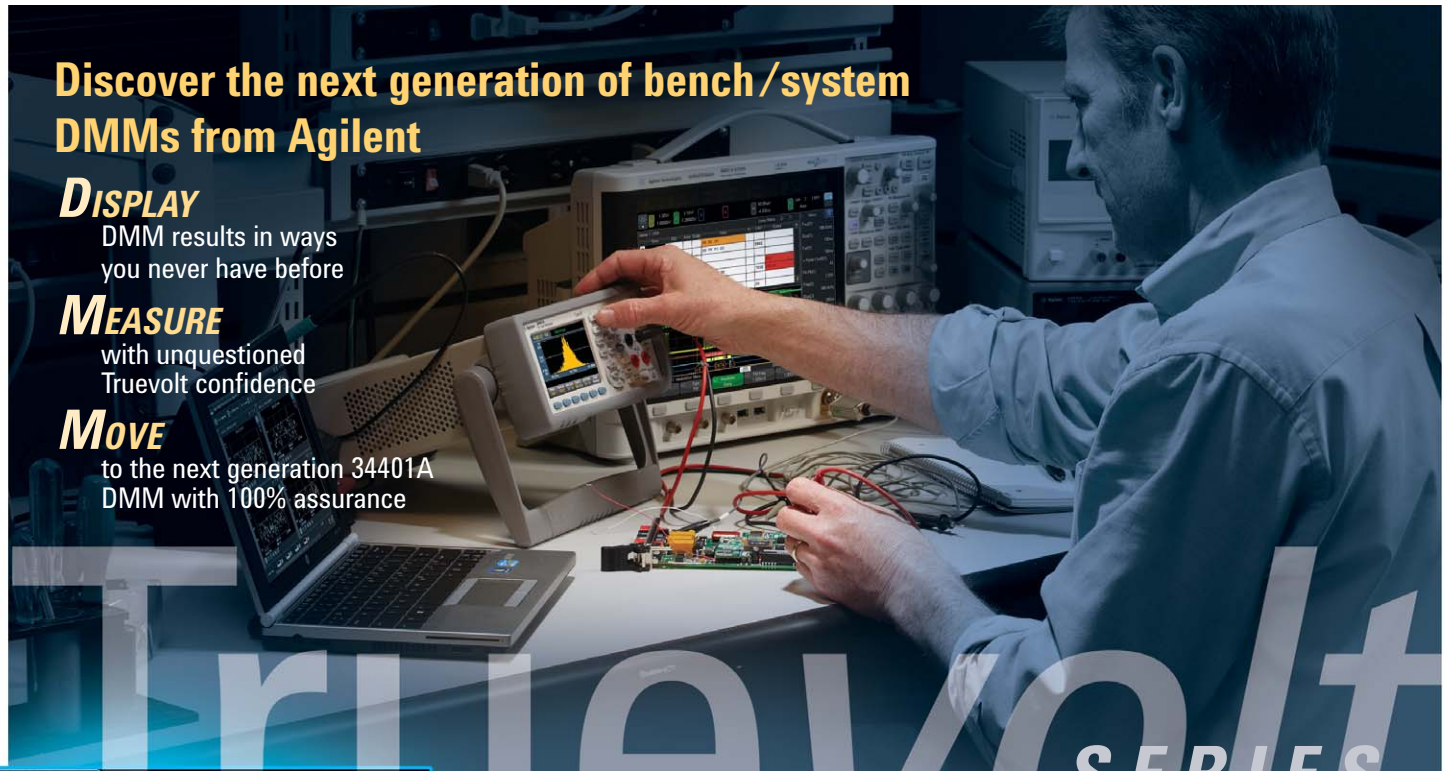
# Discover the next generation of bench/system DMMs from Agilent

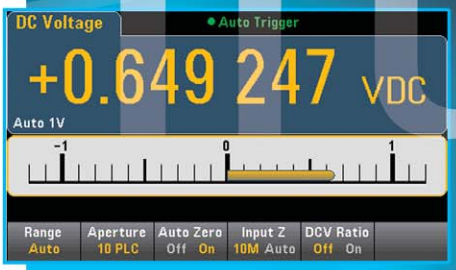
## *Display*
DMM results in ways you never have before

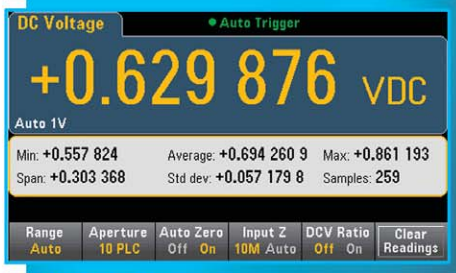
## *Measure*
with unquestioned Truevolt confidence

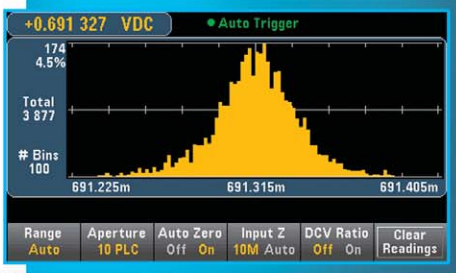
## *Move*
to the next generation 34401A DMM with 100% assurance



Truevolt SERIES





# Digital Multimeters

- **Agilent 34461A**
  **a direct replacement for the 34401A 6½ digit DMM**
- **Agilent 34460A**
  **a basic entry point into the 6½ digit class of Agilent DMMs**

*Anticipate ___Accelerate ___Achieve*

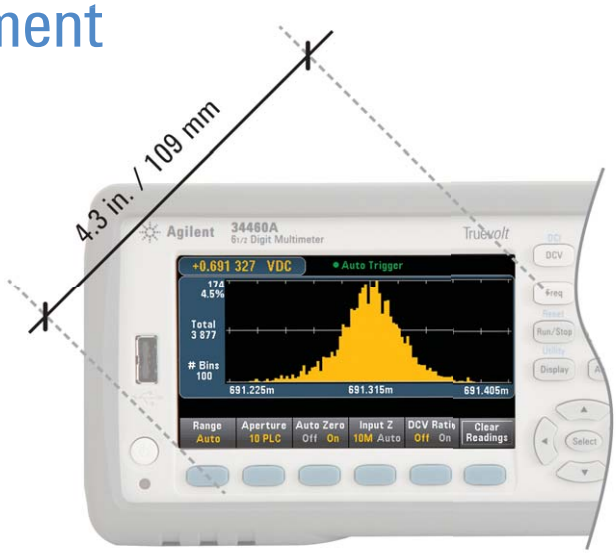
Agilent Technologies

## *Display DMM results in ways you never have before*

# Easily display, save and document your measurement results

### Easily set up and see your results and get actionable information faster

- See your results clearly on a bright, 4.3-inch (109 mm), high-resolution, color graphical display. Get answers faster using the intuitive, menu-driven interface. If you have questions about a key or functionality, press and hold the key to display built-in help on the subject.
- Customize display operation to meet your needs. Configure your preferences and pull them up automatically at the next instrument start-up.
- Add customized labels to describe the instrument's measurement your way.
- Get quick insight with graphical views of your measurement results: View readings, long-term trends (34461A only) and measurement histograms for a statistical view.

