

Keysight Technologies

4285A Precision LCR Meter

Data Sheet



Unlocking Measurement Insights

Specifications

The complete Keysight Technologies, Inc. 4285A specifications are listed below. These specifications are the performance standards or limits against which the instrument is tested. When shipped from the factory, the 4285A meets the specifications listed in this section. The specification test procedures are covered in *Keysight 4285A Maintenance Manual* (Keysight Part Number 04285-90030).

Measurement Functions

Measurement parameters

$|Z|$ = Absolute value of impedance

$|Y|$ = Absolute value of admittance

L = Inductance

C = Capacitance

R = Resistance

G = Conductance

D = Dissipation factor

Q = Quality factor

R_s = Equivalent series resistance

R_p = Parallel resistance

X = Reactance

B = Suceptance

\varnothing = Phase angle

Combinations of measurement parameters

| $ Z , Y $ | L, C | R | G |
|--|-------------------------|---|---|
| \varnothing (deg), \varnothing (rad) | D, Q, R_s , R_p , G | X | B |

Mathematical functions

The deviation and the percent of deviation of measurement values from a programmable reference value.

Equivalent measurement circuit

Parallel and series

Ranging

Auto and manual (hold/up/down)

Trigger

Internal, external, BUS (GPIB), and manual

Delay time

Programmable delay from the trigger command to the start of the measurement, 0 to 60.000 s in 1 ms steps.

Measurement terminals

Four-terminal pair

Test cable length

0 m, 1 m, and 2 m selectable

Integration time

Short, medium, and long selectable (refer to *Supplemental Performance Characteristics*, page 14, for the measurement time)

Averaging

1 to 256, programmable

Test Signal

Frequency

75 kHz to 30 MHz, 100 Hz solution

Frequency accuracy

±0.01%

Signal modes

Normal – Program selected voltage or current at the measurement terminals when they are opened or shorted, respectively

Constant – Maintains selected voltage or current at the device under test (DUT) independent of changes in the device's impedance.

Signal level

The following test signal level accuracy is specified for an ambient temperature range of 23 °C ± 5 °C and the test cable length is 0 m.

| | Mode | Range | Setting accuracy |
|---------|-----------------------|---|---|
| Voltage | Normal | 5 mV _{rms} to 2 V _{rms} | ±{(8 + 0.4 f _m)% + 1 mV _{rms} } |
| | Constant ¹ | 10 mV _{rms} to 1 V _{rms} | ±{(6 + 0.2 f _m)% + 1 mV _{rms} } |
| Current | Normal | 200 μA _{rms} to 20 mA _{rms} | ±{(8 + 1 f _m)% + 40 μA _{rms} } |
| | Constant ¹ | 100 μA _{rms} to 20 mA _{rms} | ±{(6 + 0.2 f _m)% + 40 μA _{rms} } |

1. When the ALC function is set to ON

For the temperature range of 0 °C to 55 °C, multiply the temperature induced setting error listed in Figure 1-5 to the test signal setting accuracy. When test cable length is 1 m or 2 m, add the following error due to test cable length.

$$0.2 \times f_m \times L [\%]$$

where:

f_m = Test frequency [MHz]

L = Test cable length [m]

Output impedance

The following output impedance is specified for the test cable length of 0 m:

$$(25 + 0.5 f_m) \Omega \pm \left(10 + \frac{2}{3} f_m\right) \%$$

where:

f_m = Test frequency [MHz]

Test signal level monitor

The following test signal level monitor accuracy is specified for an ambient temperature range of $23\text{ °C} \pm 5\text{ °C}$ and the test cable length is 0 m.

| Mode | Range | Monitor accuracy |
|---------|--|---|
| Voltage | Voltage $0.01\text{ mV}_{\text{rms}} - 2.000\text{ V}_{\text{rms}}$ | $\pm \left\{ S_{\text{mon}} \frac{4 + 0.2 f_m + S_{\text{set}}}{100} \frac{1}{500} \right\} [\text{V}]$ |
| Current | Current $0.001\text{ }\mu\text{A}_{\text{rms}} - 20.00\text{ mA}_{\text{rms}}$ | |

For the temperature range of 0 °C to 55 °C , multiply the temperature induced setting error listed in Figure 1-5. When test cable length is 1 m or 2 m, add the following error due to test cable length.

$$S_{\text{mon}} = 0.2 \times f_m \times L [\text{V}]$$

where:

f_m = Test frequency [MHz]

L = Test cable length [m]

S_{mon} = Readout value of test signal level

S_{set} = Setting value of test signal level

For example,

Test frequency: 1 MHz
 Test signal level: 1 V_{rms}
 Monitor readout value: $500\text{ mV}_{\text{rms}}$
 Cable length: 1 m
 Ambient temperature: 25 °C

Then, voltage level monitor accuracy V_{ma} is

$$\Delta V_{\text{ma}} = 0.5 \times \frac{4 + 0.2 \times 1}{100} + \frac{1 \times 0.2}{100} + 0.5 \times \frac{0.2}{100} \times 1 \times 1$$

$$= 0.024 [\text{V}]$$

$$V_{\text{ma}} = \frac{0.024}{0.5}$$

$$\approx 4.8 [\%]$$

Display Range

| Parameter | Range |
|-----------|--|
| Z , R, X | 0.00001 Ω to 99.9999 M Ω |
| Y , G, B | 0.00001 μS to 99.9999 S |
| C | 0.00001 pF to 999.999 μF |
| L | 0.001 nH to 99.9999 H |
| D | 0.000001 to 9.99999 |
| Q | 0.01 to 99999.9 |
| θ | -180.000° to 180.000° |
| Δ | -999.999% to 999.999% |

