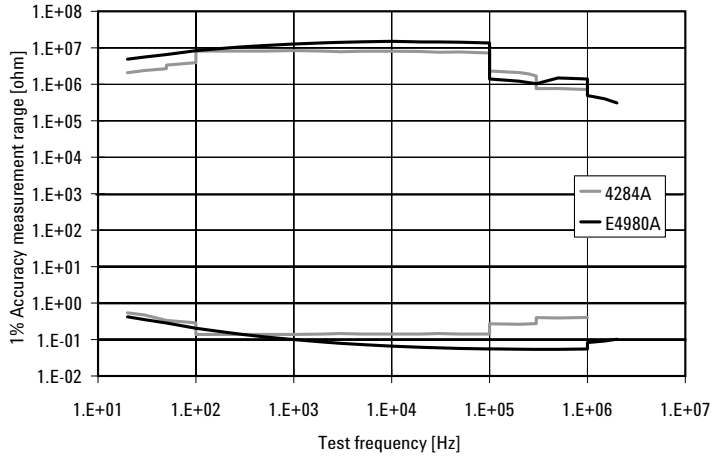


Figure 1. Measurement range comparison (accuracy = 1%)

Condition:
Test signal: 1 Vrms
Test time: MED
Cable length = 0 m
At room temperature

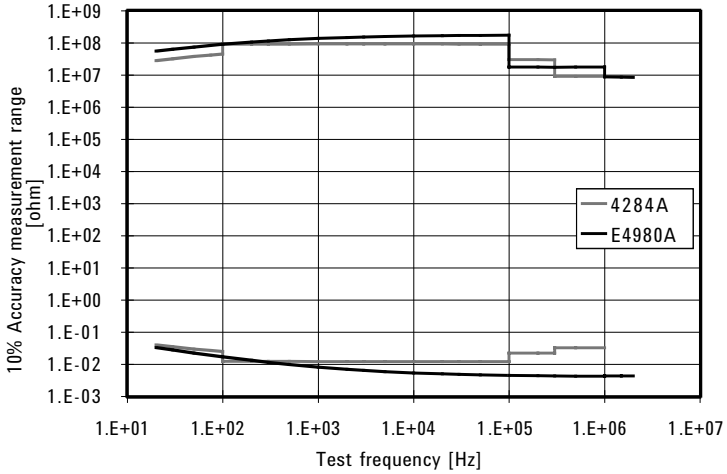


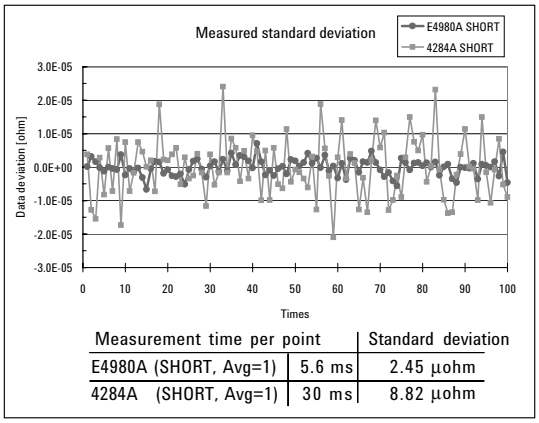
Figure 2. Measurement range comparison (accuracy = 10%)

1. Test signal voltage is over 2 Vrms and the test signal current is not more than 100 mA.
2. Test signal voltage is over 2 Vrms and the test signal current is not more than 200 mA.

Improved measurement stability

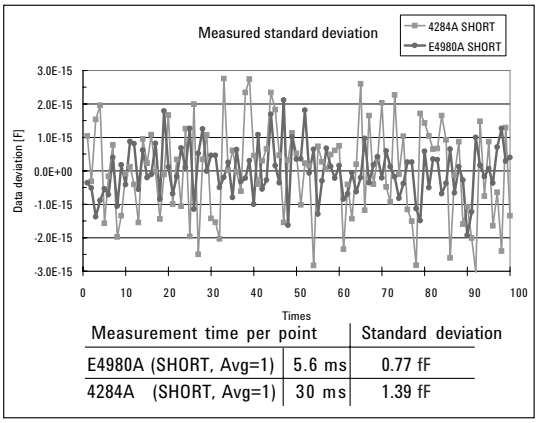
Figure 3 shows the data fluctuation comparison of low and high impedance measurements based on the results of 100 continuous measurements. (DC bias: OFF, Cable length: 0 m, Temperature: 25 °C) The graphs in Figure 3 show that the E4980A enhances both the measurement data fluctuation and the measurement time.

Low impedance measurement
DUT: 1 mohm resistor, freq: 100 kHz, 10 Vrms

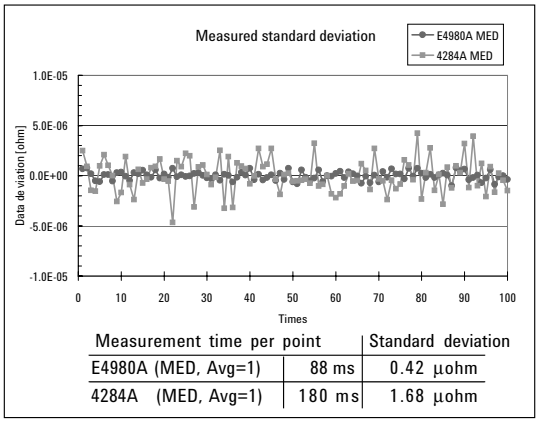


Measurement time per point		Standard deviation
E4980A (SHORT, Avg=1)	5.6 ms	2.45 µohm
4284A (SHORT, Avg=1)	30 ms	8.82 µohm

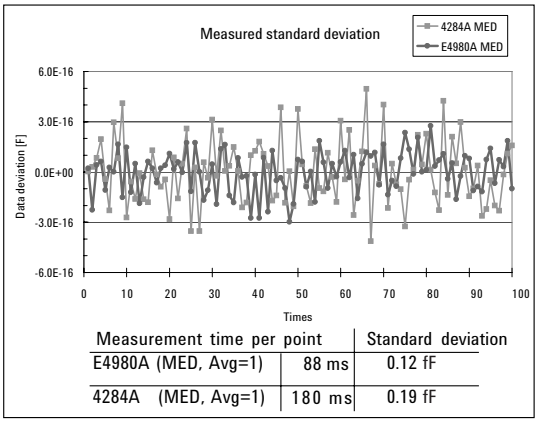
High impedance measurement
DUT: 1pF capacitor, freq: 1 MHz, 20 mVrms



Measurement time per point		Standard deviation
E4980A (SHORT, Avg=1)	5.6 ms	0.77 fF
4284A (SHORT, Avg=1)	30 ms	1.39 fF



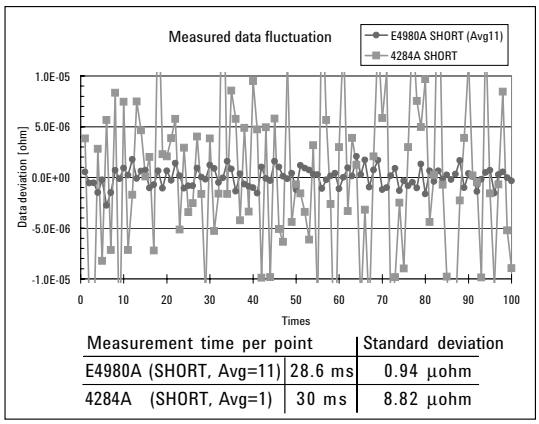
Measurement time per point		Standard deviation
E4980A (MED, Avg=1)	88 ms	0.42 µohm
4284A (MED, Avg=1)	180 ms	1.68 µohm



Measurement time per point		Standard deviation
E4980A (MED, Avg=1)	88 ms	0.12 fF
4284A (MED, Avg=1)	180 ms	0.19 fF

