

Keysight Technologies

Faster Data Analysis with Graphical Digital Multimeter Measurements

Application Brief

Test Challenges:

- Analyzing changes with time
- Identifying noise in your design

Overview

New modern DMMs allow you to analyze your setup and data using only the front panel. The *Truevolt* Series of DMMs—the 34460A, 34461A, 34465A, and 34470—offer other methods for gaining insight into measurement data, without having to first transfer that data to a PC. *Truevolt* DMMs feature a large graphical display and built-in math functions that show measurement trends, statistics, and histograms all in a single, compact unit. With advanced analysis and data collection methods on the 34465A and 34470A, it may even be possible to run an entire analysis using only the DMM. See how the *Truevolt* Series DMMs can help you more quickly analyze your data.

Analyzing changes with time

You need to characterize the drift of a precision resistor in your design. Rather than setting up a program or using your PC, you decide to use your *Truevolt* DMM's trend chart feature to gather the data. After allowing the design to heat up for 20 minutes, you start to see nonlinear behavior in the resistor. With the pan, zoom and cursor capability of the new 34465A/34470A DMM's, you identify the instant the measurement goes nonlinear. As a result of this discovery, you decide that the resistor is not performing to specification and that you need to evaluate other parts.

Identifying noise in your design

You are troubleshooting a switching DC power supply that appears to work well. However, there is some behavior that drops the voltage out of tolerance. Using your *Truevolt* DMM you characterize the power supply's output. By switching between trend chart and histogram mode you identify that the power supply's noise is not Gaussian and is skewed toward the lower end of regulation. Your analysis only takes 10 minutes and was accomplished without a computer.

Trend charts show direction

If you expect a measurement to remain constant, only measure it once. That’s because in the real world values drift with time, track other parameters, or vary in complex ways with outside influences. You can set the trend chart display on the 34461A, 34465A, and 34470A DMMs to display the most recent data over the last minute, or to display all of the data collected since the last time the readings were cleared (Figure 1).

An example of a common secondary measurement would be the ability to measure the frequency of an AC signal, as shown in Figure 1.

Histograms tell all about the data

When the lowest digits of a reading are changing constantly and sometimes too quickly to visually track, it is important to know the nature of that variation. The histogram provides insight by showing the distribution of the measured values (Figure 2). The average, distribution shape, and standard deviation are all critical information for understanding the variation phenomena.

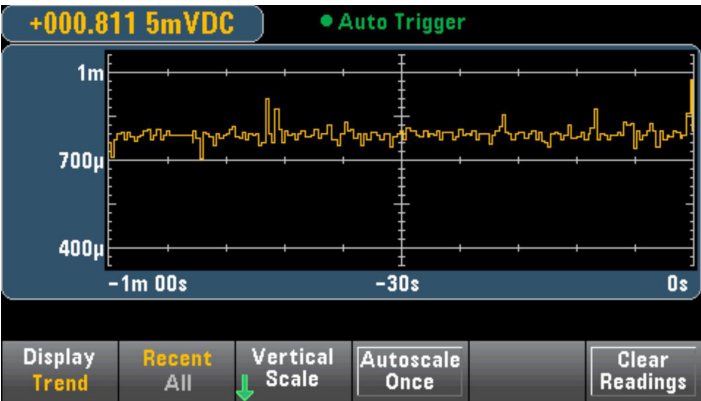


Figure 1. The trend chart display shows direction and reading anomalies.

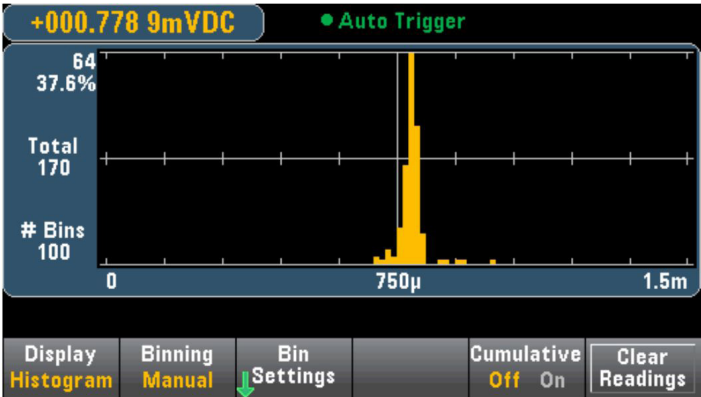


Figure 2. The histogram show data distribution.