Measurement Accuracy

The measurement accuracy includes stability, temperature coefficient, linearity, repeatability, and calibration interpolation error. The measurement accuracy is specified when all of the following conditions are satisfied:

- Warm-up time: ≥ 30 minutes
- Test cable length: 0 m, 1 m (Keysight 16048A), or 2 m (Keysight 16048D). For the 1 m or 2 m cable length operation (with Keysight 16048A/D), CABLE CORRECTION has been performed
- OPEN and SHORT corrections have been performed.
- The optimum measurement range is selected by matching the DUT's impedance to the effective measuring range shown in Figure 1-1 and Figure 1-2. (For example, if the DUT's impedance is 3 k Ω and oscillator level is less than or equal to 1 V, the optimum range is the 500 Ω range.)
- Measurement accuracy is specified at the following reference planes:
 - Test frequency ≤ 1 MHz
At the UNKNOWN terminals on the Keysight 4285A front panel or at the end of the standard test leads (Keysight 16048A/D).
 - Test frequency ≥ 1.001 MHz
At the 1-port terminal of the Keysight 16085B Terminal Adapter, which should be connected to the UNKNOWN terminals of the Keysight 4285A or to the end of the standard test leads (Keysight 16048A/D).

|Z|, |Y|, L, C, R, X, G, and B accuracy

|Z|, |Y|, L, C, R, X, G, and B accuracy A_e is given as

$$A_e = \pm(A_n + A_c) K_t [\%]$$

where:

A_n = Basic accuracy equation given from the A_1 to A_{16} shown in Table 1-1. The applicable frequency range and impedance range of equations A_1 to A_{16} are shown in Figure 1-3 and Figure 1-4. (Refer to *Basic Accuracy Equations* on page 7.)

A_c = Cable length factor (Refer to *Cable Length Factor* on page 10.)

K_t = Temperature factor (Refer to *Temperature Factor* on page 10.)

L, C, X, and B accuracies apply when D_x (measured D value) ≤ 0.1 .

When $D_x > 0.1$, multiply A_e by $1 + D_x^2$ for L, C, X, and B accuracies.

R and G accuracies apply when Q_x (measured Q value) ≤ 0.1 .

When $Q_x > 0.1$, multiply A_e by $1 + Q_x^2$ for R and G accuracies. G accuracy given by the equation above applies to the G-B combination only.

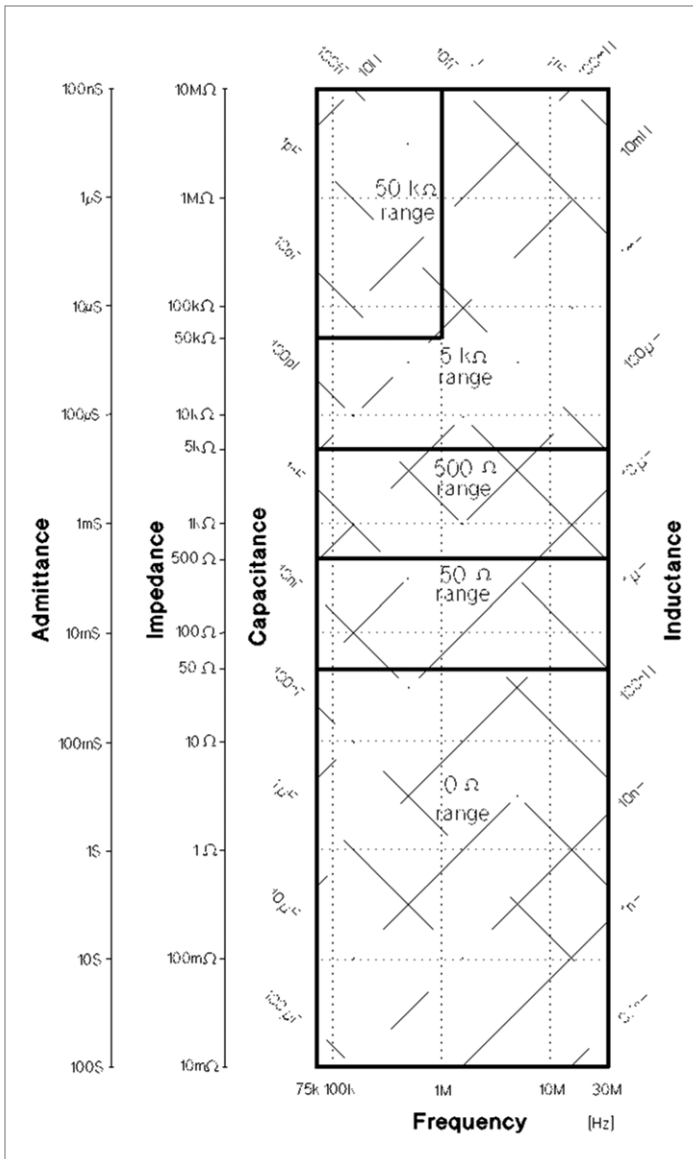


Figure 1-1. Effective measurement range (oscillator level $\leq 1 V_{rms}$)