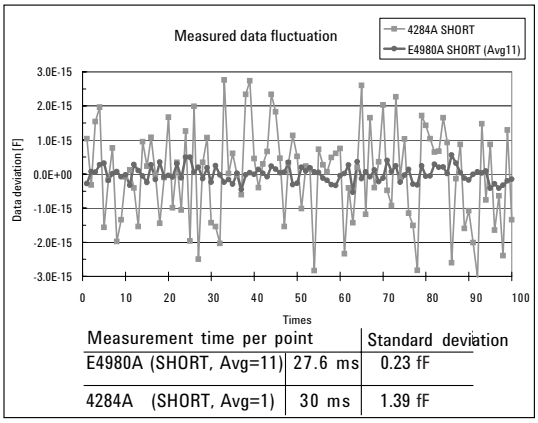
Figure 3. Data fluctuation comparisons of the E4980A and the 4284A using SHORT and MED with the same average number of 1

Low impedance measurement
DUT: 1 mohm resistor, freq: 100 kHz, 10 Vrms



Measurement time per point		Standard deviation
E4980A (SHORT, Avg=11)	28.6 ms	0.94 µohm
4284A (SHORT, Avg=1)	30 ms	8.82 µohm

High impedance measurement
DUT: 1pF capacitor, freq: 1 MHz, 20 mVrms



Measurement time per point		Standard deviation
E4980A (SHORT, Avg=11)	27.6 ms	0.23 fF
4284A (SHORT, Avg=1)	30 ms	1.39 fF

Figure 4. Data fluctuation comparisons of the E4980A and the 4284A using SHORT with the same measurement time

The graphs in Figure 4 show the E4980A set up as "SHORT, Avg=11". The test time is similar to the 4284A's "SHORT" mode test times, but the data fluctuation has been greatly improved. The data fluctuation in this example is similar to the 4284A's data fluctuation in "MED" mode.

Speed:

Faster measurement speeds

The E4980A offers more than 5 times faster in SHORT mode, and approximately two times faster measurement speed in MED mode than the 4284A; this is the best speed in its class. Maximum speed and repeatability can be achieved using the three measurement modes (SHORT/MED/LONG) with the average function. See Figure 5.

The E4980A precision LCR meter's fast measurement speed, combined with high accuracy and measurement repeatability, provides accurate and high-throughput test capability for both low and high impedance measurements.

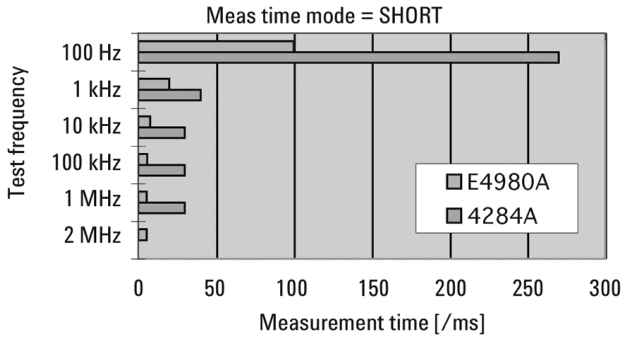


Figure 5. Measurement time[1] comparison of the standard E4980A and 4284A LCR meters.

Option E4980A-005: For users that do not require the ultimate measurement speed in a short length of time, an economical, entry model option is available. The entry model offers the same level of accuracy, only with 2 to 5 times less speed than the standard model.

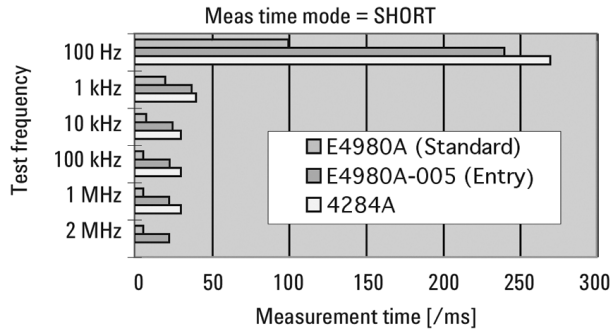


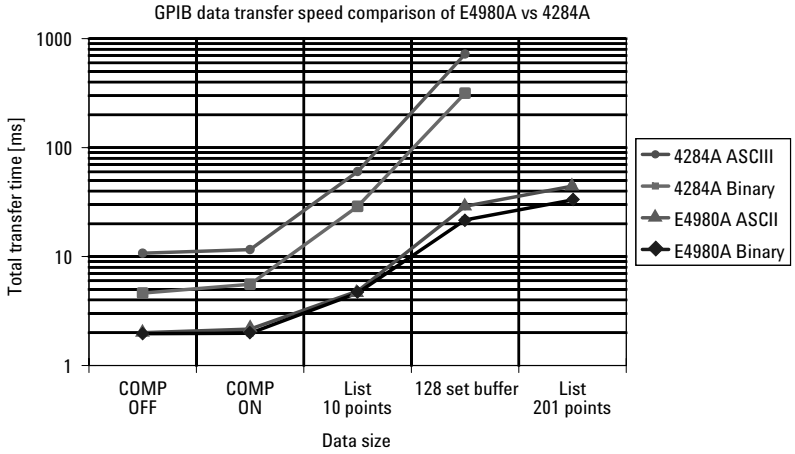
Figure 6. Measurement speed: standard E4980A LCR vs. economy model E5980A-005 LCR vs. 4284A LCR

1. Measurement time at 1 MHz. For additional details, refer to the E4980A data sheet (literature number 5989-4435EN).

Faster data transfer speed

The E4980A's GPIB data transfer speed is 5 to 40 times faster than the data transfer speed of the 4284A.

COMP ON: Comparator function is On
COMP OFF: Comparator function is OFF
List 10 points: list sweep is set at 10 points
128 set buffer: buffer memory stores and transfers 128 sets of the data.
List 201 points: list sweep is set at 201 points



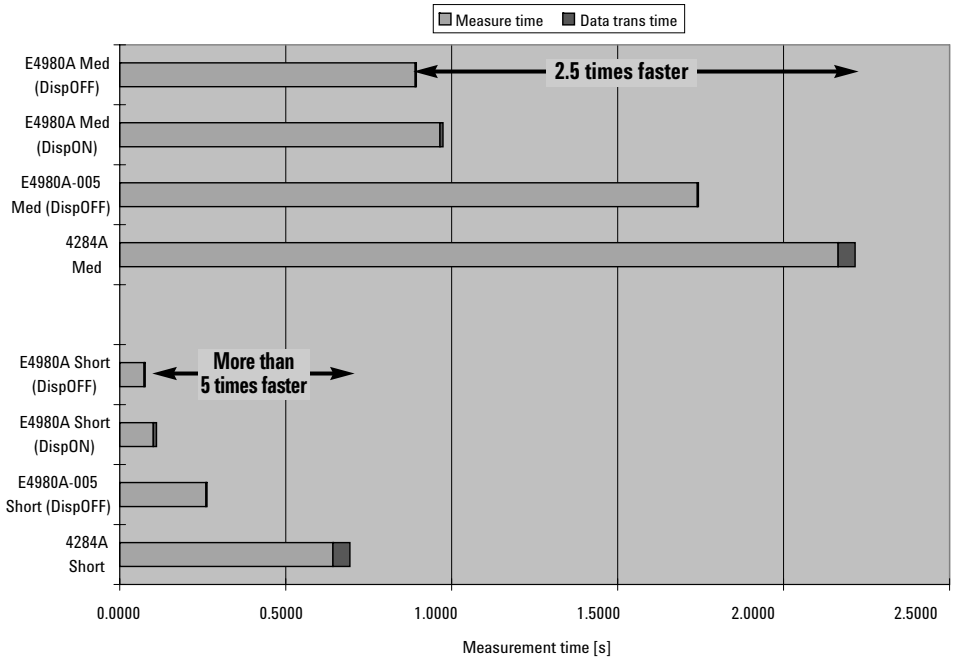
		COMP OFF	COMP ON	List 10 points	128 set buffer	List 201 points
E4980A	ASCII	2	2.16	4.82	28.95	44.33
	Binary	1.96	1.98	4.64	21.67	33.09
4284A	ASCII	10.74	11.6	60.33	723.03	
	Binary	4.62	5.57	28.88	315.51	

Figure 7. GPIB data transfer rates for the E4980A and 4284A LCR meters.

Shorter cycle time

Enhanced measurement and data transfer times result in shorter cycle time. Figure 8 compares the total measurement times of the E4980A, the E4980A-005[1] and the 4284A LCRs. As you can see, the E4980A offers 2 to more than 5 times improvement in measurement speed.

