



Agilent

Migration from the Agilent 34401A to the Agilent 34405A Digital Multimeter

Application Note



Agilent Technologies

Introduction

The Agilent 34405A is the latest member of Agilent’s digital multimeter (DMM), expanding Agilent’s offerings in electronics measurement tools. The 34405A is designed to meet general industrial needs, providing a broad range of features and measurement functions such as DC voltage, DC current, true RMS AC voltage and AC current, 2-wire resistance, frequency measurement, diode test, and continuity test. It is not only affordable, but also rich in features, fast, accurate, reliable and easy to use.

This application note explains how to migrate from the Agilent 34401A to the new 34405A digital multimeter. It answers questions such as: “Will the 34405A run well in an application that was previously accustomed to the 34401A? Is there a compatibility switch? Which functionality remains the same? How is 34405A’s performance as compared to the existing 34401A?”

The following topics will include feature comparisons, Standard Commands for Programmable Instrumentation (SCPI) compatibility, measurement speed (timing), interfacing differences, operation differences, and electrical and mechanical compatibility.

Comparing the DMMs

The best way to understand the differences between the 34401A and the new 34405A is to perform a side-by-side comparison. Table 1 presents the different key features for both digital multimeters.

From Table 1, one obvious difference is in the count resolution of the digital multimeters. The new 34405A is a 5-½ digit multimeter, while the 34401A is a 6-½ digit resolution. Both multimeters is targeted for different market segments.

The 34405A targets education and primary manufacturing while+ the 34401A is generally designed for advance manufacturing, aerospace and defense. Despite being a basic instrument, the 34405A has some significant improvements over the existing 34401A in the following areas:

- Additional functions and ranges
- Simultaneous measurements with dual display
- Standard computer I/O interface

Besides, the new 34405A also offers an easy-to-use front panel with easy setup, easy-to-program feature, and easy viewing with the dual display feature.

Table 1. Comparison of the 34401A and 34405A

Function	Key Features of 34401A		Key Features of 34405A	
DC functions and ranges	DC voltage	100 mV to 1000 V	DC voltage	100 mV to 1000 V
	DC accuracy	35 ppm	DC accuracy	250 ppm
	DC current	10 mA to 3 A	DC current	10 mA to 10 A
	2 W/4 W resistance	100 Ω to 100 MΩ	2 W resistance	100 Ω to 100 MΩ
	Continuity	1000 Ω 1 mA	Continuity	1000 Ω 0.83 mA
	Diode test	1 V 1 mA	Diode test	1 V 0.83 mA
	Capacitance		Capacitance	1 nF to 10 000 μF
AC functions and ranges	True RMS AC voltage	100 mV to 750 V 3 Hz to 300 kHz	True RMS AC voltage	100 mV to 750 V 20 Hz to 100 kHz
	True RMS AC current	1 A to 3 A 3 Hz to 5 kHz	True RMS AC current	10 mA to 10 A 20 Hz to 10 kHz
	Frequency and period	100 mV to 750 V 3 Hz to 300 kHz	Frequency and period	100 mV to 750 V 20 Hz to 300 kHz
	DC system throughput	6.5 digits 5.5 digits 4.5 digits	6 readings/s 60 readings/s 1000 readings/s	6.5 digits 5.5 digits 4.5 digits
AC system throughput	6.5 digits	50 readings/s	6.5 digits 5.5 digits	Not supported 1 reading/s
I/O and Connectivity	GPIB, RS232 Labview, IVI driver, and Intuilink DMM Primary measurement on front panel display		USB Labview, IVI driver, and Intuilink DMM Dual display and support simultaneous measurement on secondary display	

SCPI Compatibility

The 34405A provides an enhanced SCPI command set that is backward compatible with the 34401A. However, due to some features and functions differences, some SCPI commands that work on the 34401A does not work on the 34405A and vice versa, as shown on Table 2.

Measurement Speed (Timing)

There are measurement speed difference between the 34401A and 34405A, which can be seen on Table 1 as both DMMs are built for different market segments. Table 1 shows that the 34405A is actually slower than the 34401A. Hence, timing is a factor that needs to be considered when a user switches from the 34401A to the 34405A.