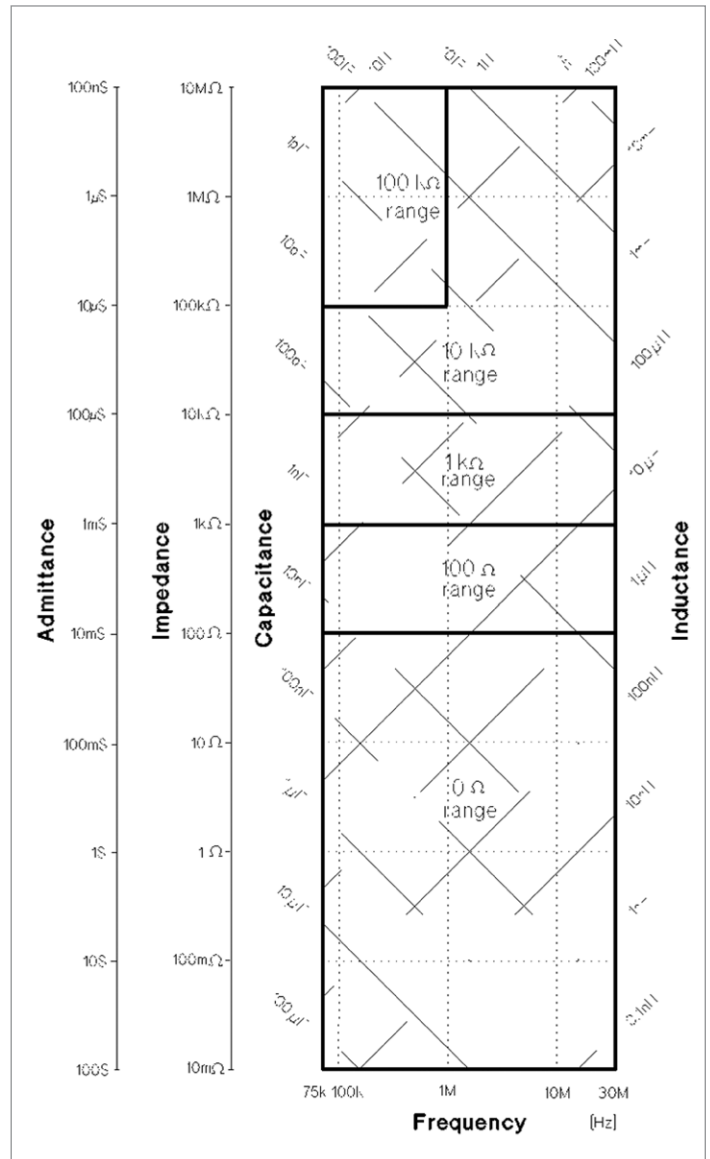


Figure 1-2. Effective measurement range (oscillator level $> 1 V_{rms}$)

D accuracy

D accuracy D_e is given as

$$D_e = \pm \frac{A_e}{100}$$

where:

A_e = |Z|, |Y|, L, C, R, X, G, and B accuracy

D accuracy applies when D_x (measured D value) ≤ 0.1 .

When $D_x > 0.1$, multiply D_e by $(1 + D_x)$.

Q accuracy

Q accuracy Q_e is given as

$$Q_e = \pm \frac{Q_x^2 D_e}{1 \pm Q_x \times D_e}$$

where:

Q_x = Measured Q value

D_e = D accuracy

Q accuracy applies when $Q_x \times D_e < 1$.

Φ Accuracy

θ accuracy θ_e is given as

$$\theta_e = \pm \frac{180 \times A_e}{\pi \times 100} \text{ [deg]}$$

where:

A_e = |Z|, |Y|, L, C, R, X, G, and B accuracy

G Accuracy

G accuracy G_e is given as

$$G_e = \pm B_x D_e [S]$$

$$\left(B_x = 2 \pi f C_x = \frac{1}{2 \pi f L_x} \right)$$

where:

B_x = Measured B value [S]

C_x = Measured C value [F]

L_x = Measured L value [H]

D_e = D accuracy

f = Test frequency [Hz]

G accuracy applies when D_x (measured D value) ≤ 0.1 .

G accuracy given by the equation above applies to the C_p -G and L_p -G combinations only.

R_p accuracy

R_p accuracy R_{pe} is given as

$$R_{pe} = \pm \frac{R_{px} \times D_e}{D_x + D_e} \quad [\Omega]$$

where:

R_{px} = Measured R_p value $[\Omega]$

D_x = Measured D value

D_e = D accuracy

R_p accuracy applies when D_x (measured D value) ≤ 0.1 .

R_s accuracy

R_s accuracy R_{se} is given as

$$R_{se} = \pm X_x \times D_e \quad [\Omega]$$

$$\left(X_x = 2 \pi f L_x = \frac{1}{2 \pi f C_x} \right)$$

where:

X_x = Measured X value $[\Omega]$

C_x = Measured C value [F]

L_x = Measured L value [H]

D_e = D accuracy

f = Test frequency [Hz]

R_s accuracy applies when D_x (measured D value) ≤ 0.1 .

Basic accuracy equations

The basic accuracy A_n is calculated from the following procedure:

1. Determine A_n equation from Figure 1-3 or Figure 1-4. In both charts, boundary line belongs to the better accuracy area.

When the oscillator level is $\leq 1 V_{rms}$, determine A_n to be applied, value of K_j and value of K_{osc} from the Figure 1-3. If the determined $K_{osc} \leq 1$, then round up K_{osc} to 1.

When the oscillator level is $> 1 V_{rms}$, determine A_n to be applied and value of K_j from the Figure 1-4.

2. Calculate A_n from the formula to be applied. The n accuracy factor included in the A_n equation is shown in Table 1-2. Use K_j and K_{osc} factors determined in previous step.