Actual measurement setup:
DUT: 1pF capacitor
Freq: 1 MHz
Test signal level: 30 mVrms
10 points bias current list sweep
Comparator function: OFF
Measurement rang hold
AVG = 1, OSL: OFF
Bias current: 1, 2, 5, 7, 10, 13, 15, 20, 25, 30 V



(Unit: s)	4284A Short	E4980A-005 Short (DispOFF)	E4980A Short (DispON)	E4980A Short (DispOFF)	4284A Med	E4980A-005 Med (DispOFF)	E4980A Med (DispON)	E4980A Med (DispOFF)
Measurement time	0.6422	0.2599	0.1013	0.0734	2.1642	1.7399	0.9648	0.8904
Data transfer time	0.0516	0.0036	0.0097	0.0036	0.0517	0.0037	0.0097	0.0037
Total time	0.6938	0.2635	0.1110	0.0770	2.2159	1.7436	0.9745	0.8942

Figure 8. Measurement speed comparison of the E4980A, E4980A-005 and 4284A LCR meters

From the data shown above, it is easy to conclude that the E4980A provides higher throughput than the 4284A; further lowering cost of test in manufacturing environments.

1 E4980A-005 is the entry model. Please see page 7 for more information.

Versatility:

The E4980A provides powerful features to increase test reliability and efficiency. The instrument has a new user interface that is even easier to use and the measurement capability to suit your applications.

User friendly interface offers more PC connectivity

Flexible connectivity: Use USB (USB TMC), LAN and GPIB interfaces to control the E4980A LCR. You can even use a LAN cable with a computer and a Web browser.

USB memory interface: A USB memory device can be used to save setup states, measurement log data and graphic image files (memory devices only).

Figure 9. Control your instrument remotely and easily using USB (USB TMC) or LAN connections

Figure 10. A USB memory device can be used to save set up states, data or graphs

Advanced, easy-to-use interface

- New “skip” key enables access lower-level menus quickly and easily
- New larger windows for enhanced readability
- Quick recall to shorten recall time
- New [Preset] key enables fast, easy clearing and resetting of test setups.

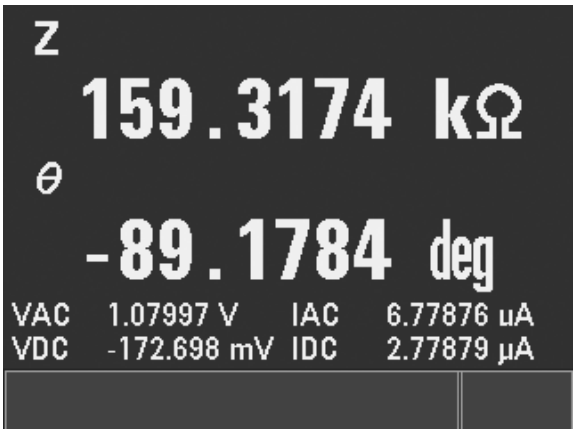


Figure 11. Large display mode example

Enhanced setup flexibility

The E4980A provides more accurate evaluation under actual usage situations. This is due to:

- Enhanced frequency point resolution, 0.01 Hz (min.) and 4-digit resolution in every frequency range.
- 10 times enhanced resolution of test signal voltage and DC bias voltage (max.).
    - Test signal: Min. 100 uV (1 mV for the 4284A)
    - Bias voltage: Min. 330 uV (1 mV for the 4284A)
- Enhanced data display: 7 digit resolution for the E4980A (6 digit resolution for the 4284A), and a new DISP:ENAB OFF command to turn off the display completely saving display refresh time.
- Delay time: Min 100us (1 ms for the 4284A) for step delay. Min 100 us (N/A for the 4284A) for trigger delay.

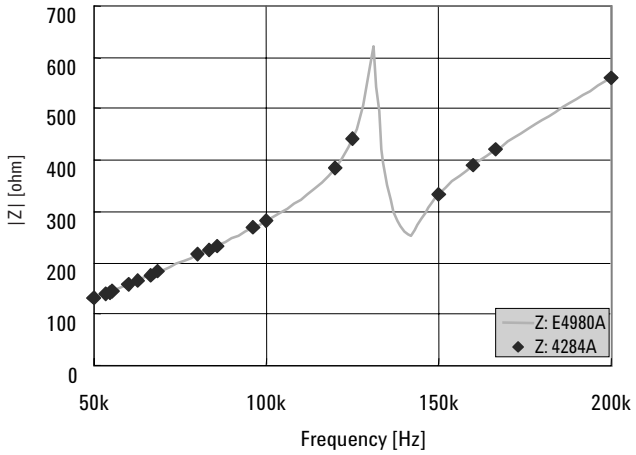
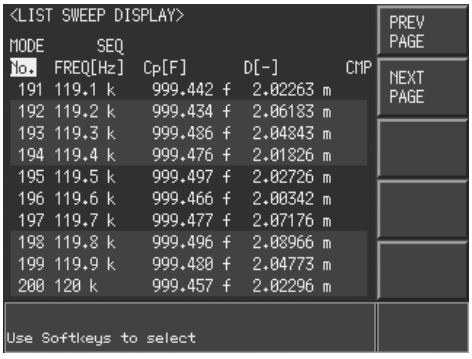


Figure 12. Increased frequency resolution enhances test accuracy

201 points list sweep with 2 parameter flexibility



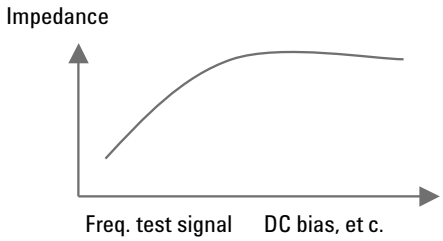


Figure 13. 201 point list sweep lets you set your own parameters

With the E4980A LCR, you can set frequency, measurement range and stimulus conditions as list parameters (up to 201). Set two parameters independently to achieve measurements results under a variety of conditions.

Add an external PC with a data spreadsheet application such as Microsoft ® Excel, to simplify character analysis of impedance vs frequency (test signal, DC bias, etc.)

New measurement capability

DCR, DCI and DCV measurements are now readily available. Furthermore, the addition of an independent DC source (Option E4980A-001) expands the flexibility of DC control and bias applications. With this low noise voltage source, you can evaluate the AC characteristics of 3 terminal devices easily without using external DC source. E4980A provides you with a simplified one-box solution, making an additional DC source or multimeter unnecessary. For example, you can easily evaluate the ON/OFF state condition transistors or analog switches by sweeping the DC source voltage. Figure 15 shows a CMOS evaluation example which is a typical sample of this type of application.

Figure 14. DCR, DCV and DCI measurements

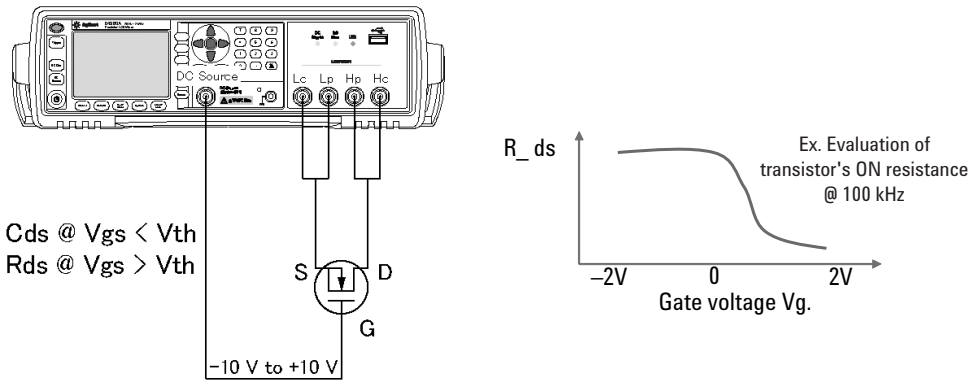


Figure 15. CMOS evaluation example: measurement setup (left), measurement results (right)

E4980A and 4284A Common Features

The Agilent 4284A LCR meter has been regarded as the industry standard in its instrument class for its excellent performance. The E4980A inherits all the core functions of Agilent 4284A, and is further optimized for efficient measurements and high reliability, The E4980A also introduces new, easy-to-use measurement capabilities. Common features include:

User interface

- Menu hierarchy
- Display modes
- BIN setting
- "Preset" key function

Hardware features

Standard:
- 0.05 % basic accuracy
- 2 Vrms test signal
- 1.5, 2 V DC bias support
- 1 m cable correction
- Current fixture compatibility

Option E4980A-001 and 4284A-001:
- 20 Vrms test signal support
- ±40 V DC bias support

Option E4980A-002 and 4284A-002
- 40A DC support with the 42841A

Option E4980A-201 and 4284A-201
- Handler interface support

Option E4980A-301 and 4284A-301
- 128 channels multi-correction
- Scanner interface support

E4980A (standard) and Option 4284A-006
- 2/4-m cable correction

Remote user interface

- Trigger/status byte system
- GPIB commands (Refer to "Appendix 9" on page 22 for detailed command compatibility.)

