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How do I calculate total measurement error on the Keysight 34401A?

The accuracy specifications for the Agilent 34401A are expressed in the form: '% of reading + % of range' which match the dominate sources of error, gain and offset.

The reading error term is from inaccuracies such as amplifier gains, divider ratios or internal reference voltages. The range error term is from inaccuracies such as amplifier offsets, leakage current effects and thermocouple effects. Total measurement error is the sum of the readings and range errors.

Example: Assume that you want to measure a 5 Vdc signal using the Agilent 34401A that you purchased nine months ago. The one-year accuracy specification for the 10 Vdc range (assumes 6.5 digits of resolution) is: **0.0035% of reading + 0.0005% of range. Which is $(0.000035) \times (5V) + (0.000005) \times (10V)$ or 225 μV .**

Therefore, assuming that you are measuring the output from a perfect 5.000000 Vdc source, your reading will fall between 4.999775 and 5.000225 V.

Additional Errors: Other errors may exist if not making the most accurate readings possible:

DCV, DCI, and Resistance

Autozero OFF, 0.0002% of range + 5 μV or 1 μA or 1 mOhm within 1 degree C and 10 minutes of calibration

NPLC

100 NPLC no additional error

10 NPLC no additional error

1 NPLC 0.001% of range

.2 NPLC .001% of range + 20 μV or 4 μA or 20 mOhms

.02 NPLC 0.01% of range + 20 μV or 4 μA or 20 mOhms

2 Wire Ohms without using MATH NULL, add 0.2 Ohms

AC readings (not including frequency or period measurements)

Filters, using medium or fast rather than slow:

Frequency: Medium /Fast (% of reading)