Table 1-1. A_n equations

$$A_1 = N_1\% + \left(\frac{f_m}{30}\right)^2 \cdot 3\% + \frac{50}{|Z_m|} \left[0.02\% + \left(\frac{f_m}{30}\right) \cdot 0.1\%\right] \cdot K_i \cdot K_{osc}$$

$$A_2 = N_1\% + \left(\frac{f_m}{30}\right)^2 \cdot 3\% + \frac{|Z_m|}{50} \left[0.02\% + \left(\frac{f_m}{30}\right) \cdot 0.05\%\right] \cdot K_i \cdot K_{osc}$$

$$A_3 = N_1\% + \left(\frac{f_m}{5}\right)^2 \cdot 0.1\% + \frac{|Z_m|}{500} \left[0.02\% + \left(\frac{f_m}{30}\right) \cdot 0.05\%\right] \cdot K_i \cdot K_{osc}$$

$$A_4 = 0.3\% + \left(\frac{f_m}{30}\right)^2 \cdot 3\% + \frac{|Z_m|}{500} \left[0.05\% + \left(\frac{f_m}{30}\right) \cdot 0.1\%\right] \cdot K_i \cdot K_{osc}$$

$$A_5 = 0.18\% + \frac{f_m}{5_k} \cdot 0.02\% \cdot K_i \cdot K_{osc}$$

$$A_6 = 0.18\% + \left(\frac{f_m}{30}\right)^2 \cdot 3\% + \frac{|Z_m|}{5_k} \left[0.02\% + \left(\frac{f_m}{30}\right) \cdot 0.03\%\right] \cdot K_i \cdot K_{osc}$$

$$A_7 = 0.5\% + \left(\frac{f_m}{30}\right)^2 \cdot 3\% + \frac{|Z_m|}{5_k} \cdot \left(\frac{f_m}{30}\right) \cdot 0.2\% \cdot K_i \cdot K_{osc}$$

$$A_8 = 0.18\% + \frac{|Z_m|}{50_k} \cdot 0.03\% \cdot K_i \cdot K_{osc}$$

$$A_9 = N_2\% + \left(\frac{f_m}{30}\right)^2 \cdot 3\% + \frac{100}{|Z_m|} \left[0.02\% + \left(\frac{f_m}{30}\right) \cdot 0.1\%\right] \cdot K_i$$

$$A_{10} = N_2\% + \left(\frac{f_m}{30}\right)^2 \cdot 3\% + \frac{|Z_m|}{100} \left[0.02\% + \left(\frac{f_m}{30}\right) \cdot 0.05\%\right] \cdot K_i$$

$$A_{11} = 0.18\% + \left(\frac{f_m}{5}\right)^2 \cdot 0.1\% + \frac{|Z_m|}{1_k} \left[0.02\% + \left(\frac{f_m}{30}\right) \cdot 0.05\%\right] \cdot K_i$$

$$A_{12} = 0.3\% + \left(\frac{f_m}{30}\right)^2 \cdot 3\% + \frac{|Z_m|}{1_k} \left[0.05\% + \left(\frac{f_m}{30}\right) \cdot 0.1\%\right] \cdot K_i$$

$$A_{13} = 0.18\% + \frac{|Z_m|}{10_k} \cdot 0.02\% \cdot K_i$$

$$A_{14} = 0.18\% + \left(\frac{f_m}{30}\right)^2 \cdot 3\% + \frac{|Z_m|}{10_k} \left[0.02\% + \left(\frac{f_m}{10}\right) \cdot 0.03\%\right] \cdot K_i$$

$$A_{15} = 0.5\% + \left(\frac{f_m}{30}\right)^2 \cdot 3\% + \frac{|Z_m|}{10_k} \cdot \left(\frac{f_m}{30}\right) \cdot 0.2\% \cdot K_i$$

$$A_{16} = 0.18\% + \frac{|Z_m|}{100_k} \cdot 0.03\% \cdot K_i$$

$|Z_m|$: Absolute value of measured impedance in [Ω]

f_m : Test frequency in [MHz]