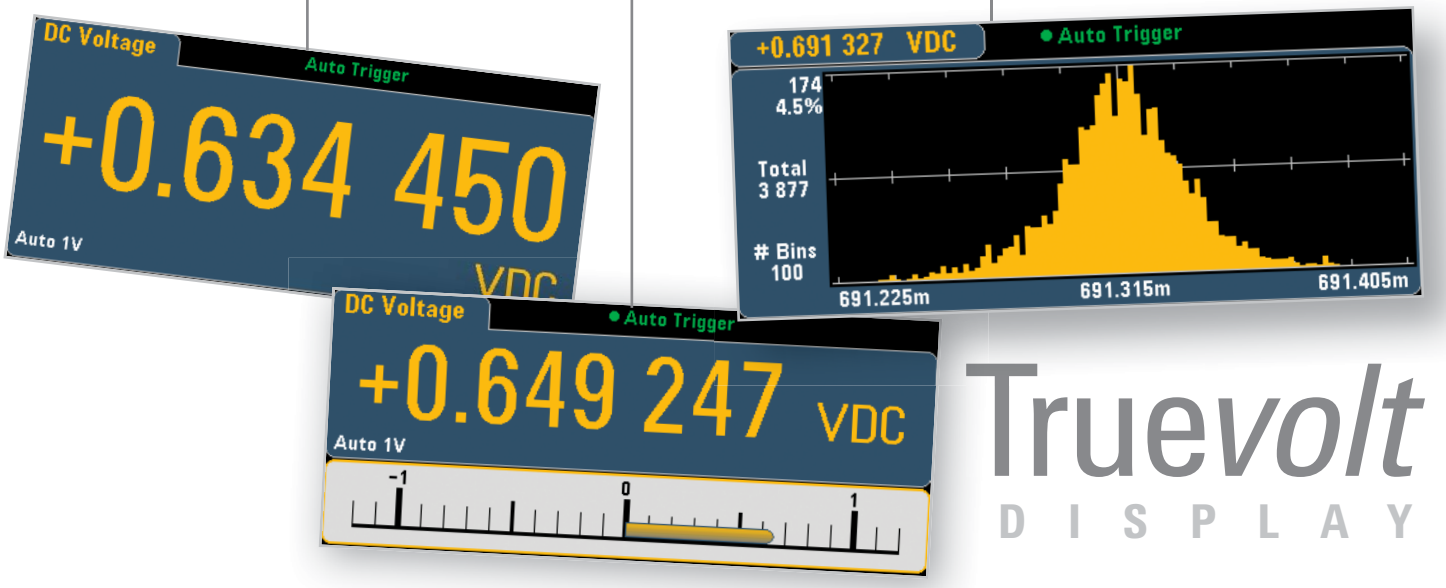



*The bright, 4.3" high-resolution monitor is a prominent feature of Agilent's new Truevolt multimeter family.*

*Bar meter mode provides the number display along with an analog meter to provide a visual view of your measurements.*

*Number mode provides the traditional "digits" view of measurements.*

*Histogram mode gives you a statistical view of your measurements.*

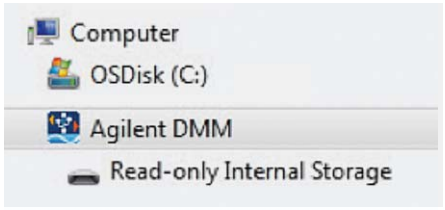



Truevolt DISPLAY

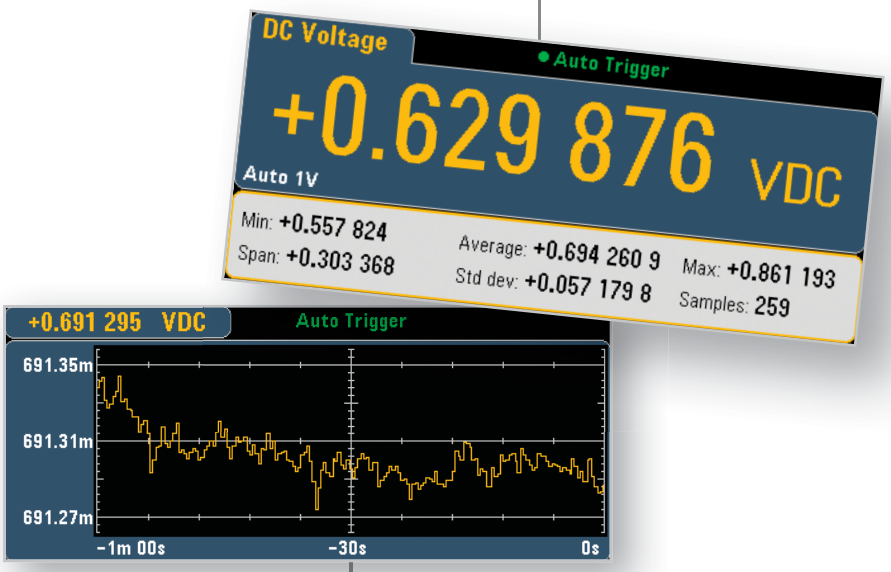
# Display DMM results in ways you never have before

## Save and document your DMM's data to your PC or mobile device using your preferred I/O:

- Control, capture and view your DMM's data on your PC with a single click using the Digital Multimeter Connectivity Utility via USB, GPIB, LAN, or RS-232 (for older generation Agilent DMMs).
- Easily access the files on your DMM using drag-and-drop to transfer files via USB – no software required.
- Choose the I/O that works best for you: USB, LAN/LXI Core (optional on 34460A), GPIB (optional on 34460A & 34461A).
- Easily access the front-panel USB memory connector.




*Test result screens allow you to show measurement statistics on the display.*




*Trend chart mode (34461A only) displays your measurements over time.*

## The free DMM connectivity utility helps you get your job done faster

***Capture and export data to your PC with drag and drop ease***

Capture a digitized record, log measurements for longer periods under PC control or upload data captured directly from the instrument. Export data from a single DMM, or multiple DMMs with time alignment, to popular tools such as Microsoft Excel, Microsoft Word and MATLAB. Simplify test documentation and data analysis without the hassles of programming.

***Visualize multiple DMM outputs at once***

Display single measurements, charts, or histograms from a single instrument or up to four DMMs simultaneously. See what's happening on your bench, all on one display—to spot correlated trends you might otherwise miss.

***Simplify instrument configuration***

Instrument controls provide easy measurement setup and instrument state management. Reduce set-up times and quickly reconfigure for new tests.

***Speed up instrument discovery and connection for a broad range of Agilent DMMs***

With one-click access to Agilent IO Libraries Suite, connect to DMMs via USB, GPIB, LAN or RS-232. Spend your valuable time testing your designs rather than setting up, connecting, and troubleshooting software.

***Access and control tests on your DMM remotely on your mobile device***

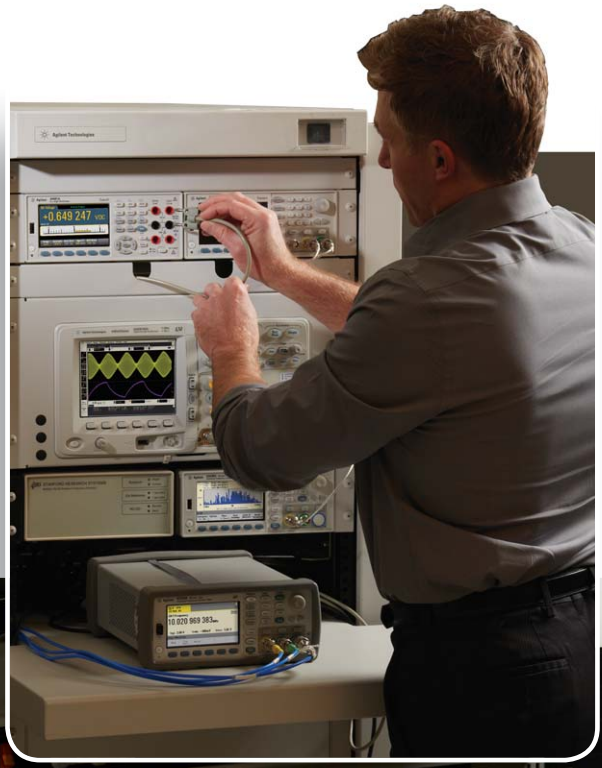
With a companion app available, DMM Mobile Utility, as a free download from the Apple App Store, view and control your LAN-enabled instrument wherever you go and receive email alerts when problems occur. Remotely remedy problems on long running tests to minimize project delays.