10 Hz to 20 Hz: 0.74 / NA

20 Hz to 40 Hz: 0.22 / NA

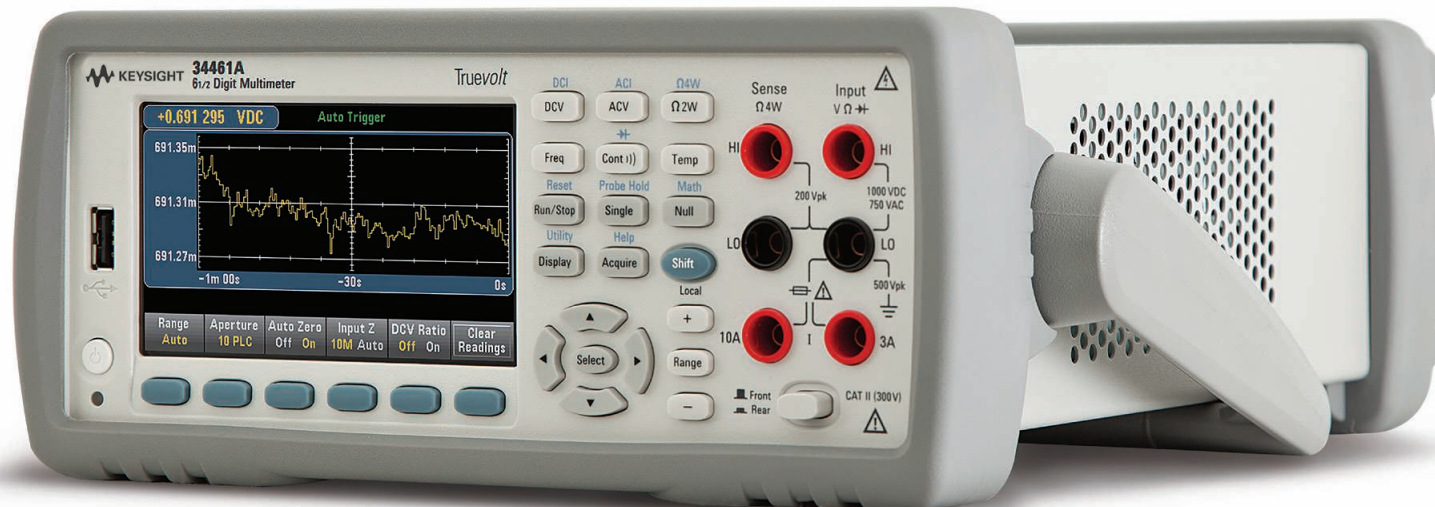
40 Hz to 100 Hz: 0.06 / 0.73

100 Hz to 200 Hz: 0.01 / 0.22

Specifications 34461A

34461A accuracy specifications: \pm (% of reading + % of range) ¹

These specification are compliant to ISO/IEC 17025 for K = 2



Range ² /frequency	24 hour ³ T _{CAL} \pm 1 °C	90 day T _{CAL} \pm 5 °C	1 year T _{CAL} \pm 5 °C	2 year T _{CAL} \pm 5 °C	Temperature coefficient/°C ⁴
DC voltage					
100 mV	0.0030 + 0.0030	0.0040 + 0.0035	0.0050 + 0.0035	0.0065 + 0.0035	0.0005 + 0.0005
1 V	0.0020 + 0.0006	0.0030 + 0.0007	0.0040 + 0.0007	0.0055 + 0.0007	0.0005 + 0.0001
10 V	0.0015 + 0.0004	0.0020 + 0.0005	0.0035 + 0.0005	0.0050 + 0.0005	0.0005 + 0.0001
100 V	0.0020 + 0.0006	0.0035 + 0.0006	0.0045 + 0.0006	0.0060 + 0.0006	0.0005 + 0.0001
1000 V	0.0020 + 0.0006	0.0035 + 0.0010	0.0045 + 0.0010	0.0060 + 0.0010	0.0005 + 0.0001

True RMS AC voltage ^{2, 5, 6}					
100 mV, 1 V, 10 V, 100 V, and 750 V ranges					
3 – 5 Hz	1.00 + 0.02	1.00 + 0.03	1.00 + 0.03	1.00 + 0.03	0.100 + 0.003
5 – 10 Hz	0.35 + 0.02	0.35 + 0.03	0.35 + 0.03	0.35 + 0.03	0.035 + 0.003
10 Hz – 20 kHz	0.04 + 0.02	0.05 + 0.03	0.06 + 0.03	0.07 + 0.03	0.005 + 0.003
20 – 50 kHz	0.10 + 0.04	0.11 + 0.05	0.12 + 0.05	0.13 + 0.05	0.011 + 0.005
50 – 100 kHz	0.55 + 0.08	0.60 + 0.08	0.60 + 0.08	0.60 + 0.08	0.060 + 0.008
100 – 300 kHz	4.00 + 0.50	4.00 + 0.50	4.00 + 0.50	4.00 + 0.50	0.200 + 0.020

Resistance ⁷	Test current					
100 Ω	1 mA	0.0030 + 0.0030	0.008 + 0.004	0.010 + 0.004	0.012 + 0.004	0.0006 + 0.0005
1 k Ω	1 mA	0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	0.012 + 0.001	0.0006 + 0.0001
10 k Ω	100 μ A	0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	0.012 + 0.001	0.0006 + 0.0001
100 k Ω	10 μ A	0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	0.012 + 0.001	0.0006 + 0.0001
1 M Ω	5 μ A	0.002 + 0.001	0.008 + 0.001	0.010 + 0.001	0.012 + 0.001	0.0010 + 0.0002
10 M Ω	500 nA	0.015 + 0.001	0.020 + 0.001	0.040 + 0.001	0.060 + 0.001	0.0030 + 0.0004
100 M Ω	500 nA 10 M Ω	0.300 + 0.010	0.800 + 0.010	0.800 + 0.010	0.800 + 0.010	0.1500 + 0.0002

DC current	Burden voltage					
100 μ A	<0.011 V	0.010 + 0.020	0.040 + 0.025	0.050 + 0.025	0.060 + 0.025	0.0020 + 0.0030
1 mA	<0.11 V	0.007 + 0.006	0.030 + 0.006	0.050 + 0.006	0.060 + 0.006	0.0020 + 0.0005
10 mA	<0.05 V	0.007 + 0.020	0.030 + 0.020	0.050 + 0.020	0.060 + 0.020	0.0020 + 0.0020
100 mA	<0.5 V	0.010 + 0.004	0.030 + 0.005	0.050 + 0.005	0.060 + 0.005	0.0020 + 0.0005
1 A	<0.7 V	0.050 + 0.006	0.080 + 0.010	0.100 + 0.010	0.120 + 0.010	0.0050 + 0.0010
3 A	<2.0 V	0.180 + 0.020	0.200 + 0.020	0.200 + 0.020	0.230 + 0.020	0.0050 + 0.0020
10 A	<0.5 V	0.050 + 0.010	0.120 + 0.010	0.120 + 0.010	0.150 + 0.010	0.0050 + 0.0010