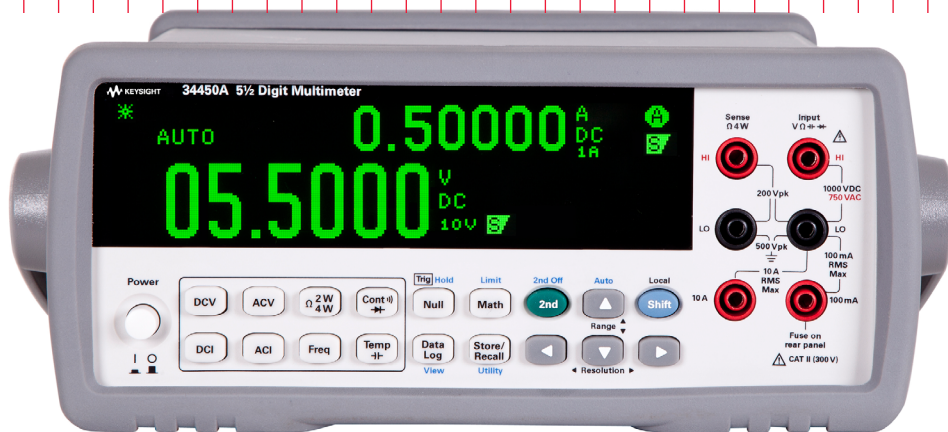


Keysight Technologies

Tips and Tricks for

Using the 34450A 5½ Digit Bench Top Digital Multimeter

Application Note



The Keysight Technologies, Inc. 34450A 5½ digit multi-purpose digital multimeter (DMM) offers a variety of advanced features and capabilities. This application note provides five key insights and tips on the functionality, performance, and the use of this DMM, which are aimed at helping you work faster and more efficiently.

Tip 1: Dual Display Measurement

In electronic industries, voltage and current measurements are fundamental measurements made regardless of whether the signal source is AC or DC. Typically, there is a desire to monitor both voltage and current values on a circuit without repeatedly breaking connection in the circuit, and switching the DMM probes between making voltage and current measurements. You may also need to measure the AC component or noise level that sits on top of a DC signal. In another instance, it may be necessary for you to measure the frequency of an AC signal while reading its voltage or current.

All the measurement examples above are performed with ease using the dual display measurement function of the 34450A. The function allows the DMM to make two measurements and display both results on the 34450A’s OLED display that provides visibility over a large viewing angle (See Figure 1). Table 1 shows the measurement combinations available when the 34450A is operating in dual-display measurement mode.



Figure 1. Dual display measurements on 34450A.

The 34450A has a high speed analog-to-digital converter (ADC) that takes samples from the input terminals. When using the 34450A’s dual display measurement feature, the internal circuitry switches between making primary and secondary measurements so that the ADC takes samples for both measurements. This eliminates the need for a dual ADC, and thus reduces the price of the DMM.

When using a DMM with a single ADC, there are a few ways to minimize dead time between dual measurements and increase the refresh rate of both readings. One means is to manually set the correct

range for primary and secondary measurements. Leaving the 34450A in auto-range mode can prolong dead time because the DMM will search for the correct range before making each measurement.

Another way to optimize measurement speed while in dual display measurement mode is to set both the primary and secondary measurement to the same resolution. Unless different resolution is required between the two measurements, having one measurement in slow mode and another measurement in fast mode decreases the overall throughput.

Table 1. Measurements available in dual display mode.

Primary Display	Secondary Display				
	DCV	ACV	DCI	ACI	Frequency
DCV		✓	✓	✓	
ACV	✓		✓	✓	✓
DCI	✓	✓			
ACI	✓	✓			✓
Frequency		✓		✓	

Tip 2: Triggering

The 34450A has a triggering function that allows you to initiate a measurement at desired conditions. The triggering feature is used through the front panel during manual operation, while for automated operation the DMM is controlled through the USB, GPIB, or serial connector. Setting the 34450A to be triggered must be done in the proper sequence to ensure the DMM starts measuring once the triggering signal is received. The DMM's measurement function, range, resolution, and speed are among the first few settings that need to be set. Leaving the DMM in auto-range reduces the overall speed of each measurement because an additional algorithm is used to search, compare, and set the right measurement range. Manually setting the measurement range is always a good practice when the measurement values are known.

When the DMM is to be used in automated or remote mode, it can be set to receive a triggering signal either through the software or hardware. Software triggering (also known as bus triggering) is achieved by sending standard commands for programmable instruments (SCPI) commands to the DMM over a USB, GPIB, or serial connection. This triggering method is preferred in software-controlled environments where the test program determines the measurement timing by sending a *TRG command to the DMM. If your application requires data analysis or the comparison of values before making a decision to continue a measurement on the DMM, using a software trigger is the best approach.