***Download the DMM connectivity utility:***

**www.agilent.com/find/DMMutilitysoftware**

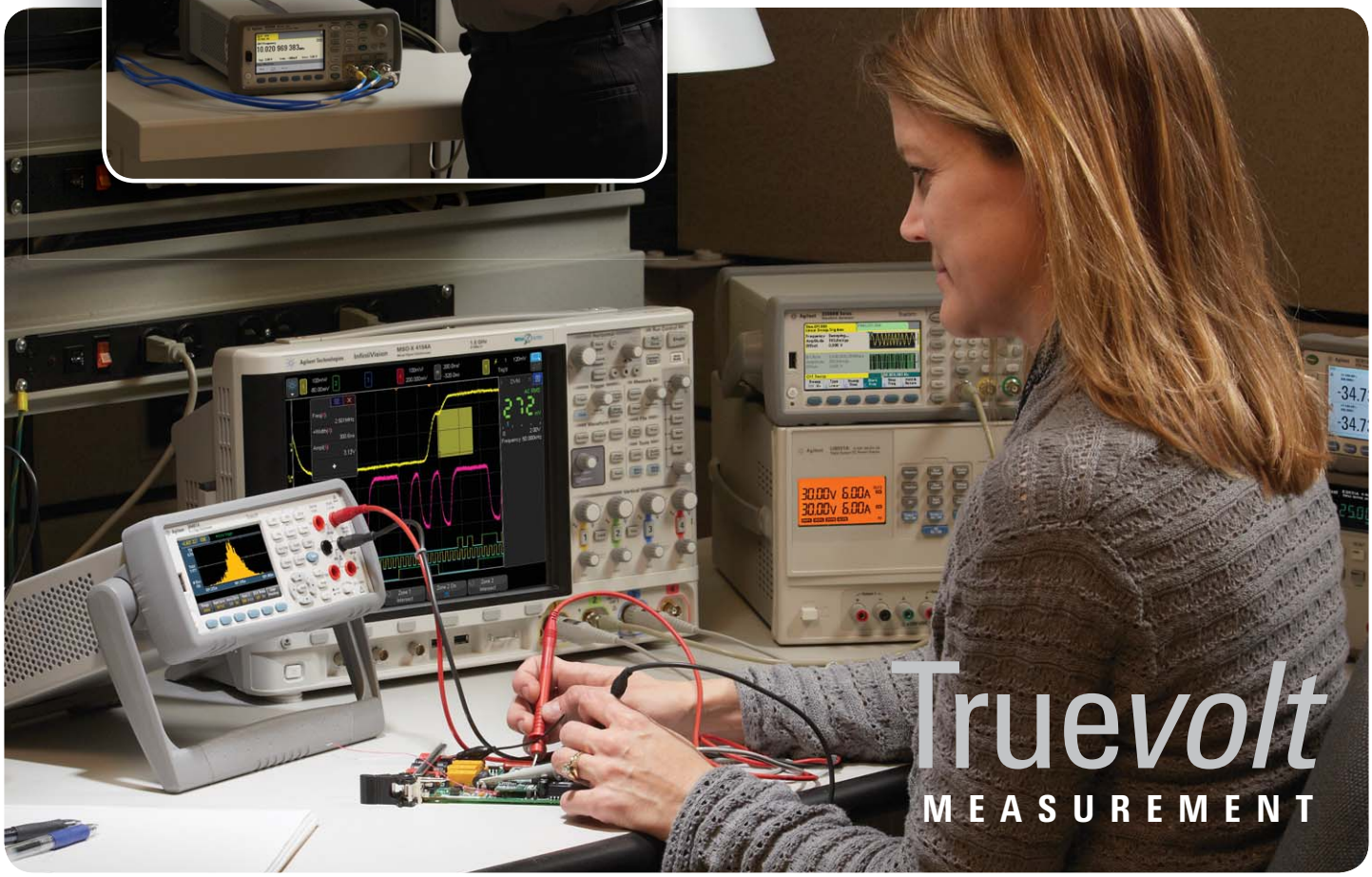
## *Measure with unquestioned Truevolt confidence*

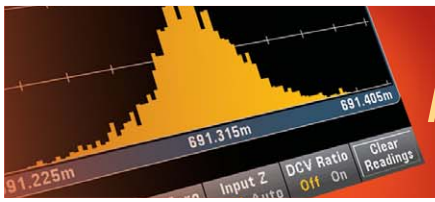

# Worry about the quality of your design, not the quality of your measurements



In a rack or on a bench real-world signals are never flat. They have some level of AC signal riding on top from power line noise, other environmental noise, or injected current from the meter itself. How well your meter deals with these extraneous factors and eliminates them from the true measurement makes a big difference to your accuracy. Behind the scenes, Agilent's Truevolt technology accounts for measurement errors created by these real-world factors so you can be confident in your measurements and it is only available on Agilent DMMs.

Truevolt technology starts with an analog-to-digital converter that enables a patented metrology-grade architecture. Using this architecture, Agilent delivers a good balance of measurement resolution, linearity, accuracy, and speed at a value price, all derived and guaranteed per ISO/IEC 17025 industry standards.



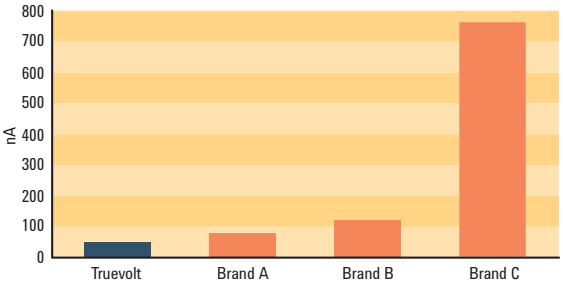



# Measure with unquestioned Truevolt confidence

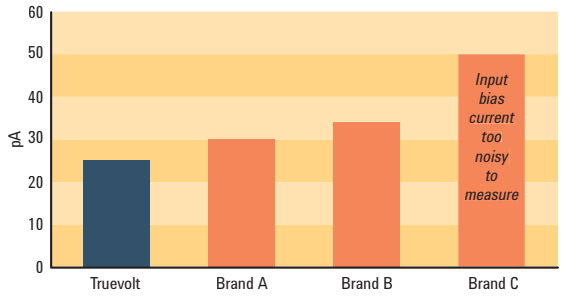
## What Truevolt technology means to you:

### You can measure your real-world signals, not instrument error

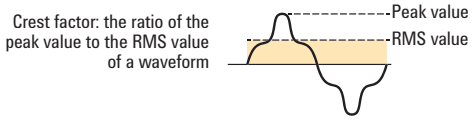
**Noise and injected current:** Agilent Truevolt DMMs contribute less than 30% of the injected current than alternatives. Compared to some lower cost alternatives, Truevolt DMMs offer almost 100% less noise.

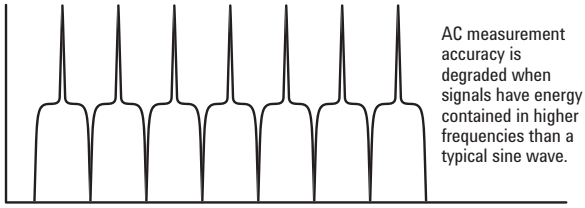



**Input bias current:** Ideally, no current flows into the measurement terminals of your DMM. In real measurement situations, there are always input currents creating additional measurement errors. Truevolt DMMs take care of input bias current. Some alternative DMMs offer 20% to infinitely poorer performance (some are too noisy to measure).




**Digital AC rms measurements:** For meters in this class, only Agilent uses digital direct sampling techniques to make AC rms measurements. This results in a true rms calculation technique that avoids the slower response of analog RMS converters used in all other vendor's 6½ digit DMMs. This allows for crest factors up to 10 without additional error terms. This is a unique, patented technique – only used by Agilent.



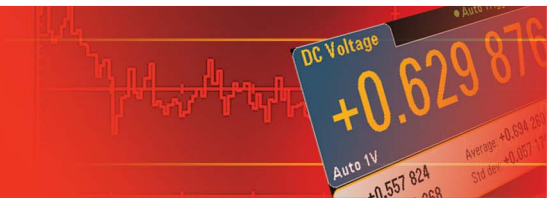

### You can measure your real-world signals with confidence

All Truevolt DMM specifications are tested and guaranteed for compliance with ISO/IEC 17025 standards so you can prove the effectiveness of your lab or production line's quality management system. Many lower-cost DMMs in this class do not carry a guarantee of their measurement specifications.