Migration Reference

1. Maximum test signal current is 100 mA for the E4980A and 200 mA for the 4284A

In order to perform a SHORT correction or low impedance measurement (less than 100 ohm), the test signal voltage of E4980A must be set up so that the total test signal current does not exceed 100 mA.

2. Selection for handler interface connection

Current Option 4284A-202 users and customers using the following component handlers should refer to "Appendix 12" on page 26 of this document. Some modification is necessary.

- Palomar Model M16 Handler
- Palomar Model M11 Handler
- Q-Corporation RTR2 Handler
- Isumeca 83 Handler
- EA Model M015 Handler

3. Interference of front rubber guide

The rubber guide on the front of the E4980A may interfere with some fixture connections. Follow one of the two methods below to resolve this issue.

- Take the rubber guide off the E4980A
- Take the "STOPPER" off of the Agilent fixtures

Figure 16. Front rubber guide and STOPPER

Appendix 1.
Specification Comparison

Table 1. Specifications for the E4980A and 4284A LCR meters

	4284A	E4980A
Frequency	20 Hz to 1 MHz	**DC**, 20 Hz to **2 MHz**
Frequency resolution	8610 fixed points	0.01Hz(min) **4 digits (= 45001 points total)**
AC signal voltage level	ALC OFF: 5 m to 2 Vrms ALC ON: 10 m to 1 Vrms ALC OFF: 5 m to 20 Vrms with Option 4284A-001 installed ALC ON: 10 m to 10 Vrms with Option 4284A-001 installed	ALC OFF: **0 m** to 2 Vrms ALC ON: **0 m** to **2 Vrms** ALC OFF: **0 m** to 20 Vrms with Option E4980A-001 installed ALC ON: **0 m** to **20 Vrms** with Option E4980A-001 installed
AC signal voltage level resolution	1 mV (min.)	**100 uV (min.)**
AC signal current level	ALC OFF: 50 uA to 20 mArms ALC ON: 100 uA to 10 mArms ALC OFF: 50 uA to **200 mArms** with Option 4284A- 001 installed ALC ON: 100 uA to 100 mArms with Option 4284A-001 installed	ALC OFF: **0 uA** to 20 mArms ALC ON: **0 uA** to 20 mArms ALC OFF: **0 uA** to 100 mArms with Option E4980A-001 installed ALC ON: **0 uA** to 100 mArms with Option E4980A-001 installed
AC signal current level resolution	10 uA (min.)	**1 uA** (min.)
Output impedance	100 ohm	100 ohm
DC bias voltage/current level	Default: 0, 1.5, 2.0 V/20 mA (fixed) With Option 4284A-001 installed: –40 V to +40 V/–100 mA to 100 mA	Default: 0, 1.5, 2.0 V/20 mA (fixed) With Option E4980A-001 installed: –40 V to +40 V/–100 mA to +100 mA
DC bias voltage /current level resolution (with Option 4284A-001 installed)	1 mV (min.)/10 uA (min.)	**330 uV (min.) / 1 uA (min.)**
List sweep	Mode: SEQ/STEP Parameter: frequency, AC voltage, AC current, DC voltage, DC current Max point: 10 points	Mode: SEQ/STEP Parameter: frequency, AC voltage, AC current, DC voltage, DC current, **DC source voltage** Max point: **201 points**
Remote control	GPIB	GPIB, **LAN, USB, Web**
Command	4284A original	**4284A compatible**
Comparator	Yes (10 BIN, Abs/tolerance)	Yes (10 BIN, Abs/tolerance)
Handler interface	Yes/Option 4284A-201, Option 4284A-202	Yes/Option E4980A-201[1]
Multi correction	Default: none Option 4284A-301/128 channels	Default: none Option E4980A-301/128 channels
Scanner interface	Yes/Option 4284A-301	Yes/Option E4980A-301
Basic accuracy	0.05 %	0.05 %
Measurement parameter	Impedance	Impedance with Option E4980A-001 installed
Measurement speed (SHORT) 	 1500 ms @ 20 Hz 270 ms @ 100 Hz 40 ms @ 1 kHz 30 ms @ 1 MHz	**5x faster than 4284A (SHORT)** **330 ms** @ 20 Hz **100 ms** @ 100 Hz **20 ms** @ 1 kHz **5.6 ms** @ 1 MHz
Measurement speed (MED/LONG) 	 1500/1800 ms @ 20 Hz 400/1040 ms @ 100 Hz 190/ 830 ms @ 1 kHz 180/ 820 ms @ 10 k~1 MHz	**2x faster than 4284A (MED)** **4x faster than 4284A (LONG)** **380/480 ms** @ 20 Hz **180/300 ms** @ 100 Hz **110/240 ms** @ 1 kHz **92/230 ms** @ 10k **89/220 ms** @ 100 k~2 MHz
Cable length operation	0, 1 (Default) 2, 4 m (Option 4284A-006)	0, 1, 2, 4 m **(Default)**
Cabinet dimension (mm)	426 (W) x 177 (H) x 498 (D) mm	**370 (W) x 105 (H) x 390 (D) mm**
LCD	Dot Matrix LCD, approx. 6-inch monochrome, narrow LCD viewing angle	TFT LCD, approx. 4-inch (320 x 240 pixel), **color, wide LCD viewing angle**
Weight	15 kg	**5.3 kg**

1. Option E4980A-201 is compatible with Option 4284A-201, but requires modification to work with the Option 4284A-202. Please refer to "Appendix 12" on page 26."

Appendix 2. Setup Resolution Comparison

Table 2-1. Test signal voltage level and resolution (standard)

	Resolution	
Test signal voltage level	**4284A**	**E4980A**
0 Vrms to 5 mVrms	Unavailable	100 uVrms
5 mVrms to 200 mVrms	1 mVrms	100 uVrms
200 mVrms to 500 mVrms	10 mVrms	200 uVrms
500 mVrms to 1 Vrms	10 mVrms	500 uVrms
1 Vrms to 2 Vrms	10 mVrms	1 mVrms

Table 2-2. Test signal voltage level and resolution (with Option E4980A-001 installed)

	Resolution	
Test signal voltage level	**4284A**	**E4980A**
0 Vrms to 5 mVrms	Unavailable	100 uVrms
5 mVrms to 200 mVrms	1 mVrms	100 uVrms
200 mVrms to 500 mVrms	10 mVrms	200 uVrms
500 mVrms to 1 Vrms	10 mVrms	500 uVrms
1 Vrms to 2 Vrms	10 mVrms	1 mVrms
2 Vrms to 5 Vrms	100 mVrms	2 mVrms
5 Vrms to 10 Vrms	100 mVrms	5 mVrms
10 Vrms to 20 Vrms	100 mVrms	10 mVrms

Table 2-3. DC bias voltage level and resolution (with Option E4980A-001 installed)

	Resolution	
DC bias voltage level	**4284A**	**E4980A**
0 V to 4 V	1 mV	330 uV
4 V to 5 V	2 mV	330 uV
5 V to 8 V	2 mV	1 mV
8 V to 10 V	5 mV	1 mV
10 V to 20 V	5 mV	2 mV
20 V to 40 V	10 mV	5 mV

Table 2-4. Frequency resolution

	Resolution	
Frequency	**4284A**	**E4980A[1]**
20 Hz to 1 kHz	N/A (8330 fixed points) F(Hz) = m/n; Where, m = 60000, 62500, 75000 N = 13 to 3750 (Integer)	0.01 Hz (20 Hz - 100 Hz) 0.1 Hz (100 - 1 kHz)
1 kHz to 10 kHz	N/A (280 fixed points)	1 Hz
10 kHz to 100 kHz		10 Hz
100 kHz to 1 MHz		100 Hz
1 MHz to 2 MHz	N/A	1 kHz

1. 45001 points total.