Consider the following steps for a test operation:

1. Set the DMM to a particular function and perform the measurement.
2. Close the channel.

If no delay time is applied after Step 1, the instrument may actually begin taking readings before the current function completely switches to a measurement state. This timing issue could cause the 34405A to generate errors during testing. Hence, when using the 34405A, delay time is recommended for functions switching and SCPI commands related to MEAS, CONF, TRIG, and SENS subsystems commands.

Table 2. SCPI commands incompatibility between the 34401A and 34405A

SCPI commands	34405A	34401A
CONFigure:CAPacitance	yes	no
CONFigure:PERiod	no	yes
CONFigure:TEMPerature	yes	no
CONFigure:VOLTage:DC:RATio	yes	no
DATA:FEED	no	yes
DATA:FEED?	no	yes
DETEctor:BANDwidth	no	yes
DETEctor:BANDwidth?	no	yes
DISPlay:TEXT	no	yes
DISPlay:TEXT:CLEar	no	yes
DISPlay[:WINDow[1 2][:STATe]]	yes	no
DISPlay[:WINDow[1 2][:STATe]]?	yes	no
DISPlay[:WINDow[1 2]:TEXT:CLEar	yes	no
DISPlay[:WINDow[1 2]:TEXT[:DATA]	yes	no
DISPlay[:WINDow[1 2]:TEXT[:DATA]?	yes	no
FREQuency:APERture	no	yes
FREQuency:APERture?	no	yes
INPut:IMPedance:AUTO	no	yes
INPut:IMPedance:AUTO?	no	yes
MEASure:CAPacitance?	yes	no
MEASure:FRESistance?	no	yes
MEASure:PERiod?	no	yes
MEASure:TEMPerature?	yes	no
MEASure:VOLTage:DC:RATio?	no	yes
PERiod:APERture	no	yes
PERiod:APERture?	no	yes
PERiod:TERMinals?	no	yes
*RCL	yes	no
*SAV	yes	no
SAMPlE:COUNt	no	yes
SAMPlE:COUNt?	no	yes
[SENSe:]FUNCTion "VOLTage:DC:RATio"	yes	no
[SENSe:]TEMPerature:TRANsdUCer:THERmistor:TYPE	yes	no
[SENSe:]TEMPerature:TRANsdUCer:THERmistor:TYPE?	yes	no
TEMPerature:TRANsdUCer:THERmistor:TYPE	yes	no
TEMPerature:TRANsdUCer:THERmistor:TYPE?	yes	no
TRIGger:COUNt	no	yes
TRIGger:COUNt?	no	yes
TRIGger:DELay	no	yes
TRIGger:DELay?	no	yes
UNIT:TEMPerature	yes	no
UNIT:TEMPerature?	yes	no

34405A Operating Differences

Although in most cases, users can just replace the 34401A with the 34405A without much of a qualm, users should consider the operating differences between the two that are summed in the following areas:

- Additional functions and ranges
- Predefined range and measurement (Dual display feature)
- Connectivity
- Math operations

Additional Functions and Ranges

The functions and ranges comparisons are shown in Table 1. This extra coverage permits a much wider dynamic range of measurable signals, notably capacitance and temperature.

Predefined range or measurement (Dual display feature)

The 34401A makes very good measurements, however it is considered a single-tasking instrument which can only perform one operation at a time. The 34405A uses the INIT command to ready and trigger the measurement engine before making measurements. Besides, the 34405A allows the following:

- Command parser is free to accept new commands
- Simultaneous measurements can be made

Such simultaneous measurement functions have predefined ranges and measurement capabilities such as the following:

- Measurement of DC voltage or current range and AC voltage or current, while measuring DC voltage or current
- Measurement of AC voltage or current range and frequency while measuring AC voltage or current



Figure 1. Front and rear view of the 34405A Digital Multimeter

- Measurement of AC voltage range and AC voltage while measuring frequency
- Display of capacitance or resistance range while measuring capacitance or resistance
- Statistical math functions: Limit, Null, dBm, dBV, Min / Max and Hold

These secondary measurements are displayed real-time on the secondary display, and can be transferred via the USB 2.0 I/O interface while measurements are being taken.