### You can take advantage of expanded measurement functionality

***Compared to the 34401A DMM, Truevolt DMMs offer expanded current ranges from 100 µA to 10 A. We have also added a temperature measurement function (RTD/PT100, 5 kΩ thermistor). Additionally, diode measurement capability has been expanded to allow a larger full-scale voltage to be measured (5 V) to enable the measurement of more diode types such as LEDs.***

## *Move to the next-generation 34401A DMM with 100% assurance*




# Migrate with confidence: Everything you depend on with the 34401A and more

Like most 34401A DMM owners, you rely on your DMM and you trust the answers it gives you. Now, with the Agilent Truevolt 34461A DMM, you can get all of the advantages of the 34401A and more. Now you can get faster answers and have even more confidence in your results.

The best news of all? You can migrate from the 34401A to the 34461A without a hassle. No need to rewrite your software programs or spend hours learning a brand-new, complicated interface.

**Use your existing programs:** The 34461A DMM is the industry's only 100% drop-in, SCPI-compatible replacement for the 34401A DMM. Other DMMs may claim 34401A SCPI compatibility, but only a subset of SCPI commands are implemented.

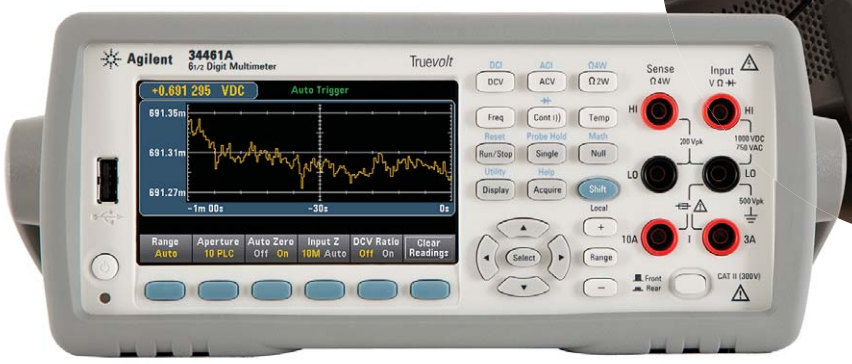
**No long learning curve:** The Truevolt DMMs were designed by the same team that created the 34401A. The team kept 34401A measurements, reliability and familiarity in mind as they created the Truevolt family of DMMs. So you can use it without spending hours learning how.

The 34461A represents everything you have known and trusted with your Agilent DMM measurements for decades – it just keeps getting stronger.

| MIGRATION Q&A | QUESTION | ANSWER |
|---|---|---|
| **Program compatibility** | Will my existing programs still work if I switch to the 34461A? | **YES** |
| **Measurements** | Will I have the same performance so it doesn't affect the results on my line? | **YES** |
| **Cost** | Will it cost the same to buy, use, maintain, and repair? | **YES** *(and potentially less since the DMMs now include a 3-year standard warranty)* |
| **Reliability** | My 34401A never breaks. Are the Truevolt DMMs going to be as good? | **YES** *That's why we can offer a 3-year standard warranty* |
| **Use** | Will we be able to use it easily? Quickly? | **YES** |



*34461A: The industry's only 100% drop-in, SCPI-compatible replacement for the 34401A DMM*




# Move to the next-generation 34401A DMM with 100% assurance

| WHICH MODEL IS RIGHT FOR YOU? | 34460A | 34461A | 34401A |
|---|---|---|---|
| **Resolution** | 6½ digits | 6½ digits | 6½ digits |
| **Input terminals** | Front | Front and rear | Front and rear |
| **1-year DCV accuracy ±(% of reading + % of range)** | 0.0075 + 0.0005 | 0.0035 + 0.0005 | 0.0035 + 0.0005 |
| **Measurement speed – 4½ digits** | 300 readings/s | 1000 readings/s | 1000 readings/s |
| **Measurements** | | | |
| **DCV, ACV, resistance, frequency, period, continuity** | Same as 34401A baseline | Same as 34401A baseline | 34401A baseline |
| **Diode** | 5 V | 5 V | 1 V |
| **Current** | 100 µA – 3 A | 100 µA – 10 A | 10 mA – 3 A |
| **Temperature** | RTD/PT100, thermistor | RTD/PT100, thermistor | N/A |
| **Internal memory** | 1,000 readings | 10,000 readings | 512 readings |
| **Graphical display** | Number, histogram, bar meter | Number, histogram, bar meter, trend | Number |
| **I/O connectivity** | USB (LAN, GPIB optional) | USB, LAN (GPIB optional) | GPIB, RS-232 |

| OPTIONS | 34460A | 34461A | 34401A |
|---|---|---|---|
| **3446ACCU: Accessory kit for 34460A** *Documentation CDs, test leads, USB cable* | OPTIONAL | INCLUDED STANDARD | INCLUDED STANDARD |
| **3446GPBU** *GPIB user installable interface module* | OPTIONAL | OPTIONAL | INCLUDED STANDARD |
| **3446LANU** *Enable rear panel LAN/LXI web interface, external triggering for 34460A* | OPTIONAL | INCLUDED STANDARD | N/A |
| **3446SECU** *Enable NISPOM and file security* | OPTIONAL | OPTIONAL | N/A |

# SPECIFICATIONS
# 34460A

34460A accuracy specifications: ± (% of reading + % of range) [1]

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


| Range [2] / frequency | 24 hour [3] $T_{CAL}$ ± 1 °C | 90 day $T_{CAL}$ ± 5 °C | 1 year $T_{CAL}$ ± 5 °C | 2 year $T_{CAL}$ ± 5 °C | Temperature coefficient/°C [4] |
|---|---|---|---|---|---|
| **DC voltage** | | | | | |
| 100 mV | 0.0040 + 0.0060 | 0.0070 + 0.0065 | 0.0090 + 0.0065 | 0.0115 + 0.0065 | 0.0005 + 0.0005 |
| 1 V | 0.0030 + 0.0009 | 0.0060 + 0.0010 | 0.0080 + 0.0010 | 0.0105 + 0.0010 | 0.0005 + 0.0001 |
| 10 V | 0.0025 + 0.0004 | 0.0050 + 0.0005 | 0.0075 + 0.0005 | 0.0100 + 0.0005 | 0.0005 + 0.0001 |
| 100 V | 0.0030 + 0.0006 | 0.0065 + 0.0006 | 0.0085 + 0.0006 | 0.0110 + 0.0006 | 0.0005 + 0.0001 |
| 1000 V | 0.0030 + 0.0006 | 0.0065 + 0.0010 | 0.0085 + 0.0010 | 0.0110 + 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 | 0.38 + 0.02 | 0.38 + 0.03 | 0.38 + 0.03 | 0.38 + 0.03 | 0.035 + 0.003 |
| 10 Hz – 20 kHz | 0.07 + 0.02 | 0.08 + 0.03 | 0.09 + 0.03 | 0.10 + 0.03 | 0.005 + 0.003 |
| 20 – 50 kHz | 0.13 + 0.04 | 0.14 + 0.05 | 0.15 + 0.05 | 0.16 + 0.05 | 0.011 + 0.005 |
| 50 – 100 kHz | 0.58 + 0.08 | 0.63 + 0.08 | 0.63 + 0.08 | 0.63 + 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 | 0.0040 + 0.0060 | 0.011 + 0.007 | 0.014 + 0.007 | 0.017 + 0.007 | 0.0006 + 0.0005 |
| 1 kΩ | 1 mA | 0.0030 + 0.0008 | 0.011 + 0.001 | 0.014 + 0.001 | 0.017 + 0.001 | 0.0006 + 0.0001 |
| 10 kΩ | 100 µA | 0.0030 + 0.0005 | 0.011 + 0.001 | 0.014 + 0.001 | 0.017 + 0.001 | 0.0006 + 0.0001 |
| 100 kΩ | 10 µA | 0.0030 + 0.0005 | 0.011 + 0.001 | 0.014 + 0.001 | 0.017 + 0.001 | 0.0006 + 0.0001 |
| 1 MΩ | 5 µA | 0.0030 + 0.0010 | 0.011 + 0.001 | 0.014 + 0.001 | 0.017 + 0.001 | 0.0010 + 0.0002 |
| 10 MΩ | 500 nA | 0.015 + 0.001 | 0.020 + 0.001 | 0.040 + 0.001 | 0.060 + 0.001 | 0.0030 + 0.0004 |
| 100 MΩ | 500 nA \|\| 10 MΩ | 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 µA | <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 |