Appendix 3. Measurement Speed Comparison

Measurement time is defined as the time from the trigger to the output of the end of measurement (EOM) at the handler interface.

Table 3. Measurement speed comparison of the E4980A, E4980A-005 and 4284A LCR meters

Frequency	Model	SHORT	MEDIUM	LONG
100 Hz	E4980A	100 ms	180 ms	300 ms
	E4980A-005	240 ms	380 ms	650 ms
	4284A	270 ms	400 ms	1040 ms
1 kHz	E4980A	20 ms	110 ms	240 ms
	E4980A-005	37 ms	200 ms	590 ms
	4284A	40 ms	190 ms	830 ms
10 kHz	E4980A	7.7 ms	92 ms	230 ms
	E4980A-005	25 ms	180 ms	580 ms
	4284A	30 ms	180 ms	820 ms
100 kHz	E4980A	5.7 ms	89 ms	220 ms
	E4980A-005	23 ms	180 ms	570 ms
	4284A	30 ms	180 ms	820 ms
1 MHz	E4980A	5.6 ms	88 ms	220 ms
	E4980A-005	23 ms	180 ms	570 ms
	4284A	30 ms	180 ms	820 ms

Entry Model (Option E5980A-005)

For users that do not require the ultimate measurement speed in a short length of time, an economical, entry model option is available. The entry model offers the same level of accuracy only with 2 to 5 times less speed than the standard model.

Appendix 4. Option Configuration Comparison

E4980A option configuration is similar to the 4284A options, and it is available to suit your specific component design and test needs.

Table 4. Option configurations of the E4980A and 4284A LCR meters

Options	4284A	E4980A
Power enhancements		
2 V Ac, 2 V DC	4284A-700	standard
20 VAC, 40 VDC	4284A-001	**E4980A-001**[1]
Function enhancements		
Cable length operation 2, 4m	4284A-006	**Default**
Interface options[2]		
No interface	4284A-710	E4980A-710
Handler connectivity	4284A-201	E4980A-201
Handler connectivity	4284A-202	**E4980A-201**[3]
Multi-compensation and scanner I/F	4284A-301	E4980A-301
Bias current source control for 42841A	4284A-002	E4980A-002
Add hardcopy manuals		
English manual	4284A-ABA	E4980A-ABA
Japanese manual	4284A-ABJ	E4980A-ABJ
Taiwan- Chinese localization	4284A-AB0	**N/A**
France – French localization	4284A-ABF	**N/A**
Italy – Italian localization	4284A-ABZ	**N/A**
Add service manual	4284A-915	**N/A (P/N: E4980-90100)**
Calibration documents		
ISO 17025 compliant calibration	4284A-1A7	E4980A-1A7
ANSI Z540 compliant calibration	4284A-A6J	**E4980A-1A7**
Other		
Memory Card set	4284A-004	**N/A. Commercial USB memory**
Front handle kit	4284A-907	**Default**
Rack mount kit	4284A-908	**E4980A-1CM**
Rack mount and front handle kit	4284A-909	**E4980A-1CM (Handle is default)**

1. Option E4980A-001 also installs DC resistance, DC current, DC voltage measurement capability and a DC source.
2. There are two slots available to install the interfaces. The two interface slots on the rear panel must be filled by selecting two different options from the interface options: E4980A-002, -201, -301 and -710. However, if only a GPIB interface is required, two blank panels (2 x E4980A-710 No Interface "blank panel") can be selected.
3. The pin assignment needs to be modified. Refer to "Appendix 12" on page 26.

Appendix 5. Interface Comparison

Table 5. Interface option comparison of the E4980A and 4284A LCR meters

4284A	E4980A	Interface type	Comparison
4284A-002	E4980A-002	Bias current source control	Same, the connector adapter is attached.
4284A-201	E4980A-201	Handler connectivity	Same, in addition, one PIN is assigned as “Ready for Trigger”
4284A-202	E4980A-201	Handler connectivity	The PIN assignment needs to be modified
4284A-301	E4980A-301	Multi-compensation and scanner interface	Same

Appendix 6.
Display Area
Design Comparison

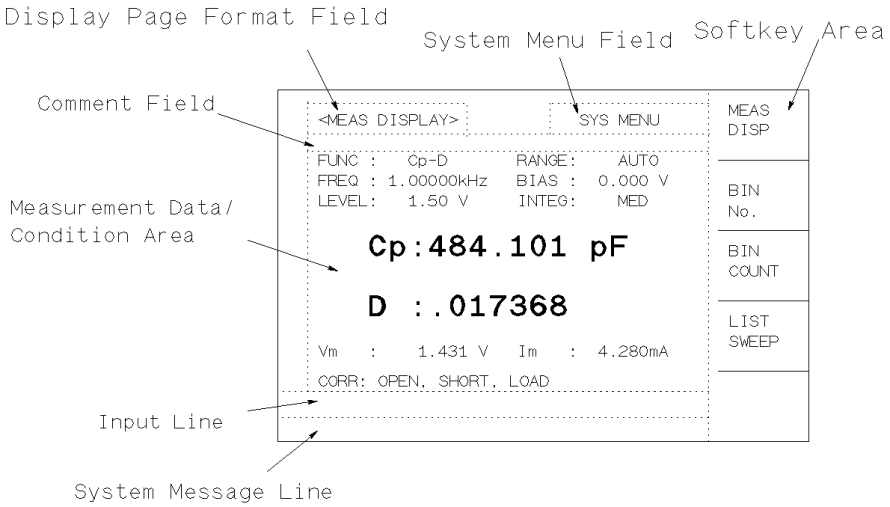


Figure 17. Display area of the 4284A LCR meter

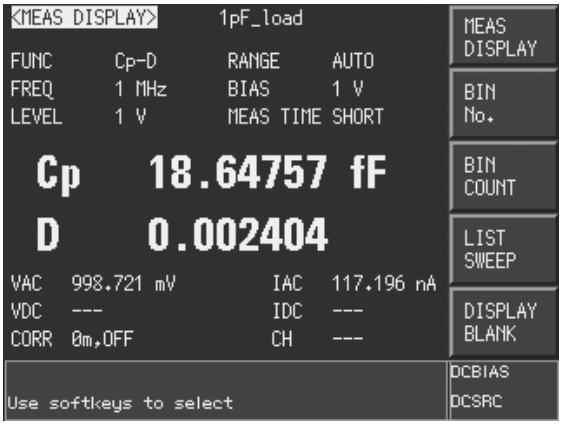


Figure 18. Display area of the E4980A LCR meter

Table 6. Display area design comparison between the 4284A and E4980A LCR meters

Area definition	4284A	E4980A
Display page format field	SAME	
System menu field		N/A
Softkey area	SAME	
Comment field	SAME (Different location)	
Measurement data/condition area	SAME	
Input line	SAME	
System message line	SAME	