Connectivity

The 34401A comes with GPIB and RS-232 interfaces, while the 34405A offers a USB 2.0 interface that is compliant with the TMC 488.2 standards. The USB 2.0 provides an inexpensive and robust alternative with auto-detect capability that voids the need for an additional GPIB card. With easy hook-up to the PC, the USB 2.0 allows remote controllability via industry standard SCPI commands or digital multimeter Intuilink Connectivity software.

Math operation

The 34401A and 34405A come with almost the same math operations, except the 34405A has additional HOLD, capacitance, and temperature measurement functions.

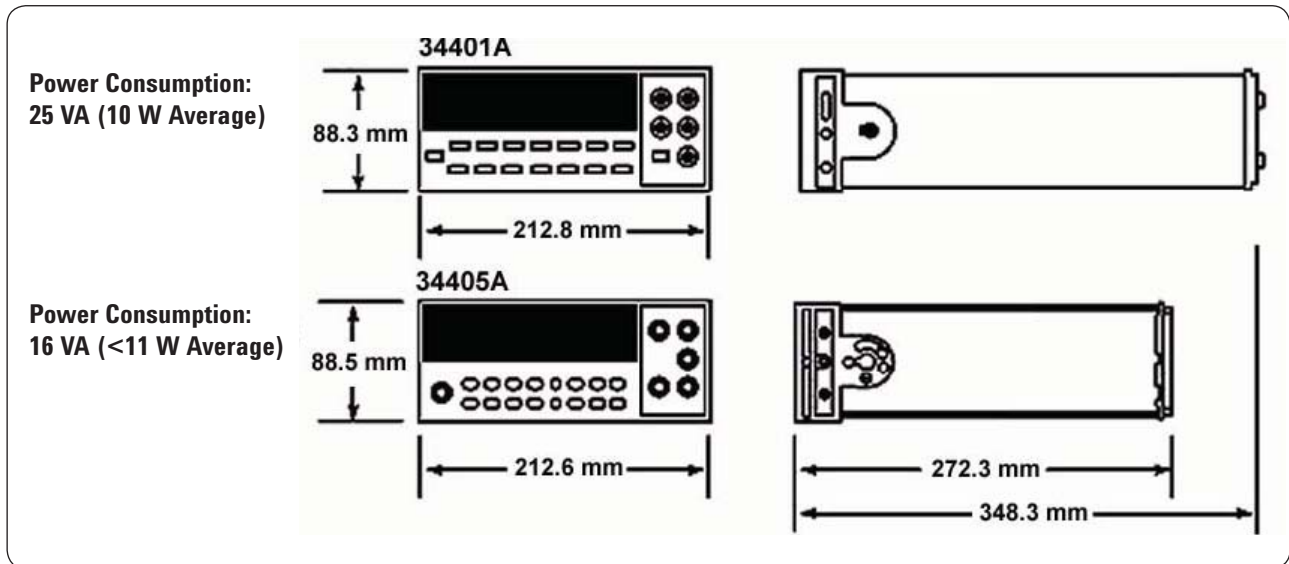


Figure 2. Power consumption and dimensions comparison

Electrical and Mechanical compatibility

Mechanically, the new 34405A is different from the 34401A. Instead of adopting the 34401A's rear terminal, the 34405A has a USB connector at its rear panel. Another significant difference is the 2-wire ohms resistance measurement terminal on the 34405A, instead of the 2-wire / 4-wire ohms resistance measurement terminal offered by the 34401A. Despite these differences, both digital multimeters rack mount in the same way, except that the 34405A is three inches (~76 mm) shorter. In fact, Agilent is converting many of its newer products to this shorter version.

Conclusion

You have been introduced to the key concepts in migrating from the Agilent 34401A DMM to the new Agilent 34405A DMM. Some of the key learning points from this application note are as follows:

- The Agilent 34405A DMM provides a broad range of measurement functions. It is feature-rich, fast, accurate, reliable, easy-to-use and highly affordable.
- Some of the SCPI commands that work for 34401A do not work on the 34405A due to some features and functions differences.
- The USB interface provides a robust and easy connection for the 34405A.
- The 34405A is mechanically and electrically compatible with the 34401A.



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Revised: July 17, 2008

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Printed in USA, July 17, 2008
5989-5515EN



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