| Range [2] / frequency | | 24 hour [3] $T_{CAL}$ ± 1 °C | 90 day $T_{CAL}$ ± 5 °C | 1 year $T_{CAL}$ ± 5 °C | 2 year $T_{CAL}$ ± 5 °C | Temperature coefficient/°C [4] |
|---|---|---|---|---|---|---|
| **True RMS AC current** [2, 6, 8] | **Burden voltage** | | | | | |
| 100 µA, 1 mA, 10 mA, and 100 mA ranges | <0.011, <0.11, < 0.05, <0.5 V | | | | | |
| 3 Hz – 5 kHz | | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.015 + 0.006 |
| 5 – 10 kHz [9] | | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.030 + 0.006 |
| 1 A range | <0.7 V | | | | | |
| 3 Hz – 5 kHz | | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.015 + 0.006 |
| 5 – 10 kHz [9] | | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.030 + 0.006 |
| 3 A range | <2.0 V | | | | | |
| 3 Hz – 5 kHz | | 0.23 + 0.04 | 0.23 + 0.04 | 0.23 + 0.04 | 0.23 + 0.04 | 0.015 + 0.006 |
| 5 – 10 kHz [9] | | 0.23 + 0.04 | 0.23 + 0.04 | 0.23 + 0.04 | 0.23 + 0.04 | 0.030 + 0.006 |

| **Continuity** | | | | | |
|---|---|---|---|---|---|
| 1 kΩ | 0.002 + 0.030 | 0.008 + 0.030 | 0.010 + 0.030 | 0.012 + 0.030 | 0.0010 + 0.0020 |

| **Diode test** [10] | | | | | |
|---|---|---|---|---|---|
| 5 V | 0.002 + 0.030 | 0.008 + 0.030 | 0.010 + 0.030 | 0.012 + 0.030 | 0.0010 + 0.0020 |

| **DC ratio** [11] | |
|---|---|
| | (normalized input accuracy) + (normalized reference accuracy) |

| **Temperature** [12] | |
|---|---|
| PT100 (DIN/ IEC 751) | Probe accuracy + 0.05 °C |
| 5 kΩ thermistor | Probe accuracy + 0.1 °C |

| **Frequency: specification ± (% of reading)** [13, 14] 100 mV, 1 V, 10 V, 100 V, and 750 V ranges [15] | | | | | |
|---|---|---|---|---|---|
| 3 – 10 Hz | 0.100 | 0.100 | 0.100 | 0.100 | 0.0002 |
| 10 – 100 Hz | 0.030 | 0.030 | 0.030 | 0.035 | 0.0002 |
| 100 Hz – 1 kHz | 0.003 | 0.010 | 0.012 | 0.017 | 0.0002 |
| 1 – 300 kHz | 0.002 | 0.008 | 0.012 | 0.017 | 0.0002 |
| Square wave [16] | 0.001 | 0.008 | 0.012 | 0.017 | 0.0002 |

| **Additional gate time errors ± ( % of reading )** [13, 14] | | | |
|---|---|---|---|
| **Frequency** | **1 second** | **0.1 second** | **0.01 second** |
| 3 – 40 Hz | 0 | 0.200 | 0.200 |
| 40 – 100 Hz | 0 | 0.060 | 0.200 |
| 100 Hz – 1 kHz | 0 | 0.020 | 0.200 |
| 1 – 300 kHz | 0 | 0.004 | 0.030 |
| Square wave [16] | 0 | 0 | 0 |

1. For DC: Specifications are for 60-minute warm-up, aperture of 10 or 100 NPLC, and auto zero on.
   For AC: Specifications are for 60-minute warm-up, slow AC filter, sine wave.
2. 20% overrange on all ranges, except 1000 DCV, 750 ACV, 3 A AC, and diode test.
3. Relative to calibration standards.
4. Add this for each °C outside $T_{CAL}$ ± 5 °C.
5. Specifications are for sine wave input > 0.3% of range and > 1 mVrms.
   750 ACV range limited to 8 x $10^7$ Volt–Hz.
6. Low-frequency performance: three filter settings are available: 3 Hz, 20 Hz, 200 Hz. Frequencies greater than these filter settings are specified with no additional errors.
7. Specifications are for 4–wire ohms function or 2–wire ohms using math null for offset. Without math null, add 0.2 Ω additional error in 2-wire ohms function.
8. Specifications are for sinewave input >1% of range and > 10 µA AC.
9. AC current specifications > 5 kHz are typical.
10. Specifications are for the voltage measured at the input terminals. The 1 mA test current is typical. Variation in the current source will create some variation in the voltage drop across a diode junction.
11. These specifications are for typical performance.
12. Actual measurement range and probe errors will be limited by the selected probe. Probe accuracy adder includes all measurement and ITS-90 temperature conversion errors PT100 $R_0$ settable to 100 Ω ± 5 Ω to remove the initial probe error.
13. Specifications are for 60-minute warm-up and sine wave input unless stated otherwise. Specifications are for 1-second gate time (7 digits).
14. Applies to sine and square inputs ≥ 100 mV.
    For 10 mV to < 100 mV inputs, multiply % of reading error x10.
15. Amplitude 10% –120% of range and less than 750 ACV.
16. Square wave input specified for 10 Hz – 300 kHz.

# SPECIFICATIONS
# 34461A

34461A accuracy specifications: ± (% of reading + % of range) [1]

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


| Range [2] / frequency | 24 hour [3] $T_{CAL}$ ± 1 °C | 90 day $T_{CAL}$ ± 5 °C | 1 year $T_{CAL}$ ± 5 °C | 2 year $T_{CAL}$ ± 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 kΩ | 1 mA | 0.0020 + 0.0005 | 0.008 + 0.001 | 0.010 + 0.001 | 0.012 + 0.001 | 0.0006 + 0.0001 |
| 10 kΩ | 100 µA | 0.0020 + 0.0005 | 0.008 + 0.001 | 0.010 + 0.001 | 0.012 + 0.001 | 0.0006 + 0.0001 |
| 100 kΩ | 10 µA | 0.0020 + 0.0005 | 0.008 + 0.001 | 0.010 + 0.001 | 0.012 + 0.001 | 0.0006 + 0.0001 |
| 1 MΩ | 5 µA | 0.002 + 0.001 | 0.008 + 0.001 | 0.010 + 0.001 | 0.012 + 0.001 | 0.0010 + 0.0002 |
| 10 MΩ | 500 nA | 0.015 + 0.001 | 0.020 + 0.001 | 0.040 + 0.001 | 0.060 + 0.001 | 0.0030 + 0.0004 |
| 100 MΩ | 500 nA \|\| 10 MΩ | 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 µA | <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 |