Appendix 7.
Front Panel Comparison

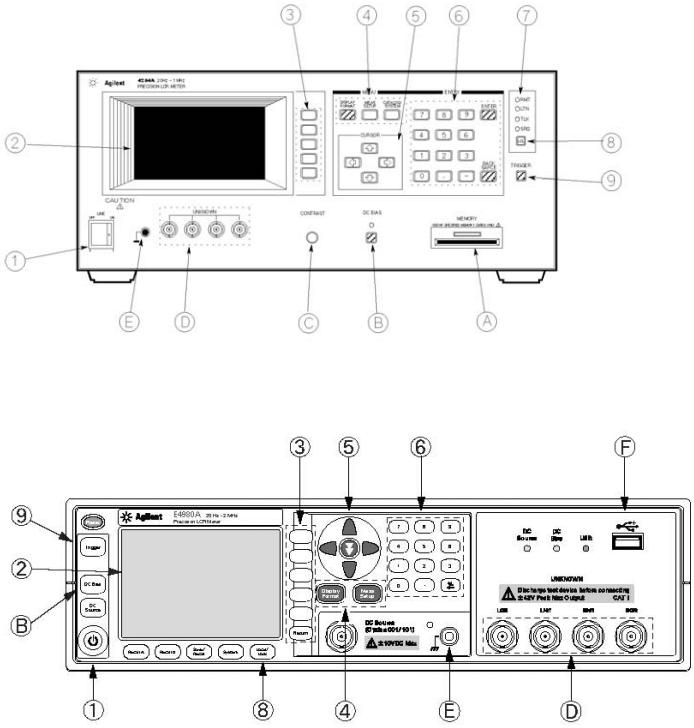


Figure 19. Front panel comparison of the 4284A and E4980A LCR meters

Table 7. Comparison of 4284A and E4980A front panels

Number	4284A	E4980A
1	Line On/Off	
2	LCD	
3	Softkeys	
4	Menu key	
	Including [DISPLAY FORMAT], [MEAS SETUP], [CATALOG/SYSTEM]	[DISPLAY FORMAT], [MEAS SETUP][1]
5	CURSOR Keys	
	Without [SKIP] key	Add [SKIP] key[2]
6	ENTRY keys	
	With [ENTER] hard key	Without [ENTER] hard key, combining the [+/-] and [BACK SPACE] key
7	GPIB status indicators	N/A
8	[LCL] key	[Local/Lock] key
9	[TRIGGER] key	
A	MEMORY card slot and UNLOCK button	N/A
B	[DC BIAS] key	
C	CONTRAST control knob	N/A
D	UNKNOWN terminals	
E	FRAME terminal/guard terminal	
F	N/A	USB memory interface

1. The [System] key is located under the LCD. [Save/Recall] displays the catalog list. Pressing [DISPLAY FORMAT] twice enlarges the text.
2. The new [skip] key provides, faster, easier access to lower-layer menus.

Appendix 8. Menu and Key Tree Structure Comparison

Table 8. Menu and key tree structure of the E4980A and 4284A LCR meters

4284A	E4980A
[DISPLAY FORMAT]	SAME
<MEAS DISPLAY> field	
MEAS DISP	SAME
BIN No.	SAME
COMP: **ON/OFF**	SAME
BIN COUNT	SAME
COUNT: **ON/OFF/RESET**	Move the cursor to "COUNT"
LIST SWEEP	SAME
MOD: **SEQ/STEP**	SAME
SYS MENU field	SAME
LOAD	[Save/Recall] – Select No. – **RECALL DATA**
D.P. FIX A	Move the cursor over the data
D.P. FIX B	Move the cursor over the data
STORE	[Save/Recall] - **SAVE**
PRINT DISP	N/A, (Refer to "SAVE DISP": [Save/Recall] – **SAVE DISPLAY**)
PRINT DATA	N/A, (Refer to "SAVE DATA")
KEY LOCK	[Local/Lock]
[MEAS SETUP]	SAME
MEAS SETUP field	SAME
<MEAS SETUP>	SAME
FUNC	SAME
FREQ	SAME
LEVEL	SAME
RANGE	SAME
BIAS	SAME
INTEG	SAME
TRIG	SAME
ALC	SAME
Hi-PW	N/A (The E4980A switches this mode automatically.)
DCI	SAME
AVG	SAME
Vm	SAME
Im	SAME
DELAY	STEP DL
DEV A:/B:	SAME
REF A:/B:	SAME
CORRECTION field	
<CORRECTION>	SAME
OPEN	SAME
SHORT	SAME
LOAD	SAME
CABLE	SAME
MODE	SAME
CH No.	SAME (It is also enabled when the MODE is SINGLE.)
FUNC	SAME
FREQ1	**SPOT No. 1**
REF A:/B:	SAME
FREQ2	**SPOT No. 2**
FREQ3	**SPOT No. 3**
LIMIT TABLE SETUP field	
<LIMIT TABLE SETUP>	All the SAME

Table 8. Menu and key tree structure of the E4980A and 4284A LCR meters ***(continued)***

4284A	E4980A
LIST SWEEP SETUP field	
<LIMIT SWEEP SETUP>	All the SAME
MODE:	SAME
FREQ [Hz]	SAME
LEVEL [V]	SAME
LEVEL [A]	SAME
BIAS [V]	Move cursor to FREQ[Hz] or VOLT[V] or CURR[I], then **MORE**, then select **BIAS [V]**
BIAS [A]	Move cursor to FREQ[Hz] or VOLT[V] or CURR[A], then MORE, then select **BIAS [A]**
LMT:	SAME
LOW:	SAME
HIGH:	SAME
SYS MENU field	SAME
LOAD	**[Save/Recall]**
STORE	**[Save/Recall]**
PRINT DISP	N/A, (Refer to "SAVE DISP": [Save/Recall] - **SAVE DISPLAY**.)
CLEAR SETUP	[Preset] – **Clear Setting**
CLEAR TABLE	**LIMIT TABLE** : move the cursor to BIN, then select **CLEAR TABLE** **LIST SETUP**: move the cursor to No., then select **CLEAR TABLE**
SYSTEM RESET	[Preset] – **Clear Setting**
[CATALOG/SYSTEM]	[Save/Recall] + [System]
CATALOG	[Save/Recall]
SYSTEM CONFIG	[System]
BEEPER	[System] - **SYSTEM CONFIG**
GP-IB ADDRESS	[System] - **SYSTEM CONFIG**
TALK ONLY	N/A
DC BIAS (Option 001)	[System] - OPTION
I BIAS I/F (Option 002)	[System] - CURR BIAS I/F
2m, 4m CABLE (Option 006)	N/A
HANDLER I/F (Option 201)	[System] – Handler I/F
SCANNER I/F (Option 301)	[System] – Scanner I/F
SELF TEST	[System] - **SELF TEST**
1 Memory card R/W test___	N/A
2 LED Display test	N/A
3 LCD Display test	Move the cursor to "Test No.", then select "5 DISPLAY"
4 Handler I/F EEPROM R/W test	Move the cursor to "Test No.", then select "7 HANDLER INTERFACE"
5 Scanner I/F EEPROM R/W test	Move the cursor to "Test No.", then select "8 SCANNER INTERFACE"
6 Scanner I/F I/O test	Move the cursor to "Test No.", then select "8 SCANNER INTERFACE"
7 Bias Current I/F I/O test	Move the cursor to "Test No.", then select "6 BIAS INTERFACE"

Appendix 9.
Remote Control: GPIB Commands Compatibility

The majority of E4980A remote commands are compatible with the 4284A.

In addition to these commands, the E480A has incorporated new commands that improve measurement throughput. For example, the E4980A adds the "DISP:ENAB OFF" command which turns the display off saving refresh time.