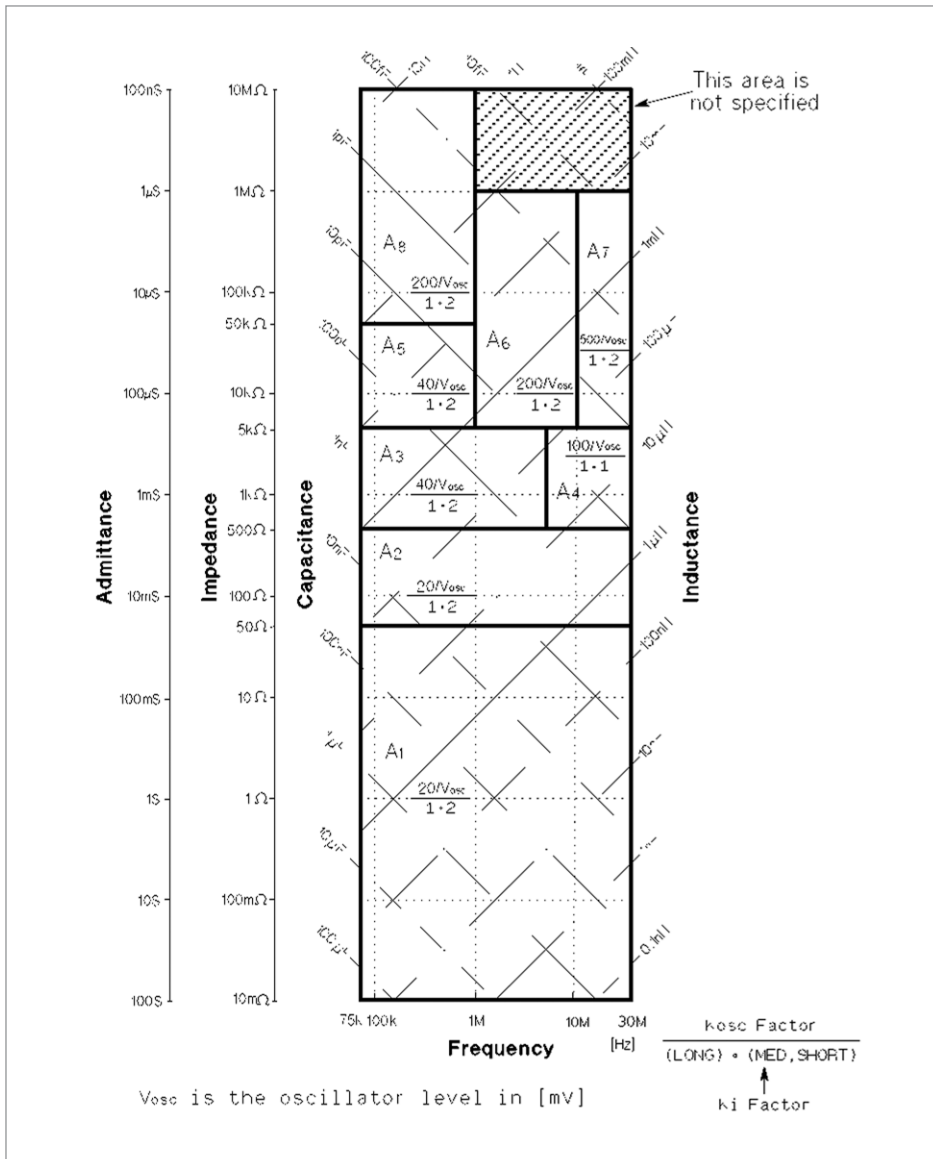


Figure 1-3. Accuracy equations, K_i factor, and K_{osc} factor (test signal level ≤ 1 V_{rms})

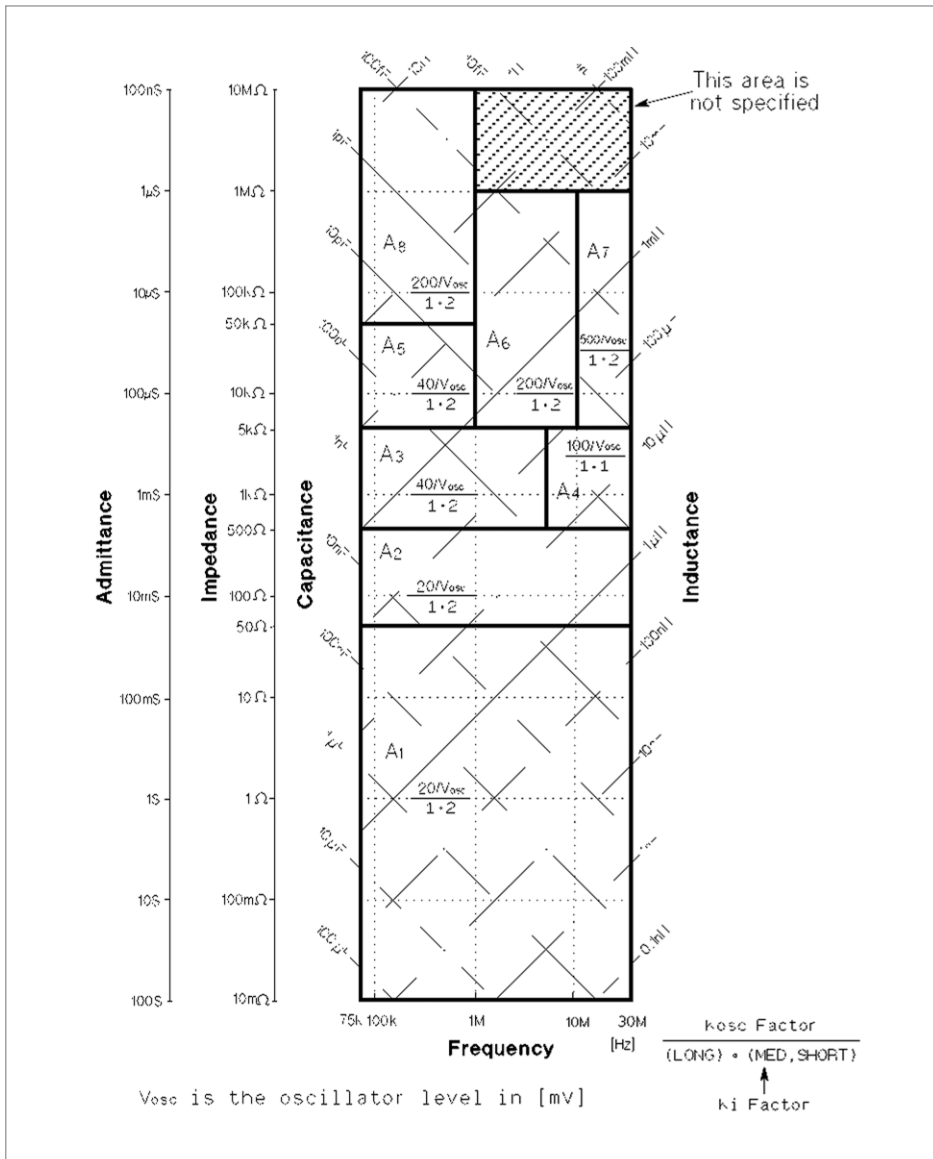


Figure 1-4. Accuracy equations and K_i factor (test signal level > 1 V_{rms})

N accuracy factors

N_1 and N_2 in the A_n equations have the following values:

Table 1-2. N accuracy factors

| Frequency(f) | N_1 | N_2 |
|----------------------|-------|-------|
| 75 kHz ≤ f ≤ 200 kHz | 0.15 | 0.15 |
| 200 kHz < f ≤ 3 MHz | 0.08 | 0.15 |
| 3 MHz < f ≤ 5 MHz | .15 | 0.38 |
| 5 MHz < f ≤ 30 MHz | 0.30 | 0.38 |

Cable length factor

Add the following cable length factor A_c to the measurement accuracy when the cable length is set to 1 m (for 16048A) or 2 m (for 16048D) in CABLE field, after performing the cable correction and the OPEN/SHORT correction. When the cable length is 0 m, A_c is 0 percent.