| Range [2]/frequency | | 24 hour [3] $T_{CAL}$ ± 1 °C | 90 day $T_{CAL}$ ± 5 °C | 1 year $T_{CAL}$ ± 5 °C | 2 year $T_{CAL}$ ± 5 °C | Temperature coefficient/°C [4] |
|---|---|---|---|---|---|---|
| **True RMS AC current** [2, 6, 8] | **Burden voltage** | | | | | |
| 100 µA, 1 mA, 10 mA, and 100 mA ranges | <0.011, <0.11, <0.05, <0.5 V | | | | | |
| 3 Hz – 5 kHz | | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.015 + 0.006 |
| 5 – 10 kHz [9] | | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.030 + 0.006 |
| 1 A range | <0.7 V | | | | | |
| 3 Hz – 5 kHz | | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.015 + 0.006 |
| 5 – 10 kHz [9] | | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.10 + 0.04 | 0.030 + 0.006 |
| 3 A range | <2.0 V | | | | | |
| 3 Hz – 5 kHz | | 0.23 + 0.04 | 0.23 + 0.04 | 0.23 + 0.04 | 0.23 + 0.04 | 0.015 + 0.006 |
| 5 – 10 kHz [9] | | 0.23 + 0.04 | 0.23 + 0.04 | 0.23 + 0.04 | 0.23 + 0.04 | 0.030 + 0.006 |
| 10 A range | <0.5 V | | | | | |
| 3 Hz – 5 kHz | | 0.15 + 0.04 | 0.15 + 0.04 | 0.15 + 0.04 | 0.15 + 0.04 | 0.015 + 0.006 |
| 5 – 10 kHz [9] | | 0.15 + 0.04 | 0.15 + 0.04 | 0.15 + 0.04 | 0.15 + 0.04 | 0.030 + 0.006 |

| **Continuity** | | | | | |
|---|---|---|---|---|---|
| 1 kΩ | 0.002 + 0.030 | 0.008 + 0.030 | 0.010 + 0.030 | 0.012 + 0.030 | 0.0010 + 0.0020 |

| **Diode test** [10] | | | | | |
|---|---|---|---|---|---|
| 5 V | 0.002 + 0.030 | 0.008 + 0.030 | 0.010 + 0.030 | 0.012 + 0.030 | 0.0010 + 0.0020 |

| **DC ratio** [11] | |
|---|---|
| | (normalized input accuracy) + (normalized reference accuracy) |

| **Temperature** [12] | |
|---|---|
| PT100 (DIN/ IEC 751) | Probe accuracy + 0.05 °C |
| 5 kΩ thermistor | Probe accuracy + 0.1 °C |

| **Frequency: specification ± (% of reading)** [13, 14]<br>100 mV, 1 V, 10 V, 100 V, and 750 V ranges [15] | | | | | |
|---|---|---|---|---|---|
| 3 – 10 Hz | 0.100 | 0.100 | 0.100 | 0.100 | 0.0002 |
| 10 – 100 Hz | 0.030 | 0.030 | 0.030 | 0.035 | 0.0002 |
| 100 Hz – 1 kHz | 0.003 | 0.008 | 0.010 | 0.015 | 0.0002 |
| 1 – 300 kHz | 0.002 | 0.006 | 0.010 | 0.015 | 0.0002 |
| Square wave [16] | 0.001 | 0.006 | 0.010 | 0.015 | 0.0002 |

| **Additional gate time errors ± ( % of reading )** [13, 14] | | | |
|---|---|---|---|
| **Frequency** | **1 second** | **0.1 second** | **0.01 second** |
| 3 – 40 Hz | 0 | 0.200 | 0.200 |
| 40 – 100 Hz | 0 | 0.060 | 0.200 |
| 100 Hz – 1 kHz | 0 | 0.020 | 0.200 |
| 1 – 300 kHz | 0 | 0.004 | 0.030 |
| Square wave [16] | 0 | 0 | 0 |

1. Specifications are for 60-minute warm-up, integration setting of 10 or 100 NPLC, and auto-zero on. Specifications are for 60-minute warm-up, slow AC filter, sinewave.
2. 20% over range on all ranges, except 1000 DCV, 750 ACV, 10 A DC, 3 A AC, 10 A AC, and diode test.
3. Relative to calibration standards.
4. Add this for each °C outside TCAL ± 5 °C.
5. Specifications are for sinewave input >0.3% of range and > 1 mVrms. 750 ACV range limited to 8 x $10^7$ Volt–Hz.
6. Low-frequency performance: three filter settings are available: 3 Hz, 20 Hz, 200 Hz. Frequencies greater than these filter settings are specified with no additional errors.
7. Specifications are for 4-wire ohms function or 2-wire ohms using math null for offset. Without math null, add 0.2 Ω additional error in 2-wire ohms function.
8. Specifications are for sinewave input > 1% of range and > 10 µA AC. The 10 A range is only available on a separate front-panel connector.
9. AC current specifications > 5 kHz are typical.
10. Specifications are for the voltage measured at the input terminals. The 1 mA test current is typical. Variation in the current source will create some variation in the voltage drop across a diode junction.
11. These specifications are for typical performance.
12. Actual measurement range and probe errors will be limited by the selected probe. Probe accuracy adder includes all measurement and ITS-90 temperature conversion errors. PT100 $R_0$ settable to 100 Ω ±5 Ω to remove the initial probe error.
13. Specifications are for 60-minute warm-up and sine wave input unless stated otherwise. Specifications are for 1-second gate time (7-digits).
14. Applies to sine and square inputs ≥ 100 mV. For 10 mV to < 100 mV inputs, multiply % of reading error x10.
15. Amplitude 10%–120% of range and less than 750 ACV.
16. Square wave input specified for 10 Hz – 300 kHz.

# MEASUREMENT CHARACTERISTICS
# 34460A/34461A

## Measurement characteristics

| DC voltage | |
|---|---|
| Measurement method: | Agilent patented continuously integrating multi-slope IV A/D converter |
| A/D linearity: | 0.0002% of reading + 0.0001% of range |
| Input resistance: | |
| 0.1 V, 1 V, 10 V range | Selectable 10 MΩ or >10 GΩ |
| 100 V, 1000 V range | 10 MΩ ± 1% |
| Input bias current: | <30 pA at 25 °C |
| Input terminals: | Copper alloy |
| Input protection: | 1000 V on all ranges |

| True RMS AC voltage | |
|---|---|
| Measurement type: | AC–coupled True RMS. Measures the AC component of the input. |
| Measurement method: | Digital sampling with anti-alias filter |
| Maximum input: | 400 DCV, 1100 Vpeak |
| Input impedance: | 1 MΩ ±1%, in parallel with <100 pF |
| Input protection: | 750 Vrms all ranges |

| DC and True RMS AC current | |
|---|---|
| AC measurement type: | Directly coupled to the fuse and shunt. AC True RMS measurement (measures the AC component only). |
| AC measurement method: | Digital sampling with anti-alias filter |
| Input protection 3 A: | Externally accessible 3.15 A, 500 V fuse (Replacement part number 2110-1547 3.15 A external fuse) Internal 11-A, 1000-V fuse (Replacement part number 2110-1402 11 A external fuse) |
| Input protection 10 A: (34461A only) | Internal 11-A, 1000-V fuse (Replacement part number 2110-1402 11 A external fuse) |

| AC crest factor and peak input | |
|---|---|
| Crest factor: | 10:1 maximum crest factor, (3:1 at full-scale). Measurement bandwidth limited to 300 kHz for signal plus harmonics. |
| Peak input: | 300% of range or maximum input |
| Overload ranging : | Will select higher range if peak input overload is detected during auto range. Overload is reported in manual ranging. |

| Resistance | |
|---|---|
| Measurement method: | Selectable 4-wire or 2-wire ohms. Current source referenced to LO input. |
| Maximum lead resistance (4-wire ohms): | 10% of range per lead for 100 Ω, 1 kΩ ranges. 1 kΩ per lead on all other ranges. |
| Input protection: | 1000 V on all ranges |

| Continuity/diode test | |
|---|---|
| Response time: | 300 samples/s with audible tone |
| Continuity threshold: | Fixed at 10 Ω |

| DC ratio | |
|---|---|
| Measurement method: | Input HI-LO/reference (sense) HI-LO |
| Input HI-LO: | 100 mV to 1000 V ranges |
| Reference (sense) HI-Input LO: | 100 mV to 10 V ranges (autoranged) |
| Input to reference (sense): | HI and LO reference (sense) terminals reference to LO input <12 V |

| Temperature |
|---|
| PT100 platinum RTD sensor, α= 0.00385Ω/Ω/°C; DIN/IEC 751. Measurement conversions limited to -200 to 600 °C. |
| 5-kΩ thermistor β= 3891; YSI 44007 or equivalent. Measurement conversions limited to -80 to 150 °C. |