Secondary measurements

With the ability to have secondary measurements run concurrently with your primary measurement, you can gather two types of information at a glance; for example, a thermistor temperature measurement (primary) and the resistance measurement made on the thermistor (Figure 3). For further information on secondary measurements, see the Keysight Technologies application brief “Simultaneous Measurements with a Digital Multimeter” publication number 5992-0419EN or the Truevolt DMM datasheet, publication number 5991-1983EN.

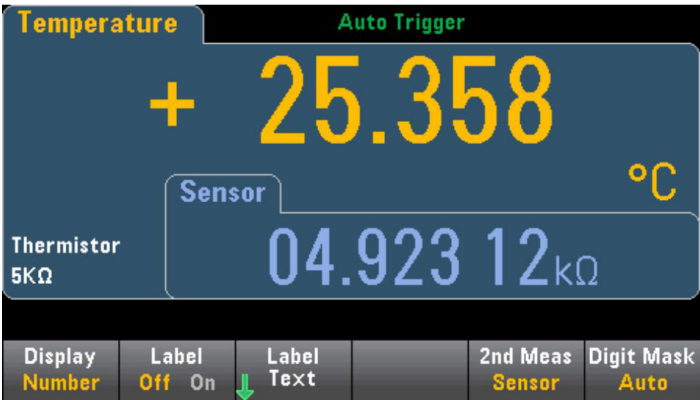


Figure 3. The Truevolt DMMs allow secondary measurements to run concurrently with a primary measurement.

Advanced DMM triggering

If the traditional DMM triggering model was insufficient for your testing needs, then the new Truevolt DMMs may have just the solution for you. Traditional DMMs either make measurements right after you configure the measurement (immediate trigger), do a single measurement, or trigger from an external source via the External Trigger port. Higher-end DMMs like the 34465A and 34470A have additional modes wherein a combination of trigger settings, delay times, number of samples per trigger, and pre-trigger settings can be used to provide concise data (Figure 4).

Using the DMM’s advanced trigger modes you can set a level trigger that will start making measurements when the desired level is reached (Figure 5). You can also set a trigger delay to wait a defined time after the trigger event. Another useful setting is the ability to define the number of samples after a trigger is received, which helps to ensure a number of continuous measurements after the trigger event, rather than just a single reading per trigger.



Figure 4. The 34465A/34470A DMMs feature advanced trigger modes.



Figure 5. The Truevolt DMMs’ advanced trigger modes allow designers to set a level trigger.

New acquisition modes

In addition to the traditional continuous measurement mode, the 34465A and 34470A DMMs provide data logging and digitizing modes from the front panel. These new modes are accessible from the Acquire menu located on the front panel. To start the acquisition, you simply press the Run/Stop button.

Data logging

The 34465A and 34470A DMMs feature a new data logging mode for front panel usage. Found under the Acquire menu, the mode allows you to get readings at a constant sample interval to effectively log your data over time. You can easily set your sample interval (e.g., how often you want to make a measurement) and your total duration (e.g., how long or how many readings you want to make). You can also choose your start time by defining either a delay time from when you press RUN or a start time in terms of Hour/Min/Sec. Data logging allows you to stream directly to a .csv file on either the DMM's internal memory or a USB thumb drive connected to the front panel of the DMM. You may log up to 100 hours or 360 million readings, whichever is less (Figure 6). In data logging mode, you may sample as fast as 1000 samples/second. Because the data logging feature is optimized for precision timing in its readings, some features are not available, such as the level trigger and external trigger.

Exporting to a .csv file allows you to analyze your data on a computer (Figure 7). The .csv file includes the start time and measurement interval (in seconds); allowing you to extract the time that your measurement was taken.

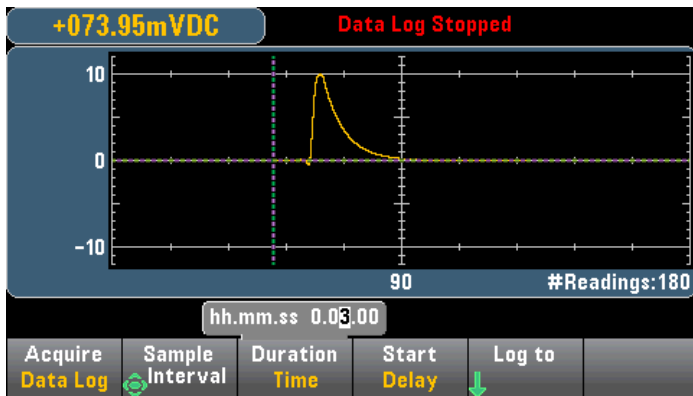


Figure 6. Data logging allows you to log up to 100 hours or 360 million readings.

