# Keysight Technologies

# Compatibility and Differences: 34465A and 34410A/34411A/L4411A Digital Multimeters

## Technical Overview


KEYSIGHT TECHNOLOGIES

The Keysight 34465A Truevolt digital multimeter (DMM) is the next-generation DMM for users that own the Keysight 34410A, 34411A, or L4411A. The new Truevolt DMM was designed by the same group that designed the previous generation of DMMs, with many of the same R&D engineers participating. With this continuity of experience and expertise, Keysight has made a DMM that is a virtual drop-in replacement for the 34410A or 34411A while continuing to evolve usability and measurement technology.

The 34465A is designed to be a compatible 34410A and 34411A replacement with few exceptions. If you are looking to migrate from the 34410A or 34411A to a 34465A and want to fully understand all differences between the two generations of DMM models, this application note will help you. The L4411A does not have a 1U direct replacement; however, you can achieve the same functionality and measurement capability with the Truevolt Series DMM. Our goal is to help you migrate from your current DMM to a Truevolt DMM effortlessly.

## Compatibility

There are many factors when looking to replace reliable instruments such as the 34410A/34411A. Here are just some of the areas where the 34465A is equivalent with the older generation of DMMs.

- Functions and ranges:
  The 34465A is a superset of 34410/34411A/L4411A capability. Differences are listed below.

- Measurement accuracy and resolution:
  The 34465A's specifications are as accurate or better with few exceptions. See Table 1. All specifications are ISO17025 compliant.

- SCPI compatibility:
  We have taken extra care to ensure the 34465A will work with SCPI programs that were written for the Keysight 34410A/34411A/L4411A. Programming considerations and differences are listed below.

- Mechanical size:
  Height, width, and depth dimensions are the same as the 34410A/34411A. There is no direct replacement for the 1U size of the L4411A.

- Accessories:
  Rack mount kits and probe accessories are compatible with both products.

- Manufacturing:
  Both DMMs are produced to the same rigorous quality standards and manufacturing process controls.

- Service and support from Keysight:
  Our international team is available to help you calibrate your DMM or answer any questions about either instrument.

Table 1. DMM specification comparison.

| Comparison of key specifications | 34465A | 34410A/34411A/L4411A |
|---|---|---|
| Resolution | 6½ | 6½ |
| Input terminals | Front/rear | Front/rear |
| 1-year DCV accuracy (%) | 0.003 + 0.0004 | 0.003 + 0.0005 |
| Max measurement speed | 5000 readings/s - STD<br>50,000 readings/s - DIG option | 10000 readings/s – 34410A<br>50,000 readings/s – 34411A/L4411A |
| Measurements<br>– DCV, ACV, resistance, frequency, period, continuity<br>– Capacitance<br>– Diode<br>– Current<br>– Temperature | Same as 34410A/34411A baseline<br><br>1nF – 100 nF<br>5 V<br>1 µA – 10 A<br>RTD/PT100, thermistor, thermocouple | 34410A/34411A baseline<br><br>1 nF – 10 nF<br>1 V<br>10 mA – 3 A<br>N/A |
| Internal memory | 50,000 readings - STD<br>2 million readings - with MEM option | 50,000 readings - 34410A<br>1 million readings - 34411A/L4411A |
| Display | Color with histogram, bar chart and trend line | Numerical VFD |
| IO connectivity | USB, LAN<br>Optional: GPIB | USB, LAN, GPIB |

## Differences

The few differences between the 34465A and 34410A/34411A/L4411A DMMs that might affect migration are listed below. Many of these differences improve the performance of the 34465A relative to the 34410A/34411A models.

### Physical differences

- GPIB is optional on the 34465A.
- The L4411A is a 1U high instrument. 34465A is a 2U high instrument. Currently Keysight doesn't offer 34465A in a 1U form factor.

## Measurement Tip

### Use SCPI compatibility mode

The 34465A has a *IDN? compatibility mode with the 34410A/34411A. By default, the 34465A *IDN? query returns:

*Keysight Technologies,34465A,* <Serial Number>,ff.ff-pp.pp-mm.mm-gg.gg-bb-pp

For compatibility purposes, use SYSTem:IDENtify AT34410A|AT34411A to return:

"Agilent Technologies,34410A, <Serial Number>,ff.ff-pp.pp-mm.mm-gg.gg-bb-pp"
or
"Agilent Technologies,34411A, <Serial Number>,ff.ff-pp.pp-mm.mm-gg.gg-bb-pp"