| Measurement noise rejection | |
|---|---|
| 60 Hz (50 Hz ) for 1-kΩ LO lead unbalance ( ± 500 V peak maximum) DC CMRR: 140 dB AC CMRR: 70 dB | |
| **Integration time** | **Normal mode rejection**[1] |
| 100 PLC/1.67 s (2 s) | 60 dB [2] |
| 10 PLC/167 ms (200 ms) | 60 dB [2] |
| 1 PLC/16.7 ms (20 ms) | 60 dB [2] |
| 0.2 PLC/3 ms (3 ms) | 0 dB |
| 0.02 PLC/400 µs (400 µs) | 0 dB |

| Frequency and period | |
|---|---|
| Measurement method: | Reciprocal-counting technique. Measurement is AC-coupled using AC measurement functions. |
| Voltage ranges: | 100 mVrms full scale to 750 Vrms. Auto or manual ranging. |
| Gate time: | 10 ms, 100 ms, or 1 s |
| Measurement considerations | All frequency counters are susceptible to error when measuring low-voltage, low-frequency signals. Shielding inputs from external noise pickup is critical for minimizing measurement errors. |

| Autozero OFF operation |
|---|
| Following instrument warm–up at a stable ambient temperature ±1 °C and <10 minutes. |
| Add 0.0002% of range + 5 µV for DCV or + 5 mΩ for resistance. |

**Measurement settling considerations**

**ACV, ACI, Frequency, Period**

Default delays are selected to give first reading right for most measurements. Errors will occur when attempting to measure the frequency or period of an input following a DC offset voltage change. The input blocking RC time constant must be allowed to fully settle (up to 1 second) before the most accurate measurements are possible.

Applying >300 V ACrms or >1 Arms will cause self-heating in signal-conditioning components. These errors are included in the instrument specifications. Internal temperature changes due to self-heating may cause additional error on other functions or ranges. The additional error will generally dissipate within a few minutes.

**DCV, DCI, Resistance**

Applying >1 A DC will cause self-heating in signal-conditioning components. These errors are included in the instrument specifications. Internal temperature changes due to self-heating may cause additional error on other functions or ranges. The additional error will generally dissipate within a few minutes.

Reading settling times are affected by source impedance, cable dielectric characteristics, and input signal changes. Agilent recommends the use of PTFE or other high-impedance, low-dielectric absorption wire insulation for these measurements.

1. For power-line frequency ± 0.1%
2. For power-line frequency ± 1%, the NMR is 40 dB
   For ± 3%, use 30 dB

# OPERATING CHARACTERISTICS
# 34460A/34461A

## Performance versus measurement speed

**For DC voltage, DC current, and resistance** [1]

| | 34460A | | 34461A | | |
|---|---|---|---|---|---|
| **Integration time** | **Digits** | **Readings/s** | **Digits** | **Readings/s** | **Additional noise error** |
| 100 PLC/1.67 s (2 s) | 6½ | 0.6 (0.5) | 6½ | 0.6 (0.5) | 0% of range |
| 10 PLC/167 ms (200 ms) | 6½ | 6 (5) | 6½ | 6 (5) | 0% of range |
| 1 PLC/16.7 ms (20 ms) | 5½ | 60 (50) | 5½ | 60 (50) | 0.001% of range |
| 0.2 PLC/3 ms (3 ms) | 5½ | 100 | 5½ | 300 | 0.001% of range [2] |
| 0.02 PLC/400 µs (400 µs) | 3½ | 300 | 4½ | 1000 | 0.01% of range [2] |

| **AC voltage, AC current** [3, 4] | **Digits** | **ACV** | **ACI** | **AC filter** |
|---|---|---|---|---|
| | 6½ | .4/s | .6/s | Slow |
| | 6½ | 1.6/s | 4/s | Medium |
| | 6½ | 40/s | 40/s | Fast |
| | 6½ | 50/s [5] | 50/s [5] | Fast |

| **Frequency, period** | **Aperture** | **Digits** | **Readings** |
|---|---|---|---|
| | 1 Second | 7 | 1 |
| | 0.1 Second | 6 | 10 |
| | 0.01 Second | 5 | 80 |

1. Reading speeds for 60 Hz and 50 Hz operation, autozero off, fixed range.
2. Add 20 µV for DCV and 20 mΩ for resistance.
   Add 0.2 µA for DC current + 10x the above range error for the 10 mA range.
3. Maximum reading rates for 0.01% of AC step additional error.
   Additional settling delay required when input DC level varies.
4. For external trigger or remote operation using default settling delay (Delay Auto).
5. Maximum useful limit with default settling delays defeated.


*34460A DMM rear panel with GPIB option installed.*


*34461A DMM rear panel with GPIB option installed.*

## System Speeds (average)

| **DC voltage, DC current, resistance** [1, 2] | **34460A** | **34461A** |
|---|---|---|
| Autorange time [3] | <30 ms | <30 ms |
| Maximum internal trigger rate | 300/s | 1000/s |
| Maximum external trigger rate | 300/s | 1000/s |
| ASCII readings to bus | 300/s | 1000/s |
| Single reading transaction rate [4] | 50/s | 150/s |
| **AC voltage, AC current** [5] | | |
| Autorange time [3] | 10/s | 10/s |
| Maximum internal trigger rate | 50/s | 50/s |
| Maximum external trigger rate | 50/s | 50/s |
| ASCII readings to bus | 50/s | 50/s |
| Single reading transaction rate [4] | 50/s | 50/s [5] |
| **Frequency, period** [6] | | |
| Autorange time [3] | 10/s | 10/s |
| Maximum internal trigger rate | 80/s | 80/s |
| Maximum external trigger rate | 80/s | 80/s |
| ASCII readings to bus | 80/s | 80/s |
| Single reading transaction rate [4] | 50/s | 50/s |

1. 0.02 NPLC, delay 0, autozero off, math off, and display off.
2. These rates apply to all I/O interfaces.
3. Time to automatically change one range and be ready for new measurement, ≤10 V, ≤10 MΩ.
4. Includes measurement and IO time (assumes connection via SOCKETS. VXI-11 connections may be slower).
5. Fast AC filter, delay 0, math off, and display off.
6. 10-ms aperture, fast AC filter, delay 0, math off, and display off.

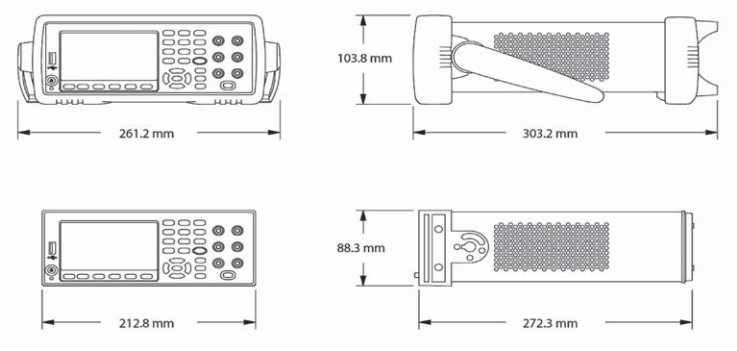
# GENERAL CHARACTERISTICS
# 34460A/34461A