Using hardware triggering is recommended when using the DMM to make one or a specified number of measurements upon receiving a pulse at the TRIG IN pin on the serial con-

necter. Hardware triggering through the serial connector is best suited for manufacturing environments where instruments or mechanical parts, such as handler and PLC, provide a pulse to the DMM to trigger a measurement. Using the TRIG IN pin of the 34450A is a good choice if a triggering pulse is available in the test environment and throughput is one of the major concerns. Figure 2 refers to the serial connector at the rear panel of the 34450A. The triggering signal is applied to the TRIG IN and Ground pin of the serial connector as denoted by a positive and negative sign respectively.

In manual operation or local mode, the triggering is meant to initiate a single measurement or start the data logging using the timing you define. This triggering method is initiated by pressing [Trig]. To manually trigger a single measurement, set the DMM's triggering source to Manual/External in the Utility menu. The triggering method for data logging is explained in the Tip 3 section of this application note. Figure 3 outlines the triggering operations on 34450A with criteria for your selection reference.

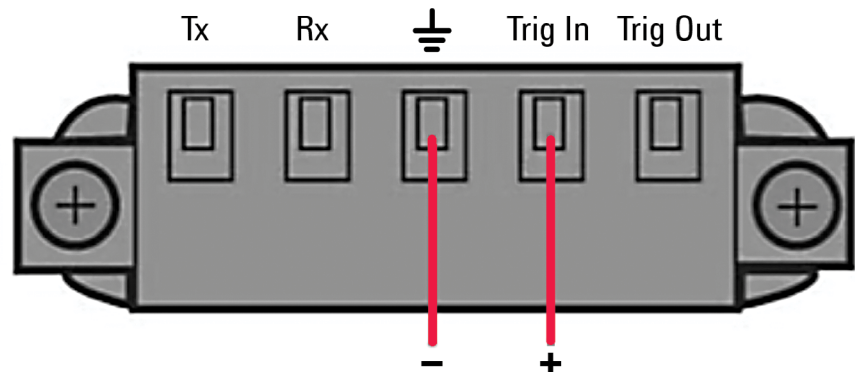


Figure 2. TRIG IN pin on the serial connector of the 34450A.

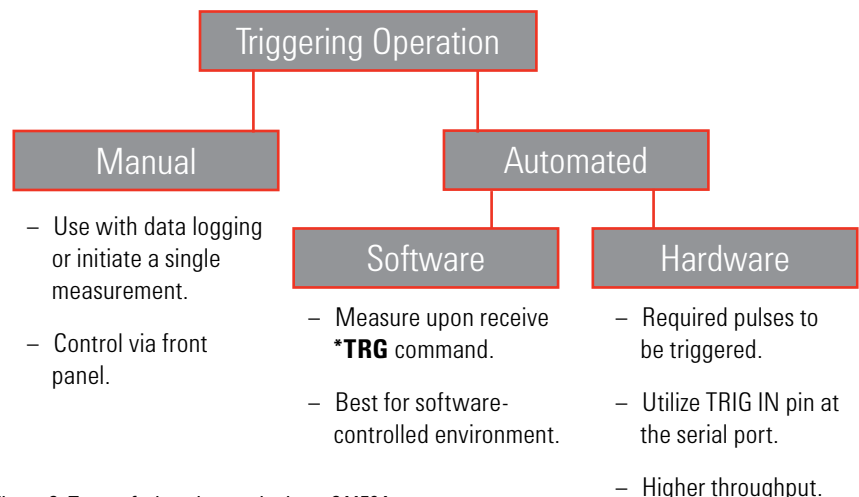


Figure 3. Types of triggering methods on 34450A.

Tip 3: Data Logging

Another 34450A feature allows you to store measurement results into its 50k non-volatile memory through the data logging function. You can perform data logging when using either single or dual display measurements. The data stored in memory is accessible from your computer through the USB, GPIB or serial connector on the rear panel of the 34450A.

Data logging on 34450A is initiated in two ways: manually pressing [TRIG] on the front panel, or by supplying a triggering pulse to the TRIG IN pin at the rear panel of the DMM. Manually pressing [TRIG] allows you to have full control over when to start acquiring readings, while using a triggering pulse immediately starts data acquisition. For timing sensitive applications and repetitive test routines, using a triggering pulse improves the overall throughput.

Data logging speed is subject to a couple of factors. The resolution of the measurement determines the minimum sample interval during data logging. To illustrate, logging 100 DCV readings in fast mode for a user-defined range is completed in approximately 7 seconds.