Table 9. GPIB Command Compatibility of the 4284A and E4980A LCR meters

4284A commands	Parameter	Corresponding E4980A command
DISPlay:PAGE	<page name>	<= as same as the 4284A
DISPlay:LINE	"<string>"	Same
FREQuency[:CW]	<value>	Same
VOLTage[:LEVel]	<value>	Same
CURRent[:LEVel]	<value>	Same
AMPLitude:ALC	{ON|OFF|1|0}	Same
OUTPut:HPOWer	{ON|OFF|1|0}[3]	Same[1]
OUTPut:DC:ISOLation	{ON|OFF|1|0}	Same *Note:* When the state is ON, and you want to use HOLD range, you need specify the DC ISO range by using the command: ":OUTPut:DC:ISOLation:LEVel:VALue".
BIAS:STATe	{ON|OFF|1|0}	Same
BIAS:VOLTage[:LEVel]	<value>	Same
BIAS:CURRent[:LEVel]	<value>	Same
FUNCtion:IMPedance[:TYPE]	{CPD|CPQ...}	Same
FUNCtion:IMPedance:RANGe	<value>	Same The measurement range selection varies slightly, please refer to the user's manual.
FUNCtion:IMPedance:RANGe:AUTO	{ON|OFF|1|0}	Same
FUNCtion:SourceMONitor:VAC[:STATe]	{ON|OFF|1|0}	Same[1]
FUNCtion:SourceMONitor:IAC[:STATe]	{ON|OFF|1|0}	Same[1]
FUNCtion:DEV<n>:MODE	{ABSolute|PERCent|OFF}	Same
FUNCtion:DEV<n>:REFerence	<value>	Same
FUNCtion:DEV<n>:REFerence:FILL	—	Same
LIST:FREQuency	<value> [,<value>*]	Same
LIST:VOLTage	<value> [,<value>*]	Same
LIST:CURRent	<value> [,<value>*]	Same
LIST:BIAS:VOLTage	<value> [,<value>*]	Same
LIST:BIAS:CURRent	<value> [,<value>*]	Same
LIST:MODE	{SEQuenc|STEPped}	Same
LIST:BAND<n>	{A|B|OFF } [,<low limit n>, <high limit n>]	Same n=1-201
APERture	{SHORt|MEDium|LONG}, <value>	Same
TRIGger[:IMMediate]	—	Same
TRIGger:SOURce	{INTernal|EXTernal|BUS|HOLD}	Same
TRIGger:DELay	<value>	Same
INITiate[:IMMediate]	—	Same
INITiate:CONTinuous	{ON|OFF|1|0}	Same
FETCh[:IMP]?	—	Same
FETCh:SourceMONitor:VAC?	<value>	Same
FETCh:SourceMONitor:IAC?	<value>	Same

1. In E4980A, this command is always "ON", so no command in necessary. This is only for 4284A program compatibility.

Table 9. GPIB Command Compatibility of the 4284A and E4980A LCR meters *(continued)*

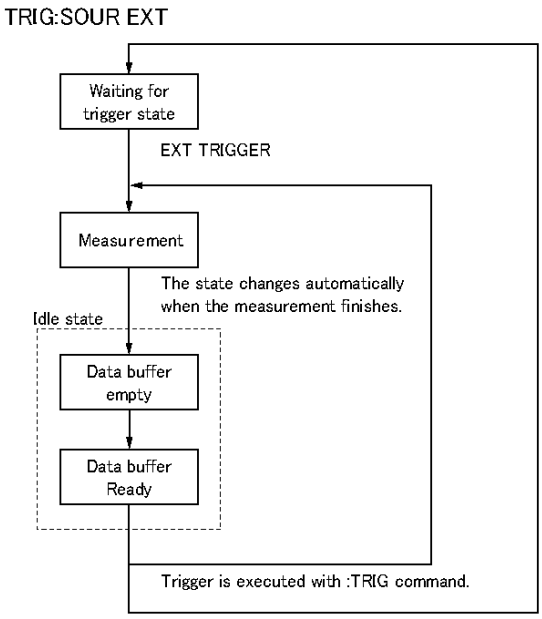
4284A Commands	Parameter	Corresponding E4980A command
ABORt	—	Same
FORMat[:DATA]	{ASCii|REAL[,64]}	Same
MEMory:DIM	DBUF, <value>	Same
MEMory:FILL	DBUF	Same
MEMory:CLEar	DBUF	Same
MEMory:READ?	DBUF	Same
CORRection:LENGth	<value>	Same
CORRection:METHod	{SINGle|MULTi}	Same
CORRection:OPEN	—	Same
CORRection:OPEN:STATe	{ON|OFF|1|0}	Same
CORRection:SHORt	—	Same
CORRection:SHORt:STATe	{ON|OFF|1|0}	Same
CORRection:LOAD:STATe	{ON|OFF|1|0}	Same
CORRection:LOAD:TYPE	{CPD|CPQ...}	Same
CORRection:SPOT<n>:STATe	{ON|OFF|1|0}	Same, n: 1-201
CORRection:SPOT<n>:FREQuency	<value>	Same, n: 1-201
CORRection:SPOT<n>:OPEN	—	Same, n: 1-201
CORRection:SPOT<n>:SHORt	—	Same, n: 1-201
CORRection:SPOT<n>:LOAD	—	Same, n: 1-201
CORRection:SPOT<n>:LOAD:STANdard	<REF.A>, <REF.B>	Same, n: 1-201
CORRection:USE	<channel number>	Same
CORRection:USE:DATA?	<channel number>	Same
COMParator[:STATe]	{ON|OFF|1|0}	Same
COMParator:MODE	{ATOLerance|PTOLerance|SEQuence}	Same
COMParator:TOLerance:NOMinal	<value>	Same
COMParator:TOLerance:BIN<n>	<low limit>, <high limit>	Same
COMParator:SEQuence:BIN	<low limit>, <high limit> ,....	Same
COMParator:SecondaryLIMit	<low limit>, <high limit>	Same
COMParator:AuxiliaryBIN	{ON|OFF|1|0}	Same
COMParator:SWAP	{ON|OFF|1|0}	Same
COMParator:BIN:CLEar	—	Same
COMParator:BIN:COUNt[:STATe]	{ON|OFF|1|0}	Same
COMParator:BIN:COUNt:DATA?		COMParator:BIN:COUNt:DATA <value>,<value>,....
COMParator:BIN:COUNt:CLEar		Same
MassMEMory:LOAD:STATe[:REGister]	<value>	Same
MassMEMory:STORe:STATe[:REGister]	<value>	Same
SYSTem:ERRor?		Same
STATus:OPERation[:EVENt]?		STATus:OPERation[:EVENt] <value>
STATus:OPERation:CONDition?		STATus:OPERation:CONDition <value>
STATus:OPERation:ENABle	<value>	Same
*CLS		Same
*ESE	<value>	Same
*ESR?	<value>	Same
*SRE	<value>	Same
*STB?	<value>	Same
*IDN?	"<string>"	Same
*OPC		Same
*WAI		Same
*RST		Same
*TST?	<value>	Same
*TRG		Same
*LRN?	"<string>"	Same
*OPT?	"<string>"	Same

Appendix 10. Trigger System and Data Transfer Comparison

The trigger systems of the E4980A and 4284A are compatible

The only difference between them is under the remote condition when the trigger source is “external” as shown in Figure 20. The “INIT:CONT ON” command doesn't function as defined (continuously proceed the trigger status to “Waiting for trigger”) in the 4284A; however, this condition does function in this manner on the E4980A system. If your system uses random pulse to trigger the signal, and the “INIT:IMM” command to synchronize the system, you will need to send the “:INIT:CONT OFF” command to the E4980A in advance.

The data transfer systems of the E4980A and the 4284A are the same.



Remote: The state changes “one time only” with :INIT:CONT ON command. (4284A)
The state changes “automatically” when continuous mode is on. (E4980A)
The state chages with :INIT:IMM command. (4284A/E4980A)
Local: The state changes automatically whether continuous mode is on or off. (4284A/E4980A)

Figure 20. The trigger system difference

Appendix 11. Status Byte Assignment Comparison

Table 10-1. Status byte assignment comparison

		4284A	E4980A
Bit no.	**Bit weight**	**Description**	
7	128	Operation status event register summary bit	
6	64	Bit 6 serves two functions (RQS/MSS) depending on how it is read.	
5	32	Standard event status register summary bit	
4	16	Message available bit (MAV)	SAME
3	8	always 0 (zero)	
2	4	always 0 (zero)	
1	2	always 0 (zero)	
0	1	always 0 (zero)	

Table 10-2. Standard operation status condition register assignment comparison

		4284A	E4980A
Bit no.	**Bit weight**	**Description**	
15 to 5		always 0 (zero)	
4	16	Measuring bit	
3	8	Sweeping bit	SAME
2	4	always 0 (zero)	
1	2	always 0 (zero)	
0	1	Measuring correction data bit	

Table 10-3. Standard operation status event register assignment comparison

		4284A	E4980A
Bit no.	**Bit weight**	**Description**	
15 to 5		always 0 (zero)	
4	16	Measurement complete bit	
3	8	List sweep measurement complete bit	SAME
2	4	always 0 (zero)	
1	2	always 0 (zero)	
0	1	Correction data measurement complete bit	

Table 10-4. Standard event status register assignment comparison

		4284A	E4980A
Bit no.	**Bit weight**	**Description**	
7	128	Power on (PON) bit	
6	64	User request (URQ) bit	
5	32	Command error (CME) bit	SAME
4	16	Execution error (EXE) bit	
3	8	Device specific error (DDE) bit	
2	4	Query error (QYE) bit	
1	2	Request control (RQC) bit	
0	1	Operation complete (OPC) bit	

Appendix 12. Technical Reference for the Handler Interface Migration

4284A has two Handler Interface options: Option 4284A-201 and Option 4284A-202. The difference between this two options are the PIN assignments. E4980A has only one Handler Interface option, Option E4980A-201. Option E4980A-201 is directly compatible with Option 4284A-201, but it needs to be modified to work with the Option 4284A-202.