## General characteristics

| Line power | |
|---|---|
| Power supply: | 100/120 (127)/ 220 (230)/240 VAC ± 10%, CAT II |
| Power line frequency: | 50/60/400 Hz ± 10% |
| Power consumption: | 25 VA |

| Environment | |
|---|---|
| Operating environment: | Full accuracy for 0 to 55 °C<br>Full accuracy to 80% R.H. at 40 °C non–condensing |
| Operating altitude: | Up to 3000 m |
| Storage temperature: | -40 to 70 °C |

| Mechanical | |
|---|---|
| Rack dimensions: | (W x H x D): 212.8 mm x 88.3 mm x 272.3 mm |
| Bench dimensions: | (W x H x D): 261.2 mm x 103.8 mm x 303.2 mm |
| Weight: | 34460A: 3.68 kg (8.1 lb)<br>34461A: 3.76 kg (8.3 lb) |




| Regulatory | |
|---|---|
| Safety | EN 61010-1:2010 (3rd Edition) |
| | ANSI/ISA-61010-1 (82.02.01) Third Edition |
| | ANSI/UL 61010-1 Third Edition |
| | CAN/CSA-C22.2 No. 61010-1 Third Edition |
| | EN 61010-2-030:2010 (1st Edition) |
| | ANSI/ISA-61010-2-030 (82.02.03) First Edition |
| | ANSI/UL 61010-2-030 First Edition |
| | CAN/CSA-C22.2 No. 61010-2-030 First Edition |
| | Refer to Declaration of Conformity for current revisions |
| | Measurement Category II to 300 V |
| | Other non MAINS circuits to 1000 Vpk |
| | Pollution Degree 2 |
| EMC | IEC 61326 |
| | EN 61326 |
| | CISPR |
| | ICES-001 |
| | AS/NZS 2064.1 |
| | Refer to Declaration of Conformity for current revisions |
| | Acoustic noise (nominal) 45 dBA |

| Triggering conditions | |
|---|---|
| External input | Low–power TTL compatible input programmable edge triggered |
| Delay: | <1 µs |
| Jitter: | <1 µs |
| Minimum pulse width: | 1 µs |
| Maximum rate: | Up to 1 kHz (34461A), up to 300 Hz (34460A) |
| Voltmeter complete output | 3.3 V logic output |
| Polarity: | Programmable edge pulse |
| Pulse width: | Approximately 2 µs |

| Computer interfaces | |
|---|---|
| LXI (rev 1.4) | 10/100Base-T Ethernet (Sockets, VXI-11 protocol, Web user interface) (Optional on 34460A) |
| USB | USB 2.0 (USB-TMC488 & MTP protocol) |
| GPIB | Optional GPIB IEEE-488 |
| Language | SCPI-1999, IEEE-488.2, 34401A compatible |

| Front-panel USB host port |
|---|
| Supports USB 2.0 high-speed mass storage (MSC) class devices |
| Capability: import/export instrument configuration files, save volatile readings and screen captures |

| System speeds (averages) | | | | |
|---|---|---|---|---|
| **Benchmark** | **GPIB** | **USB 2.0** | **VXI-11** | **Sockets** |
| Function change [1] | 50/s | 50/s | 50/s | 50/s |
| Range change [2] | 100/s | 100/s | 100/s | 100/s |

1. Rate to change from 2-wire resistance to any other function
2. Rate to change from one range to the next higher range, ≤ 10 V, ≤ 10 MΩ

| Triggering and memory | |
|---|---|
| Samples per trigger | 1 to 1,000,000 |
| Trigger delay | 0 to 3600 sec (~1 µs step size) |
| External trigger delay | <10 µs |
| External trigger jitter | <1 µs (DC fixed range) |
| Volatile reading memory | 10,000 (34461A), 1,000 (34460A) |

| Probe hold |
|---|
| Sensitivity fixed at 1% of reading<br>Capture and navigate stable list of readings |

| Internal flash file system |
|---|
| 80 MB total capacity<br>Save reading memory to non-volatile memory in CSV format<br>Store and recall user-defined states, power-off state,[1] and preference files<br>Save screen captures in BMP or PNG formats |

1. Power-off state only when power-down is initiated via front-panel power switch.

| Math functions |
|---|
| Per function null, min/max/avg/Sdev, dB, dBm, span, count, limit test, histogram |

| Display |
|---|
| 4.3" color TFT WQVGA (480x272) with LED backlight<br>Supports: basic number, bar chart, trend chart (34461A only), histogram views<br>User-defined power-on message, display label, and selectable screen colors<br>Integrated, context-sensitive system help through press-and-hold buttons |

| Real-time clock/calendar |
|---|
| Set and read, year, month, day, hour, minute, seconds (Note: seconds not settable)<br>Battery CR-2032 coin-type, replaceable, >10-year life (typ) |

| Software available |
|---|
| IO Libraries: **www.agilent.com/find/IOLibraries**<br>DMM Connectivity Utility software: **www.agilent.com/find/DMMutilitysoftware** |

# OPTIONS & ACCESSORIES
# 34460A/34461A

## Options

| 34460A Digital multimeter, 6½ digit, basic Truevolt DMM | |
|---|---|
| **LAN** | Rear panel LAN/LXI Web interface, external triggering for 34460A |
| **SEC** | Enable NISPOM and file security for Truevolt Series DMMs |
| **Z54** | Certificate of calibration – ANSI/NCSL Z540.3-2006, printed |
| **GPB** | GPIB user-installable interface module for Truevolt Series DMMs |
| **ACC** | Accessory kit for 34460A – documentation CDs, test leads, USB cable |

| 34461A Digital multimeter, 6½ digit, 34401A replacement, Truevolt DMM | |
|---|---|
| **SEC** | Enable NISPOM and file security for Truevolt Series DMMs |
| **Z54** | Certificate of calibration – ANSI/NCSL Z540.3-2006, printed |
| **GPB** | GPIB user-installable interface module for Truevolt Series DMMs |

## Accessories

| Accessories included | |
|---|---|
| **34460A:** | Power cord<br>Calibration certificate |
| **34461A:** | 34138A test lead set with probes, fine tip probes, SMT grabbers and mini grabber attachments<br>Power cord<br>Documentation CD<br>IO Libraries CD<br>USB cable<br>Calibration certificate |

| Accessories available | |
|---|---|
| **11059A** | Kelvin probe set |
| **11060A** | Surface-mount device probe |
| **11062A** | Kelvin clip set |
| **34131A** | Transit case |
| **34133A** | Precision electronic test leads |
| **34134A** | DC-coupled current probe |
| **34136A** | High-voltage probe |
| **34138A** | Test lead set |
| **34162A** | Accessory pouch |
| **34171B** | Input terminal block |
| **34172B** | Calibration short |
| **34308A** | Thermistor kit |
| **34330A** | 30-A current shunt |
| **E2308A** | Thermistor temperature probe |
| **Y1133A** | Low-thermal external digital multimeter scanning kit |

## Standalone product numbers

| Ordered as standalone to be installed by the distributor or customer | |
|---|---|
| **3446LANU** | **Upgrade:**<br>Rear panel LAN/LXI Web interface, external triggering for 34460A |
| **3446SECU** | **Upgrade:**<br>Enable NISPOM and file security for Truevolt Series DMMs |
| **3446GPBU** | **Upgrade:**<br>GPIB user-installable interface module for Truevolt Series DMMs |
| **3446ACCU** | **Accessory kit for 34460A:**<br>Documentation CDs, test leads, USB cable |

## Rack mount kits

| | |
|---|---|
| **34190A** | **Rackmount kit:**<br>Use for mounting one 2U instrument by itself, without another instrument laterally next to it. Includes one rack flange and one combination rack flange-filler panel. |
| **34191A** | **2U dual flange kit:**<br>Use for mounting two 2U instruments side-by-side.<br>Includes two standard rack flanges.<br>*Note: Mounting two instruments side-by-side will require the 34194A dual-lock link kit and a shelf for the instruments to sit on.* |
| **34194A** | **Dual lock link kit:**<br>For side-by-side combinations of instruments and includes links for instruments of different depths. |

## Standard 3-Year Warranty


## Definitions

### Specification (spec)

The warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 0 – 55 °C and after a 60-minute warm up period. All specifications include measurement uncertainty and were created in compliance with ISO-17025 methods. Data published in this document are specifications (spec) only where specifically indicated.

### Typical (typ)

The characteristic performance, which 80% or more of manufactured instruments will meet. This data is not warranted, does not include measurement uncertainty, and is valid only at room temperature (approximately 23 °C).

### Nominal (nom)

The mean or average characteristic performance, or the value of an attribute that is determined by design such as a connector type, physical dimension, or operating speed. This data is not warranted and is measured at room temperature (approximately 23 °C).

### Measured (meas)

An attribute measured during development for purposes of communicating the expected performance. This data is not warranted and is measured at room temperature (approximately 23 °C).

### $T_{CAL}$

The temperature at which the instrument was calibrated.

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