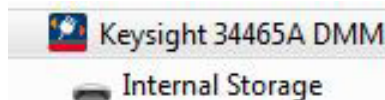


Figure 8. A Truevolt DMM shows up like a drive on your PC.

	A	B	C	D
1	Start date	11/1/2014	Start time	18:27.3
2	Sample in	100		
3	Reading #	Reading		
4	1	8.05E-02		
5	2	7.98E-02		
6	3	7.98E-02		
7	4	7.98E-02		
8	5	7.98E-02		
9	6	7.98E-02		
10	7	7.98E-02		
11	8	7.98E-02		
12	9	7.98E-02		
13	10	7.98E-02		
14	11	7.98E-02		
15	12	7.98E-02		
16	13	7.92E-02		
17	14	9.05E-02		
18	15	8.98E-02		
19	16	8.98E-02		
20	17	8.98E-02		
21	18	8.98E-02		
22	19	8.98E-02		
23	20	8.98E-02		
24	21	8.98E-02		
25	22	8.98E-02		
26	23	8.98E-02		
27	24	8.98E-02		
28	25	8.98E-02		

Figure 7. CSV data file from Truevolt DMM.

Measurement tip

You can set the DMM's real-time clock to your local time. Truevolt DMM's ship from the factory with Greenwich Mean Time (GMT) standard. Setting the clock to your local time allows for start times to be more intuitive for analysis.

Measurement tip

With a USB connection to your PC, Truevolt DMMs show up like a drive on your PC (Figure 8). Using the Easy File Access, you can drag and drop files from or to your DMM without additional software. This is an easy method to get readings from your DMM to your PC for analysis.

Digitizing mode

The Truevolt DMM digitizing mode allows you to sample at the maximum rate and analyze your data from the front panel. With a 50-kHz sampling rate, you can take a measurement every 20 μ s (Figure 9). The slowest rate for digitizing is 100 ms. The digitizing mode sends data to the DMM’s measurement memory, which can keep up to 2 million readings with the optional memory (50,000 readings standard). After the readings have completed, you can store the readings to a .csv file.

In addition to the fast sampling, the digitizing mode allows you to setup a level trigger to start your readings. You can set the level and polarity at which you want to start the triggering of the measurement. You can also select the number of pre-trigger readings to digitize. This allows you to keep measurements that happen before your trigger level has been reached.

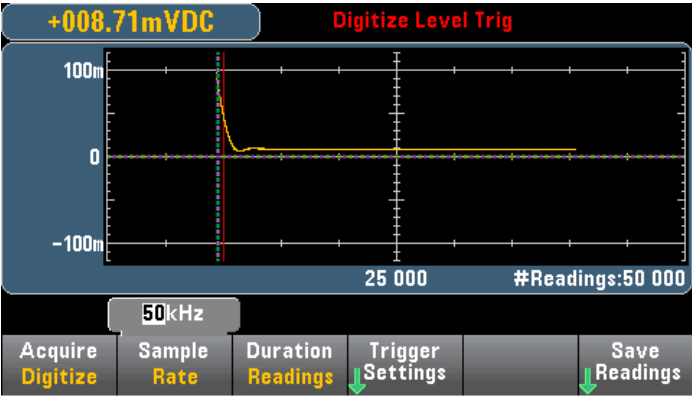


Figure 9. A 50-KHz sampling rate allows you capture fast changes in your signal.

Pan/zoom/cursors

If you are using the histogram or trend chart display modes, you have additional features for analysis. For readings in measurement memory, you can pan or zoom into your data. With zooming, you can enlarge portions of your data for viewing. Panning allows you to move the display screen to the measurement sample number that you want to view. Figure 10 shows a digitized reading that looks similar to the Keysight logo. In Figure 11, the DMM has zoomed into a number of readings to show how individual sine waves actually make up the total logo.

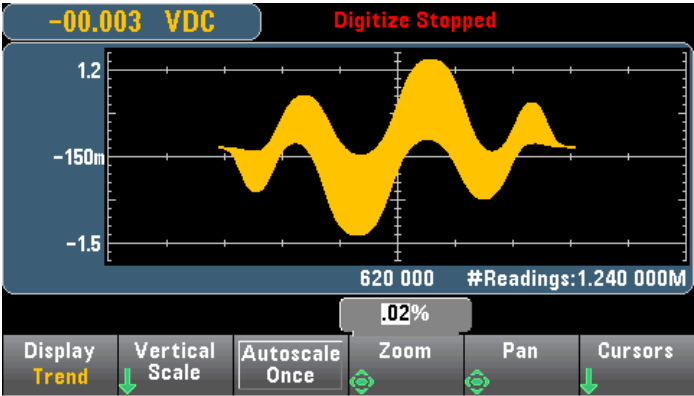


Figure 10. Digitized readings of 1.2 million readings.