$$A_c = \frac{f_m}{15} + A_{co} [\%]$$

A_{co} is the additional error when the impedance range is above 5 kΩ.

$$A_{co} = \frac{|Z_m| \cdot f_m \cdot K_t}{1000} [\%]$$

where:

f_m = Test frequency in [MHz]

Z_m = Absolute value of measured impedance in [kΩ]

K_t = Test cable length in [m]

Temperature factor

Multiply the sum of the basic accuracy and the cable length factor by the following temperature induced error K_t , when the temperature range is 0 °C to 55 °C. The boundary belongs to the smaller multiplier.

| Temperature (°C) | 0 | 8 | 18 | 28 | 38 | 48 | 55 |
|------------------|----|----|----|----|----|----|----|
| K_t | \3 | \2 | >1 | /2 | /3 | >4 | |

Figure 1-5. Temperature factor K_t

Measurement Accuracy Calculation Example

Example of L_S -Q accuracy calculation

Measurement conditions

| | |
|-----------------------------------|----------|
| Measured inductance L_x of DUT: | 220 nH |
| Measured Q value of DUT: | 30 |
| Test signal level: | 1 Vrms |
| Test frequency f_m : | 25.2 MHz |
| Integration time: | LONG |
| Cable length: | 0 m |
| Operating temperature: | 28 °C |

Determine inductance measurement accuracy A_e

1. From $|Z|$, $|Y|$, L, C, R, X, G, and B Accuracy (see page 6), measurement accuracy A_e is determined as below:

$$A_e = \pm (A_n + A_c) \times K_t$$

2. First of all, to determine the measurement accuracy A_e , calculate the impedance value from the DUT's inductance value. So the measurement impedance Z_m is:

$$Z_m = 2 \pi f_m L_x \\ \approx 35 [\Omega]$$

where:

f_m = Test frequency [Hz]

L_x = Measured inductance value of the DUT [H]

3. Choose an accuracy chart from Figure 1-3 and Figure 1-4. The oscillator level is 1 V_{rms}, then Figure 1-3 is chosen for this measurement.

4. Find the frequency point of f_m (25.2 MHz) along the X axis in Figure 1-3. Both axes are in log format. Interpolation may be required.

5. Find the impedance point of Z_m (35 Ω) along the Y axis in Figure 1-3 determined in step 2. Both axes are in log format. Interpolation may be required.

6. Mark the intersection of above two steps and determine the basic accuracy equation A_n , integration factor K_i , and oscillator level factor K_{osc} .

From:

Test frequency f_m : 25.2 MHz

DUT's impedance Z_m : 35 Ω

Integration time: LONG

Test signal level: 1 V_{rms}

Then,

$A_n = A_1$, $K_i = 1$, and $K_{osc} = 1$ (rounded from 0.02).

7. From Table 1-1, the actual accuracy equation to be applied is determined as A1.

Then,

$$A_1 = N_1\% + \left(\frac{f}{30}\right)^2 \cdot 3\% + \frac{50}{|Z_m|} [0.02\% + \left(\frac{f}{30}\right) \cdot 0.1\%] \cdot K_i \cdot K_{osc}$$

8. Determine N_1 from Table 1-2.

From frequency = 25.2 MHz, then, $N_1 = 0.3$.

9. Then,

$$A_n = 0.3\% + \left(\frac{25.2}{30}\right)^2 \cdot 3\% + \frac{50}{|35|} [0.02\% + \left(\frac{25.2}{30}\right) \cdot 0.1\%] \cdot 1 \cdot 1$$

$$\approx 2.6 [\%]$$

10. Cable length is 0 m, then $A_c = 0$.

11. Operating temperature is 28 °C, then $K_t = 1$ (from Figure 1-5).

12. Therefore, inductance measurement accuracy A_e is:

$$A_e = \pm(A_n + A_c) \times K_t$$

$$= \pm(2.6 + 0) \times 1$$

$$= \pm 2.6 [\%]$$

Determine Q measurement accuracy Q_e

1. From *Q Accuracy* (see page 6), Q measurement accuracy Q_e is determined as below:

$$Q_e = \pm \frac{Q_x^2 \times D_e}{1 \pm Q_x \times D_e}$$

2. Determine D accuracy D_e for calculating Q_e . From the previous step *Determine inductance measurement accuracy A_e* (see page 10), A_e is 2.6 [%], then:

$$D_e = \pm \frac{A_e}{100}$$

$$= \pm 0.026$$

3. Therefore Q_e is:

$$Q_e = \pm \frac{Q_x^2 \times D_e}{1 \pm Q_x \times D_e}$$

$$Q_e = \pm \frac{30^2 \times 0.026}{1 \pm 30 \times 0.026}$$

$$\approx +106/-13$$

Correction Functions

Zero open

Eliminates measurement errors due to parasitic stray admittance (C, G) of the test fixture.

Zero short

Eliminates measurement errors due to parasitic residual impedances (L, R) of the test fixture.

Load

Improves the measurement accuracy by using a device whose value is accurately known (a working standard) as a reference.

List Sweep

A maximum of ten frequencies or test signal levels can be programmed. Single or sequential tests can be performed. When Option 4285A-001 is installed, DC bias voltages can also be programmed.

Comparator Function

Ten-bin sorting for the primary measurement parameter, and IN/OUT decision output for the secondary measurement parameter.

Sorting modes

Sequential mode. Sorting into unnested bins with absolute upper and lower limits.

Tolerance mode. Sorting into nested bins with absolute or percent limits.

Bin count

0 to 999999

List sweep comparator

HIGH/IN/LOW decision output for each point in the list sweep table.