You can also configure this from the front panel:
**[Utility] > System Setup > User Settings > SCPI ID**

# Calibration Differences

## The 34465A and 34410A/34411A/L4411A use different calibration procedures, with different default passwords

Key measurement differences:

- Base specifications for the 34465A for the DC voltage and resistance functions are specified for $T_{cal}$ l ± 2 °C, whereas the specifications on the 34410A and 34411A are specified for $T_{cal}$ ± 5 °C. If an autocalibration is performed regularly (every 24 hours or when the temperature drifts more than 2 °C) the base specifications added with the ACAL temperature coefficient will be less than the 34410A/34411A/L4411A base specifications for the same range of temperatures. See application note 5992-0420EN for more information about ACAL and the application of specifications.

- Some specifications vary between the 34465A and the 34410A/34411A/L4411A. In general, the 34465A specifications equal or exceed those of the 34410A/34411A/L4411A. Two exceptions:

    1. The 34410A/34411A/L4411A's 3A range accuracy is slightly better than the 34465A's. For best current measurement results above 1 A, use the 34465A's 10 A input terminal.
    2. The 34410A/34411A/L4411A is slightly better when in certain areas when measuring Frequency at 0.01 and 0.001 second apertures after adding the additional measurement errors. For best accuracy use the 0.1 second or 1 second apertures on the 34465A.

- In standard configurations, the 34465A can sample at 5000 rdgs/sec. The 34410A samples at 10,000 rdgs/sec. With the DIG option, the 34465A samples at 50,000 rdgs/sec which matches the maximum reading rate of the 34411A/L4411A.

- The 34465A has additional current ranges: 1 µA, 10 µA, and 10 A. Therefore, the RANGe MIN parameter produces different results. In addition, autorange on the 34465A may use different ranges than on the 34410A/34411A, and autoranging may take longer.

- The 34465A has additional 100 µFarad range for capacitance. Therefore, RANGe MAX parameter produces different results.

- 34410A/34411A/L4411A allowed peak detection for AC/DC current & voltage. The 34465A does not support for peak detection for AC current/voltage (DC only).

- 34410A/34411A/L4411A's per-function NULL did not support auto-selection of the NULL value; 34465A does.

- 34411A/L4411A could run 50k rdg/sec with autorange ON if no range changes were required. 34465A cannot; there is an ~28 uS/reading penalty if autorange is on resulting in <25 K readings/sec.

- 34410A/34411A could display 2 lines of user-specified text; 34465A only allow 1.

- Default NPLC value for 34465A is 10 PLC vs. 1 PLC for 34410A/34411A/L4411A.

- Burden voltage is generally lower on the 34465A than the 34410A/34411A/L4411A.

- New measurement functions on the 34465A include DCV ratio and support for thermocouple measurements.

# Key Programming Differences

- By default, the 34465A *IDN? query returns:
  Keysight Technologies,3446xA,<Serial Number>,ff.ff-pp.pp-mm.mm-gg.gg-bb-pp

- The 34465A parses and executes commands differently than the 34410A/34411A/L4411A. Existing systems that depend (intentionally or unintentionally) on 34410A/34411A/L4411A command execution speed for timing may experience very subtle timing issues.

- The 34465A and the 34410A/34411A/L4411A may generate different error messages. This is usually not a problem, because existing programs normally do not generate SCPI errors.

- The 34465A can store up to 50,000 volatile readings, which is equal to the 34410A. With the 34465A MEM option you get 2 million readings volatile reading memory. More than the 1 million that the 34411A/L4411A allows. This is unlikely to affect existing programs.

- Under certain conditions, the 34465A may return and display negative resistance values. For details, see [Help] > Negative Resistance Values from the front panel.

- To support testing a wider range of diodes, the compliance voltage has been increased from 1.2 V to 5.05 V. The range for the 34465A is fixed at 10 V, as opposed to 1 V on the 34410A/34411A/L4411A. The current source remains fixed at 1 mA.

- The dBm reference on the 34465A is a volatile value. It was non-volatile on the 34410A/34411A/L4411A.

- 34465A has per-function secondary measurements, which retain their setting on function changes, vs. a single DISPlay:WINDow2:FEED on 34410A/34411A/L4411A, which was turned off by every function change.

- 34410A/34411A/L4411A enabled peak detection using per-function SENSe:<function>:PEAK:STATe. This allowed a secondary measurement in addition to peak detection. 34465A makes the peak detection one of the secondary measurement choices, so only peak detection or another secondary measurement can be selected.

