

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

## Application Note



### Introduction

The Agilent 34405A is the latest member in Agilent's Digital Multimeter, 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 Agilent 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, SCPI compatibility, measurement speed (timing), interfacing differences, operation differences, and electrical and mechanical compatibility.

### Overview - Comparing Digital Multimeter

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 resolution multimeter, while the 34401A is a 6 ½ digit multimeter. Both multimeters target for different market segments. The 34401A is mainly designed for high-end manufacturing, aerospace and defense, while the 34405A targets education and low-end manufacturing. Despite being the lower-end instrument, the 34405A has some significant improvements over the existing 34401A in the following areas:

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



Besides this, 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.

**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.

**Table 1** Comparison of Agilent 34401A and Agilent 34405A

Function	Key Features of 34401A		Key Features of 34405A	
DC	DC Voltage	100 mV to 1000 mV	DC Voltage	100 mV to 1000 mV
	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 to 100 M	2 W/4 W Resistance	100 to 100 M
	Continuity	1000 , 1 mA	Continuity	1000 , 0.8 A
	Diode Test	1 V, 1 mA	Diode Test	1 V, 0.8 mA
			Capacitance	1 nF to 10,000 F
			Temperature -	80 C to 150 C
AC	True RMS Voltage	100 mV to 750 V, 3 Hz to 300 kHz	True RMS Voltage	100 mV to 750 V 10 Hz to 100 kHz
	True RMS Current	1 A to 3 A, 3 Hz to 5 kHz	True RMS Current	1 A to 3 A 10Hz to 5 kHz
	Frequency and Period	100 mV to 750 V, 3 Hz to 300 kHz	Frequency and Period	100 mV to 750 V 1Hz to 5 kHz
DC System Throughput	6.5 digits	6 readings/s	6.5 digits	Not supported
	5.5 digits	60 readings/s	5.5 digits	8 readings/s
	4.5 digits	1000 readings/s	4.5 digits	19 readings/s
AC System Throughput	6.5 digits	50 readings/s	5.5 digits	1 readings/s
I/O and Connectivity	GPIB, RS-232		USB	
	Labview, IVI driver and Intuilink DMM		Labview, IVI driver and Intuilink DMM	
	Primary measurement on front panel display		Dual display and support simultaneous measurement on secondary display	

## Measurement Speed (Timing)

The 34401A and 34405A are built for different market segments in mind. Table 1 on page 2 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 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

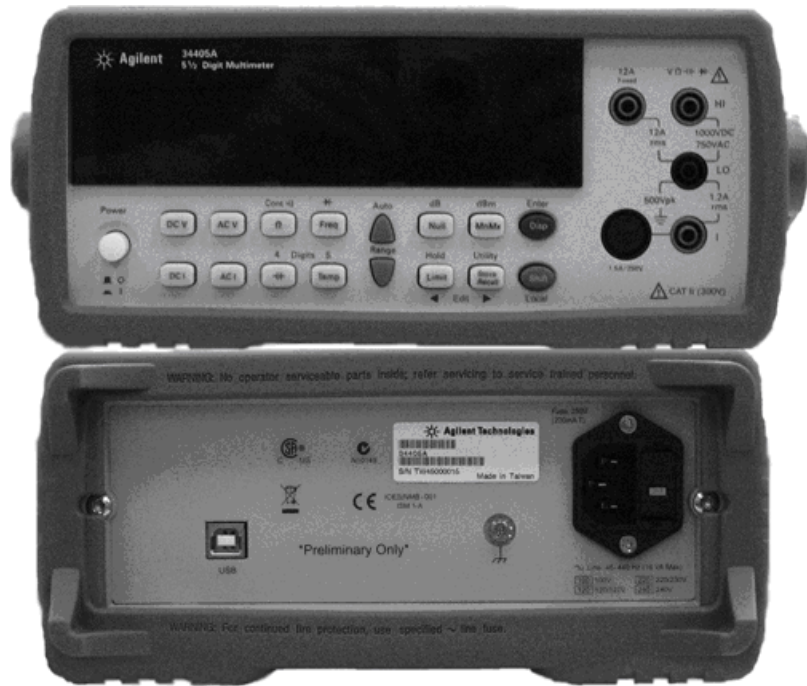
### 34405A Operating Differences

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:

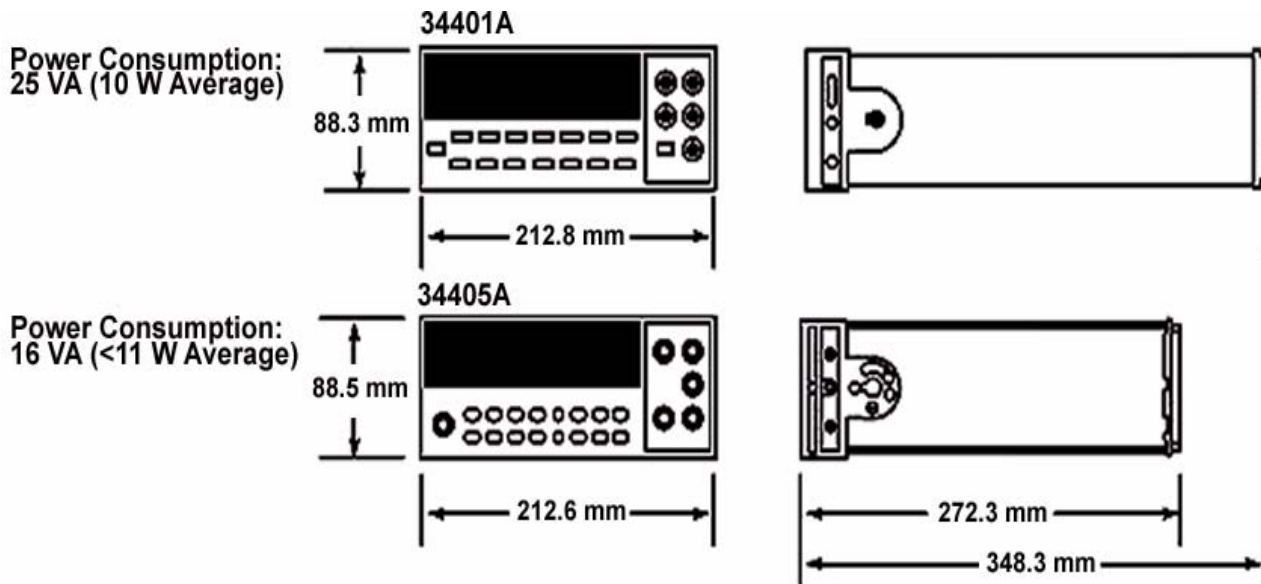
- Additional function and ranges
- Predefined range and measurement (Dual display feature)
- Connectivity
- Math operations

### Additional Functions and Ranges

The functions and ranges comparisons are shown in **Table 1** on page 2. This extra coverage permits a much wider dynamic range of measurable signals, notably capacitance and temperature.



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



**Figure 2** Power consumption and dimension comparison

### **Predefined range or measurement (Dual display feature)**

The 34401A is considered a single-tasking instrument, meaning that it can perform only one operation at a time, even though it makes very good measurements. The 34405A, on the other hand, has a command parser capability that grants it liberty to accept new commands and hence, make simultaneous measurements.

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
- 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 and 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 for additional HOLD, capacitance and temperature measurement functions.

### **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 3 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.

### **Glossary SCPI**

Standard commands for Programmable Instrumentation. This English-style language is used in instrumentation for many years.

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