Other Functions

Store/Load

Ten instrument control settings, including comparator limits and list sweep programs, can be stored and loaded into and from the internal nonvolatile memory. Ten additional settings can also be stored and loaded from each memory card.

GPIB

All control settings, measured values, comparator limits, and list sweep program can be controlled or monitored. Uses ASCII and 64-bit binary data format. GPIB buffer memory can store measured values for a maximum of 128 measurements and output packed data over the GPIB bus. Complies with IEEE-488.1 and 488.2. The programming language is Test and Measurement Systems Language (TMSL).

GPIB interface functions

SH1, AH1, T5, L4, SR1, RL1, DC1, DT1, C0, E1

Self test

Softkey controllable. Provides a means to confirm proper operation.

Option 4285A-001 (Internal DC Bias)

Adds the variable DC bias voltage function.

DC bias level

The following DC bias level accuracy is specified for an ambient temperature range of $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. Multiply the temperature induced setting error, K_t listed in Figure 1-5 for the temperature range of $0\text{ }^{\circ}\text{C}$ to $55\text{ }^{\circ}\text{C}$.

| Voltage range | Resolution | Setting accuracy |
|--|------------|--|
| $\pm(0.000\text{ to }4.000)\text{ V}$ | 1 mV | $\pm(0.1\% \text{ of setting} + 1\text{ mV})$ |
| $\pm(4.002\text{ to }8.000)\text{ V}$ | 2 mV | $\pm(0.1\% \text{ of setting} + 2\text{ mV})$ |
| $\pm(8.005\text{ to }20.000)\text{ V}$ | 5 mV | $\pm(0.1\% \text{ of setting} + 5\text{ mV})$ |
| $\pm(20.01\text{ to }40.00)\text{ V}$ | 10 mV | $\pm(0.1\% \text{ of setting} + 10\text{ mV})$ |

A maximum DC bias current of 100 mA can be applied to the DUT.

DC bias monitor terminal

DC bias voltage or current can be monitored at the rear panel BNC connector.

The following monitor accuracies are applied when the digital volt meter whose input impedance is $\geq 10\text{ M}\Omega$ is used.

- DC bias voltage monitor
DC bias voltage across the DUT $\times 1$

Output impedance: 11 k Ω

Monitor accuracy: $\pm(0.2\% \text{ of reading} + 2 + 0.8 \times I_{\text{dut}})\text{ mV}$

where:

I_{dut} is current flowing through the DUT in [mA].

- DC bias current monitor
DC bias current through the DUT $10\text{ }\Omega$ (1 V at 100 mA)

Output impedance: 10 k Ω

Monitor accuracy: $\pm(1\% \text{ of reading} + 0.3)\text{ mA}$

Other Options

Option 4285A-700: No DC bias

Option 4285A-002: Accessory Control Interface

Allows the 4285A to control the Keysight 42841A bias current source or the Keysight 42851A precision Q adapter.

The voltage ratio measurement accuracy, when the 4285A is used with the 42851A precision Q adapter, is described in the 42851A's operation manual.

Option 4285A-201: Handler interface

Option 4285A-202: Handler interface

Option 4285A-301: Scanner interface

Option 4285A-710: Blank panel

Option 4285A-907: Front handle kit

Option 4285A-908: Rack mount kit

Option 4285A-909: Rack flange and handle kit

Option 4285A-915: Add service manual

Option 4285A-ABA: Add English manual

Option 4285A-ABD: Add German manual

Option 4285A-ABJ: Add Japanese manual

Furnished Accessories

| | |
|---------------------------|--|
| Power cord | Depends on the country where the 4285A is being used |
| 100 Ω resistor box | Keysight P/N 04285-61001 |
| BNC female-female Adapter | Keysight P/N 1250-0080 (4 ea.) |
| Fuse | Only for Option 4285A-201 Keysight P/N 2110-0046 (2 ea.) |

Accessories Available

Test fixture/test leads

| | |
|-------------|--|
| 16034E | Test fixture for SMD or chip type DUT, $f \leq 40$ MHz |
| 16044A | Four-terminal test fixture for SMD or chip type DUT, $f \leq 10$ MHz |
| 16047A | Test fixture for axial or radial DUT, $f \leq 13$ MHz |
| 16047D | Test fixture for axial or radial DUT, $f \leq 40$ MHz |
| 16048A | Test leads, length 1 m (BNC connector) |
| 16048D | Test leads, length 2 m (BNC connector) |
| 16048G | Test fixture for SMD or chip type DUT, $f \leq 110$ MHz |
| 16048H | Test fixture for array-type SMD or chip type DUT, $f \leq 110$ MHz |
| 16065A | External voltage bias fixture |
| 16334A | Tweezer-type test fixture for SMD or chip type DUT, $f \leq 15$ MHz |
| 16451B | Dielectric test fixture |
| 42842C | Bias current test fixture |
| 42851-61100 | SMD test fixture (Option 42842C-201) |

DC bias source

| | |
|--------|---------------------|
| 42841A | Bias current source |
|--------|---------------------|

Memory card

| | |
|-------------|-------------------|
| 04278-89001 | Memory card, 1 ea |
|-------------|-------------------|

GPIO interconnection cables

| | |
|--------|-------------------|
| 10833A | GPIO cable, 1 m |
| 10833B | GPIO cable, 2 m |
| 10833C | GPIO cable, 4 m |
| 10833D | GPIO cable, 0.5 m |

Power Requirements

Line voltage

100, 120, 220 Vac $\pm 10\%$, 240 Vac +5% -10%

Line frequency

47 to 66 Hz

Power consumption

200 VA max.

Operating Environment

Temperature

0 °C to 55 °C

Humidity

$\leq 95\%$ R.H. at 40 °C

Dimensions

426 (W) by 177 (H) by 498 (D) (mm)

Weight

Approximately 16 kg (35.3 lb., standard)

Display

LCD dot-matrix display

Capable of displaying

Measured values

Control settings

Comparator limits and decisions

List sweep tables

Self test message and annunciations

Number of display digits

6-digits, maximum display count 999999

Supplemental Performance Characteristics

The Keysight 4285A supplemental performance characteristics are listed below. These supplemental performance characteristics are not specifications, but are typical characteristics included as supplemental information for the operator.