For Option 4284A-201 users:

Table 11. PIN assignment comparison between Option 4284A-201 and E4980A-201:

PIN no.	4284A	E4980A
22	N.C.	READY_FOR_TRIGGER
The others (1 to 21, 23 to 36)	SAME	

The remote-controlled program of 4284A-201 can also be used for E4980A-201, no change is necessary.

For Option 4284A-202 users:

The PIN assignment of Option 4284A-202 is quite different from that of the Option E4980A-201, Figure 21 shows the difference and the conversion reference from Option 4284A-202 to Option E4980A-201.

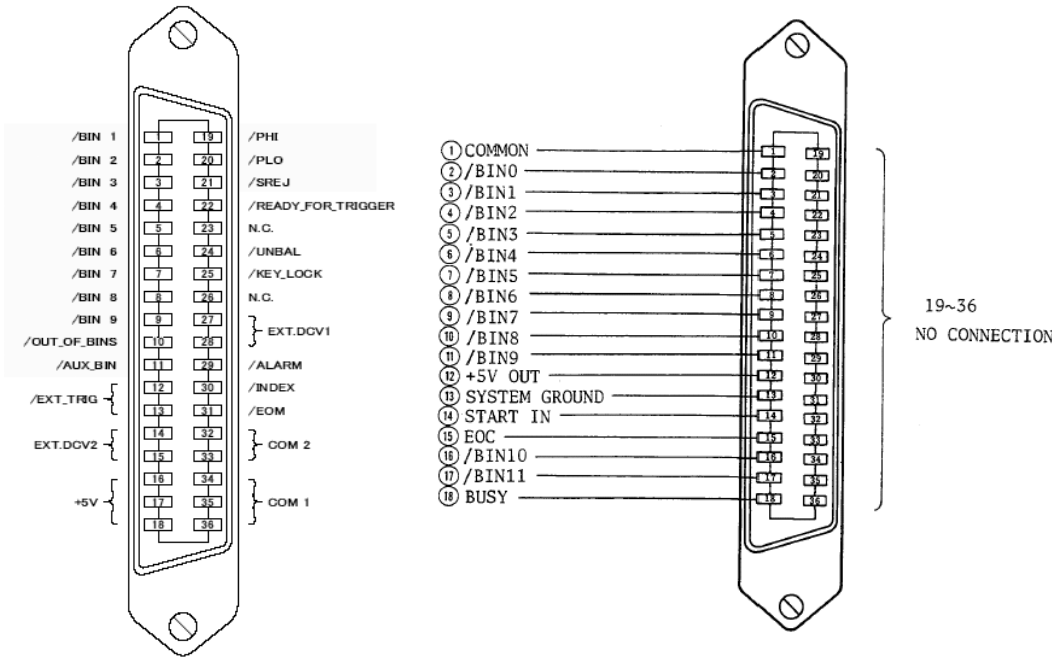


Figure 21. Pin assignment of Option 4284A-202 (left) and Option E4980A-201 (right) handler interface connector

Table 12. PIN assignment conversion reference from 4284A-202 to E4980A-201

4284A-202			E4980A-201	
PIN no.	**Signal name**	**Description**	**PIN no.**	**Signal name**
1	Common	Isolated common	32-33 34-36	COM1 COM2
2 3 4 5 6 7 8 9 10 11	BIN0 BIN1 BIN2 BIN3 BIN4 BIN5 BIN6 BIN7 BIN8 BIN9	BIN sorting results opto-isolated open collector output	10, 19 1 2 3 4 5 6 7 8 9	/OUT_OF BINS, /PHI /BIN1 /BIN2 /BIN3 /BIN4 /BIN5 /BIN6 /BIN7 /BIN8 /BIN9
12	+5V OUT	+5V for external use	16, 17, 18	+5V
13	System Ground	Instrument logic ground		COM1(32-33) with switch S1-5, COM2(34-36) with switch S1-6,
14	START IN	Trigger input (signal from handler)	12, 13	/EXT_TRIG[1]
15	EOC	End of conversion A/D output	30	/INDEX[2]
16	BIN10	BIN 10 sorting result (same as BIN0-9)	11, 21	/AUX_BIN
17		+5V output when jumper W1 is installed	16, 17, 18	+5V
18	BUSY	BUSY (conversion, calculation) output	31	/EOM[3]
19-36		No connection		

1. If W8/13 or W9/10/12 was used in 4284A-202, the polarity of trigger signal needs to be inverted when using the E4980A-201.
2. If W4 was used in 4284A-202, the polarity of the EOC signal needs to be inverted when using the E4980A-201. If W5 was used in 4284A-202, the EOC signal is the same as the "/EOM" signal of the E4980A-201.
3. If W6 was used in 4284A-202, the polarity of BUSY signal needs to be inverted when using the E4980A-201.

Summary:

The user needs to modify the remote-controlled program of Option 4284A-202 to match the PIN assignment of Option E4980A-201. Furthermore, in some cases, the polarity of input signal should also be inverted to match the polarity of the input signal of the Option E4980A-201.

The detail PIN assignment status of Option 201 and Option 202 is shown in Table 13. Figure 21 (right) shows the pin assignment for Option E4980A-201/Option 4284A-201 handler interface connections.

Table 13. Typical timing comparison between 4284A-202 and E4980A-201

Description	**4284A-202**	**4284A-201**	**E4980A-201**
Measurement time	Refer to the manual	Refer to the manual	Refer to the manual
Comparison time	1000 us	1000 us	490 us
Trigger pulse width	5 us or 50 us	1 us	300 us
Measurement delay time	200 us + Display time	200 us + Display time	290 us
Trigger wait time after EOC or INDEX is output	0 s	0 s	0 s

Web Resources

Visit our Web site for additional product information and literature.

E4980A Web page
http://www.agilent.com/find/E4980A

LCR Meters
http://www.agilent.com/find/lcrmeters

Impedance analyzers
www.agilent.com/find/impedance

RF & MW test accessories:
www.agilent.com/find/accessories

Agilent Email Updates

www.agilent.com/find/emailupdates
Get the latest information on the products and applications you select.

Agilent Direct

www.agilent.com/find/agilentdirect
Quickly choose and use your test equipment solutions with confidence.

Agilent Open

www.agilent.com/find/open
Agilent Open simplifies the process of connecting and programming test systems to help engineers design, validate and manufacture electronic products. Agilent offers open connectivity for a broad range of system-ready instruments, open industry software, PC-standard I/O and global support, which are combined to more easily integrate test system development.

Microsoft is a U.S. registered trademark of Microsoft Corporation.

www.agilent.com

Agilent Technologies' Test and Measurement Support, Services, and Assistance
Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise
Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you receive your new Agilent equipment, we can help verify that it works properly and help with initial product operation.

Your Advantage
Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and onsite education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

United States:
(tel) 800 829 4444
(fax) 800 829 4433
Canada:
(tel) 877 894 4414
(fax) 800 746 4866
China:
(tel) 800 810 0189
(fax) 800 820 2816
Europe:
(tel) 31 20 547 2111
Japan:
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840
Korea:
(tel) (080) 769 0800
(fax) (080) 769 0900
Latin America:
(tel) (305) 269 7500
Taiwan:
(tel) 0800 047 866
(fax) 0800 286 331
Other Asia Pacific Countries:
(tel) (65) 6375 8100
(fax) (65) 6755 0042
Email: tm_ap@agilent.com
Contacts revised: 09/26/05

For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:

www.agilent.com/find/contactus

Product specifications and descriptions in this document subject to change without notice.

© Agilent Technologies, Inc. 2006
Printed in USA, February 3, 2006
5989-4434EN

Agilent Technologies