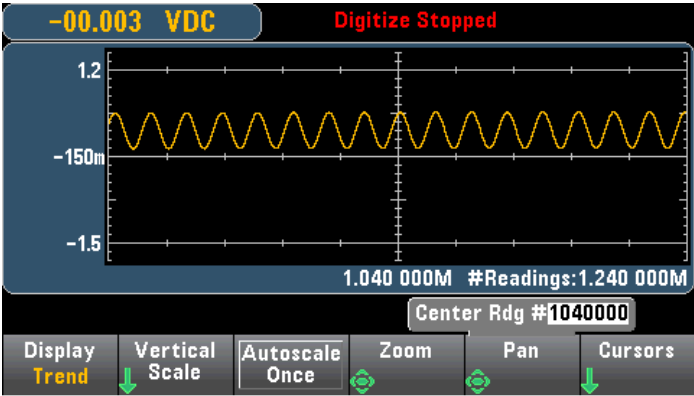


Figure 11. Zoomed/panned in data that shows individual sine waves.

The new cursor functionality in the trend chart allows you to place two X and Y cursors on your data (Figure 12). Each cursor shows the time (from a start time of 0 seconds) and the measurement value for where the cursor is placed. While this feature has been commonly used in oscilloscopes for years, it is new to DMMs and only available on Truevolt DMMs.

Histograms include cursor functionality as well (Figure 13). Histogram cursors allow you to select which bin to view and show the number of occurrences and percentage of total readings that the bin has accumulated. The span feature includes between the cursor information about the range of the readings, the number of readings, and the percentage of readings between the cursors compared to the total readings.

Measurement tip

If you need to control multiple DMMs or a mix of instruments, and analyze their data, use Keysight's BenchVue software for your PC. BenchVue supports all Truevolt DMMs, along with more than 200 other Keysight instruments.

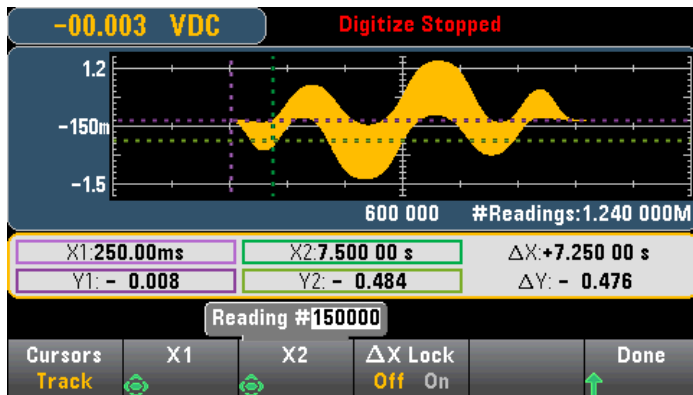


Figure 12. The Truevolt DMMs allows you to place X and Y cursors on your data.

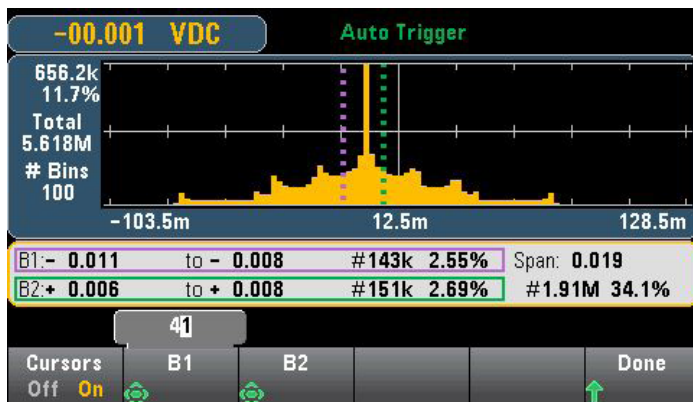


Figure 13. Histogram cursors.

Conclusion

Setting up a computer connection for data collection and analysis can take too much time, especially if you are measuring a single parameter. It is clear that a single value does not provide much insight into the performance of your DUT over time or in response to outside interference. A picture, on the other hand, can offer much richer insight with just a single glance. Now, with the Truevolt Series DMMs' new graphical display, advanced analysis modes, and built-in math functions, the ability to turn lots of data into results that can be quickly analyzed is at your fingertips—all this with just simple front-panel menu entries. Using the Truevolt DMMs you can now meet your testing goals faster than ever before.

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