However, the same DCV readings take approximately 82 seconds to complete if the 34450A is running in slow mode, and approximately 268 seconds if the 34450A is running in auto-ranging slow mode. Table 2 lists the minimum sample interval over the common measurement functions at three different resolutions in manual and auto ranging.

Table 2. Minimum sample interval (in second) for data logging.

Resolution	DCV		DCI		ACV		ACI		2-wire Ohm		4-wire Ohm	
	manual range	auto range	manual range	auto range	manual range	auto range	manual range	auto range	manual range	auto range	manual range	auto range
Fast Mode	0.0690	0.7475	0.0690	0.6670	0.0690	1.4950	0.0575	1.3800	0.0810	0.9200	0.3335	2.9325
Medium Mode	0.0805	1.1155	0.0977	0.9200	0.1610	2.2310	0.1150	1.7940	0.1840	1.5065	0.4715	3.4730
Slow Mode	0.8165	2.6795	0.9430	2.0700	0.8165	10.4530	0.7015	6.9920	1.0465	3.6110	1.5065	4.3700

Tip 4: Storing and Recalling Settings

On top of the 50k non-volatile memory for data logging function, the 34450A has six non-volatile memory locations for storing the DMM's settings such as measurement configuration, math operation, and system operations. The 34450A stores the last DMM configuration at location LAST before it shuts down, while Locations 1 thru 5 are available for storing your preferred configurations.

The store and recall function is particularly useful for operations where multiple test profiles must be performed by a single 34450A. You can store the DMM's configuration at any time and recall it as needed. The store and recall function is accessible during both manual and remote

operation. Using this function helps eliminate the need to repetitively program the DMM with the same configuration, allowing you to quickly perform your measurements without having to do extensive programming or manually set the DMM for the same measurement previously performed.

For example, if your measurement requires multiple test points and each has different needs in terms of measurement functions, range, and resolution, you can dedicate a specific memory location to the test points. Whenever you need to measure the test point, you simply recall that specific memory location. The store and recall feature is supported in both local and remote modes.



Figure 4. Selecting or recalling the store location can be done easily on the front panel of the 34450A.

Tip 5: Limit Test

Limit test is an extra value-added feature of the 34450A. When the limit operation is enabled, the DMM instantly notifies you if a measurement result falls outside the high or low limits you establish prior to making a series of measurements. Upon setting the 34450A to limit operation, the DMM's display is divided into four segments as shown in Figure 5. The two segments on the left are for setting the high and low limits. The upper right segment displays the last measurement and the lower right segment displays the limit results; whether it is pass, fail low, or fail high.

Limit operation is extremely useful for manual operations. There are many simple and low cost production tests require only one DMM to perform a specific test. For example, measuring the voltage across an LED to determine whether it is within its tolerance can be done easily using the limit test function of the 34450A. The 34450A displays "PASS", "FAIL-LO" or "FAIL-HI" based on the limits set. Apart from displaying the measurement value with a pass or fail identification, the 34450A beeps to alert the operator when a measured value falls outside the set limits. You can put the 34450A into the limit operation by pressing [Shift] > [Math].

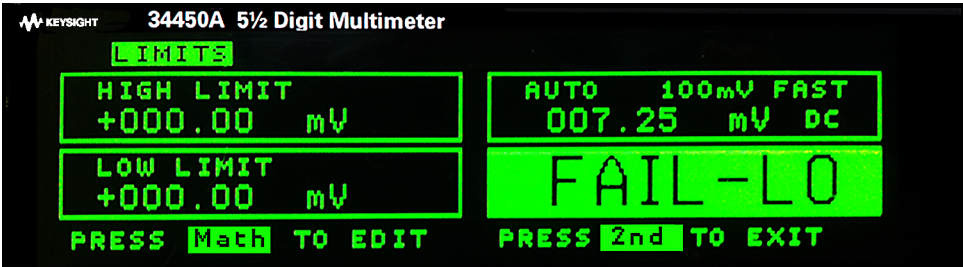


Figure 5. The display of 34450A in limit operation.

Conclusion

The 34450A 5½ digit multimeter offers superior ease of use on the bench and for remote operations. Whether your application requires general purpose measurements, or fast throughput and programming speed, using the tips provided will help you optimize the capabilities of your 34450A DMM.

Related Literature

Please refer to the publication below for further information.

Publication title	Publication number
Keysight 34450A 5½ Digit Dual Display, Benchtop DMM, Data Sheet	5991-1133EN
Keysight 34450A 5½ Digit Multimeter User's Guide	34450A-90000

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