Stability

When the following conditions are satisfied,

Integration time: LONG

Operating temperature: Constant operating temperature of 23 °C \pm 5 °C

| Parameter | ≤ 1 MHz | 30 MHz |
|------------------|--------------|--------------|
| Z , Y , L, C, R | < 0.01%/day | < 0.05%/day |
| D | < 0.0001/day | < 0.0005/day |

Temperature coefficient

When the following conditions are satisfied,

Integration time: LONG
 Test signal voltage: ≥ 20 mVrms
 Operating temperature: $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$

| Parameter | ≤ 1 MHz | 30 MHz |
|------------------|------------------------------|-----------------------------|
| Z , Y , L, C, R | $< 0.004\%/^{\circ}\text{C}$ | $< 0.05\%/^{\circ}\text{C}$ |
| D | $< 0.00004/^{\circ}\text{C}$ | $< 0.0005/^{\circ}\text{C}$ |

Settling time

Frequency (fm)

< 50 msec.

Test signal level

< 100 msec.

Measurement range

< 50 msec./range shift

Input protection

Internal circuit protection, when a charged capacitor is connected to the UNKNOWN terminals.

The maximum capacitor voltage is:

$$V_{max} = \sqrt{\frac{1}{C}} [V]$$

where:

$$V_{max} = \leq 200\text{ V}$$

$$C = \text{Capacitance value in Farads}$$

Measurement time

Typical measurement times from the trigger to the output of EOM at the Handler Interface. (EOM: End of Measurement)

| Integration time | Measurement time |
|------------------|------------------|
| SHORT | 30 ms |
| MEDIUM | 65 ms |
| LONG | 200 ms |

In the following condition an additional measurement time, approx. 300 ms, is added to the measurement time.

Test signal voltage: $0.51\text{ V} - 2\text{ Vrms}$
 Measurement range: $0\ \Omega$ Range
 Test signal current: $\geq 22\text{ mA}$

Display time

Display time for each display format is given as:

| | |
|-------------------------------|----------------|
| <i>MEAS DISPLAY</i> page | Approx. 8 ms |
| <i>BIN No. DISPLAY</i> page | Approx. 5 ms |
| <i>BIN COUNT DISPLAY</i> page | Approx. 0.5 ms |

GPIB data output time

Internal GPIB data, processing time from EOM output to measurement data output on GPIB lines (excluding display time):

- Approx. 10 ms

Option 4285A-001 (internal DC bias)

Maximum DC bias current when the normal measurement can be performed is 100 mA.

DC bias settling time

When DC bias is set to ON, add 5 ms to the measurement time. This settling time does not include the DUT charge time.

Sum of DC bias settling time plus DUT (capacitor) charge time is shown in the following figure.

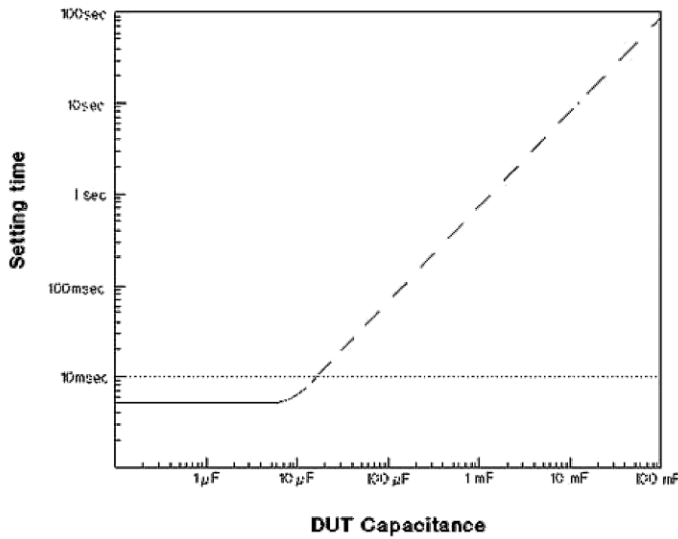


Figure 1-6. Sum of the DC bias settling time and DUT (capacitor) charge time

myKeysight

myKeysight

www.keysight.com/find/mykeysight

A personalized view into the information most relevant to you.



www.axistandard.org

AdvancedTCA® Extensions for Instrumentation and Test (AXIe) is an open standard that extends the AdvancedTCA for general purpose and semiconductor test. Keysight is a founding member of the AXIe consortium. ATCA®, AdvancedTCA®, and the ATCA logo are registered US trademarks of the PCI Industrial Computer Manufacturers Group.



www.lxistandard.org

LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. Keysight is a founding member of the LXI consortium.



www.pxisa.org

PCI eXtensions for Instrumentation (PXI) modular instrumentation delivers a rugged, PC-based high-performance measurement and automation system.



Three-Year Warranty

www.keysight.com/find/ThreeYearWarranty

Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.



Keysight Assurance Plans

www.keysight.com/find/AssurancePlans

Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.



www.keysight.com/go/quality

Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2008
Quality Management System

Keysight Infoline

Keysight Infoline

www.keysight.com/find/service

Keysight's insight to best in class information management. Free access to your Keysight equipment company reports and e-library.

Keysight Channel Partners

www.keysight.com/find/channelpartners

Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

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

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
(BP-04-23-15)