Agilent 34410A/11A
6 ½ Digit Multimeter

(includes the L4411A 1U DMM)

User's Guide

Agilent Technologies

DC Characteristics

Accuracy Specifications ±(% of reading + % of range) [1]

Function	Range [3]	Test Current or Burden Voltage	24 Hour [2] T_{CAL} ± 1 °C	90 Day T_{CAL} ± 5 °C	1 Year T_{CAL} ± 5 °C	Temperature Coefficient/°C 0 °C to (T_{CAL} − 5 °C) (T_{CAL} + 5 °C) to 55 °C
DC	100.0000 mV		0.0030+0.0030	0.0040+0.0035	0.0050+0.0035	0.0005+0.0005
	1.000000 V		0.0020+0.0006	0.0030+0.0007	0.0035+0.0007	0.0005+0.0001
	10.00000 V		0.0015+0.0004	0.0020+0.0005	0.0030+0.0005	0.0005+0.0001
	100.0000 V		0.0020+0.0006	0.0035+0.0006	0.0040+0.0006	0.0005+0.0001
	1000.000 V [5]		0.0020+0.0006	0.0035+0.0006	0.0040+0.0006	0.0005+0.0001
Resistance [4]	100.0000 Ω	1 mA Current Source	0.0030+0.0030	0.008+0.004	0.010+0.004	0.0006+0.0005
	1.000000 KΩ	1 mA	0.0020+0.0005	0.007+0.001	0.010+0.001	0.0006+0.0001
	10.00000 KΩ	100 µA	0.0020+0.0005	0.007+0.001	0.010+0.001	0.0006+0.0001
	100.0000 KΩ	10 µA	0.0020+0.0005	0.007+0.001	0.010+0.001	0.0006+0.0001
	1.000000 MΩ	5.0 µA	0.0020+0.0010	0.010+0.001	0.012+0.001	0.0010+0.0002
	10.00000 MΩ	500 nA	0.0100+0.0010	0.030+0.001	0.040+0.001	0.0030+0.0004
	100.0000 MΩ	500 nA || 10 MΩ	0.200+0.001	0.600+0.001	0.800+0.001	0.1000+0.0001
	1.000000 GΩ	500 nA || 10 MΩ	2.000+0.001	6.000+0.001	8.000+0.001	1.0000+0.0001
DC Current	100.0000 µA	<0.03 V Burden V	0.010+0.020	0.040+0.025	0.050+0.025	0.0020+0.0030
	1.000000 mA	<0.3 V	0.007+0.006	0.030+0.006	0.050+0.006	0.0020+0.0005
	10.00000 mA	<0.03 V	0.007+0.020	0.030+0.020	0.050+0.020	0.0020+0.0020
	100.0000 mA	<0.3 V	0.010+0.004	0.030+0.005	0.050+0.005	0.0020+0.0005
	1.000000 A	<0.80 V	0.050+0.006	0.080+0.010	0.100+0.010	0.0050+0.0010
	3.00000 A	<2.0 V	0.100+0.020	0.120+0.020	0.150+0.020	0.0050+0.0020
Continunity	1000 Ohms	1 mA Test Current	0.002+0.010	0.008+0.020	0.010+0.020	0.0010+0.0020
Diode Test	1.0000 V [6]	1 mA Test Current	0.002+0.010	0.008+0.020	0.010+0.020	0.0010+0.0020

[1] Specifications are for 90 minute warm–up and integration setting of 100 NPLC.
For <100 NPLC, add the appropriate "RMS Noise Adder" from the table on the following page.

[2] Relative to calibration standards.

[3] 20% overrange on all ranges, except 1000 VDC, 3 A range.

[4] Specifications are for 4–wire ohms function, or 2–wire ohms using Math Null. Without Math Null, add 0.2 Ω additional error in 2–wire ohms function.

[5] For each additional volt over ± 500 VDC add 0.02 mV of error.

[6] Accuracy specifications are for the voltage measured at the input terminals only. 1 mA test current is typical. Variation in the current source will create some variation in the voltage drop across a diode junction.

To Calculate Total Measurement Error

The multimeter's accuracy specifications are expressed in the form: (% of reading + % of range). In addition to the reading error and range error, you may need to add additional errors for certain operating conditions. Check the list below to make sure you include all measurement errors for a given function. Also, make sure you apply the conditions as described in the footnotes on the specification pages.

- If you are operating the multimeter outside the temperature range specified, apply an additional temperature coefficient error.
- For dc voltage, dc current, and resistance measurements, you may need to apply an additional reading speed error or autozero OFF error.
- For ac voltage and ac current measurements, you may need to apply an additional low frequency error or crest factor error.

Understanding the " % of reading " Error The reading error compensates for inaccuracies that result from the function and range you select, as well as the input signal level. The reading error varies according to the input level on the selected range. This error is expressed in percent of reading. The following table shows the reading error applied to the multimeter's 24–hour dc voltage specification.

Range	Input Level	Reading Error (% of reading)	Reading Error (Voltage)
10 VDC	10 VDC	0.0015	±150 µV
10 VDC	1 VDC	0.0015	±15 µV
10 VDC	0.1 VDC	0.0015	±1.5 µV

Understanding the " % of range " Error The range error compensates for inaccuracies that result from the function and range you select. The range error contributes a constant error, expressed as a percent of range, independent of the input signal level. The following table shows the range error applied to the multimeter's 24–hour dc voltage specification.

Range	Input Level	Range Error (% of range)	Range Error (Voltage)
10 VDC	10 VDC	0.0004	±40 µV
10 VDC	1 VDC	0.0004	±40 µV
10 VDC	0.1 VDC	0.0004	±40 µV

Total Measurement Error To compute the total measurement error, add the reading error and range error. You can then convert the total measurement error to a "percent of input" error or a "ppm (parts–per–million) of input" error as shown below.

$$\%\ of\ input\ error = \frac{\text{Total Measurement Error}}{\text{Input Signal Level}} \times 100$$

$$ppm\ of\ input\ error = \frac{\text{Total Measurement Error}}{\text{Input Signal Level}} \times 1{,}000{,}000$$

Error Example Assume that a 5 VDC signal is input to the multimeter on the 10 V range. Compute the total measurement error using the 90–day accuracy specifications: ± (0.0020% of reading + 0.0005% of range).

Reading Error = 0.0020% x 5 VDC = 100 µV

Range Error = 0.0005% x 10 VDC = 50 µV

Total Error = 100 µV + 50 µV = \150 µV
= \0.003% of 5 VDC
= \30 ppm of 5 VDC