- 34410A/34411A's peak values could be read using specialized FETCh:<func>:PEAK:MIN/MAX/PTP? for DC or FETch:<func>:PTPeak? for AC. 34465A will not have these queries; rather, the secondary measurement information will be read via a common SENSe:DATA2? query. An additional command will be needed to setup the desired secondary measurement using [SENSE]:<func>:SEC “param” commands. See user’s manual for more information on Sense:DATA2 and SECondary commands

- 34410A/34411A/L4411A's peak detection function was internal to each measurement, not cumulative over multiple measurements. 34465A is cumulative, and requires an explicit user clear to reset, if desired, inside one INIT command.

- 34410A/34411A/L4411A allowed both global (CALC subsystem) and per-function NULL, although the global NULL was deprecated. 34465A does not support the global NULL.

- 34410A/34411A/L4411A offered a rather strict 34401A emulation mode (SYSTem:LANGuage command), trying to match timing, speed/resolution, ... 34465A does not offer an emulation mode.

- 34410A/34411A/L4411A supported commands to force the line frequency to non-autosensed. 34465A do not.

- 34410A/34411A/L4411A could measure the actual line frequency (not just 50/60, but 49.98...) and return value to user; 34465A cannot.

- 34410A/34411A/L4411A used MEMory commands to configure power-on state recall; 34465A use MMEMory commands to configure from either the internal or USB file systems.

- 34410A/34411A/L4411A used DATA commands to store data to a single location in non-volatile memory. 34465A use MMEMory commands to map to different locations on either the internal or USB file systems.

- When reading data back from NV, 34410A/34411A/L4411A returned the data as a list of comma-separated numbers. 34465A return the data as stored in either CSV, or binary format enclosed in an IEEE-488 definite block.

- 34410A/34411A/L4411A had several additional LAN configuration commands not supported on 34465A.

  - SYSTem:COMMunicate:LAN:AUTOip[:STATe] {OFF|0|ON|1}
  - SYSTem:COMMunicate:LAN:AUTOip[:STATe]?
  - SYSTem:COMMunicate:LAN:BSTatus?
  - SYSTem:COMMunicate:LAN:DDNS {OFF|0|ON|1}
  - SYSTem:COMMunicate:LAN:DDNS?
  - SYSTem:COMMunicate:LAN:HISTory:CLEar
  - SYSTem:COMMunicate:LAN:HISTory?
  - SYSTem:COMMunicate:LAN:KEEPalive {<seconds>|MIN|MAX}
  - SYSTem:COMMunicate:LAN:KEEPalive? [{MIN|MAX}]
  - SYSTem:COMMunicate:LAN:LIPaddress?
  - SYSTem:COMMunicate:LAN:MEDiasense {OFF|0|ON|1}
  - SYSTem:COMMunicate:LAN:MEDiasense
  - SYSTem:COMMunicate:LAN:NETBios {OFF|0|ON|1}
  - SYSTem:COMMunicate:LAN:NETBios?

- 34410A/34411A/L4411A supported commands to sanitize internal memory known as NISPOM sanitize, without a license e.g. SYST:SEC:IMM. The 34465A requires a SEC license to enable NISPOM capability.

- Default NPLC value for 34465A is 10PLC vs. 1PLC for 34410A/34411A/ L4411A. This affects the CONFigure, MEASure, SENSe:<func>:NPLC, and SENSe:<func>:RESolution commands.

## Conclusion

The 34465A Truevolt DMM is the next-generation 34410A/34411A/L4411A DMM. Most will be able replace their 33410A, 34411A, or L4411AA with the 33465A DMM with little problem. The above differences highlight areas that need additional research. With the new 34465A, you can spend more time making measurements and less time migrating your existing program or learning a complicated interface.

Learn more about the 34465A Truevolt Series DMM at www.keysight.com/find/Truevolt
To learn more about migrating from your 33410A, 34411A, or L4411AA to the 34465A Truevolt Series DMM, visit: www.keysight.com/find/nextgenDMMs

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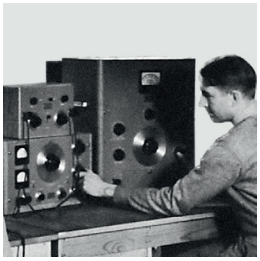

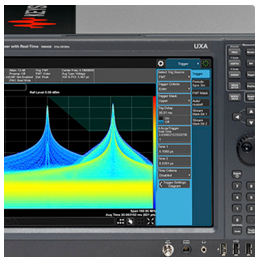

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