

MEASUREMENT BRIEF

No Programming Required: Multisignal Capture and Analysis with DMMs



Introduction

New Agilent software reduces the learning curve for DMMs and provides an easy way to set up multiple Agilent DMMs to acquire your signals. In addition to making it easier to set up multiple DMMs, Agilent's new DMM Connectivity Utility supports quicker instrument setups and faster data capture and visualization and addresses many of the difficulties you face in using digital multimeters. The application supports older DMM models including the 34401A, 34405A, 34410A, and 34411A. It also supports our latest-generation 34450A, 34460A, and 34461A DMMs. With this application, you spend more time using your instrument and less time learning and troubleshooting it.

This measurement brief explores how the new Agilent DMM application can help you acquire multiple signals in parallel and understand the data faster. It helps you quickly synchronize measurements, graph measurements and export data in a variety of common formats. First we'll discuss how the DMM Connectivity Utility makes setting up communication with a DMM easier, then we'll look at how the application helps you understand your data with ease. We'll conclude with an example that shows how to use two DMMs to make simultaneous voltage and current drain measurements on your device.

Snapshot

An IC validation engineer needed to characterize a design for a linear regulator. His task was to measure a regulator with an output voltage range of 1 V to 3.3 V with an output current of 150 mA. His first step was to ensure the voltage would stay constant ($\pm 0.5\%$) under varying load conditions. After setting up the hardware for the test, he needed to be able to log his V/I data. The engineer doesn't like to program, but he is familiar with the Agilent DMMs on his bench. He discovered the Agilent DMM Connectivity Utility and learned about its multiple-signal capture capability. With this utility, he was able to use a DMM to measure the output voltage and one to monitor the load current at the same time. Without writing any code, he characterized his V/I curve and discovered the IC had a defect: every 60 seconds it deregulated for 500 ms. The engineer went back to the design team with graphical data from the Agilent DMM Connectivity Utility and they agreed to investigate the defect.

Anticipate — Accelerate — Achieve



Agilent Technologies

An easier way to communicate with a DMM with I/O

Paired together with Agilent I/O Libraries, identifying DMMs connected to your PC is easier than ever. Agilent's new DMM Connectivity Utility will automatically identify connected DMMs configured on your bus. This initial opening view shows the model of DMM and the I/O address that it is connected to. The app intuitively presents the DMMs as bench tiles. Each tile's launch button will initiate control and datalogging for each DMM. You can control multiple DMMs within the app.

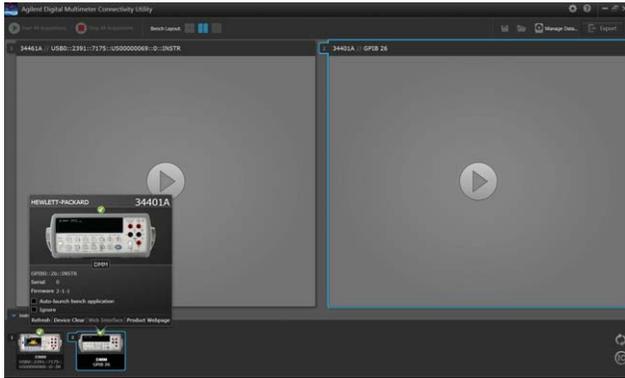


Figure 1. View of connected DMMs using PC app

Make a measurements and understand the data without learning the whole instrument

Engineers are often time constrained and don't necessarily want to spend time on extraneous activities. If you want to make a simple DMM measurement, you want to ensure that the instrument is fully set up and not missing a key parameter when running a test. Measuring multiple signals can be especially painful if you aren't familiar with the DMM or if you have differing generations of Agilent equipment. Agilent DMM Connectivity Utility's unified interface supports Agilent DMMs released in the last 25 years. The PC DMM app can communicate using RS-232, GPIB, USB, or LAN. With this I/O flexibility you can now use the same intuitive interface for all these DMMs.

Very few of us can look at a group of numbers and make quick, accurate judgments on the data set. Graphing the data is preferable, but sometimes it just takes too much effort to get a nice-looking chart that is easy to read and understand. The Agilent DMM app can help you understand your data visually, in real time, with time-stamped data. Its layout is intuitive and graphs are aesthetically pleasing. The app also has numerical outputs for those who need the raw data.

Agilent's DMM Connectivity Utility presents the full setup for given measurement functions. The app intuitively presents the DMMs as bench tiles. With this new app, you can now visualize the outputs of up to four different DMMs. The application has the ability to control and get measurements with up to 9 DMMs at a time. An intuitive bench layout allows you to see your virtual bench in a single, double, or four-tiled view.

To change parameters for each DMM, press the configuration wrench in each tile. This brings up the Measurement menu and the Data Logger menu in tabbed windows.

Let's go through a simple example that is a common test on many benches: measuring voltage and the current drain from a device.

Making simultaneous voltage and current drain measurements

In this example, we want to do a simple DCV measurement. Use the Measurement menu to select the DC Voltage measurement function. The context-sensitive Measurement tab now presents all the parameters you would want to use for DCV measurements for your DMM. You can then set up your second DMM to measure DC current in the second bench tile. See Figure 2 to see DMM1 set up to measure DCV and DMM2 set up to measure DCI.

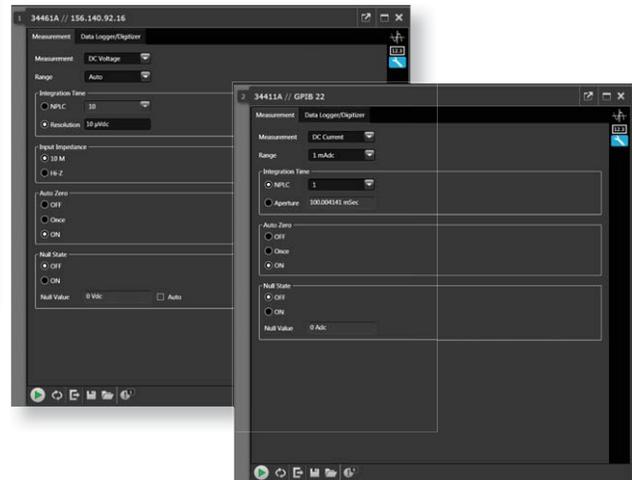


Figure 2. Configuration of two different DMMs shown side by side in the DMM Connectivity Utility

The Data Logger/Digitizer tab presents you with more advanced functionality such as trigger menus, in-program limit testing, and digitizing setups. This context-sensitive menu is dependent on your DMM model. New functionality allows you to set up the apps to email you when a measurement fails a limit. Let's set the triggering for both to be immediate triggering (you could also use an external trigger). Figure 3 also shows that we are stopping after 1 minute of sampling. You can set up the acquisition to sample indefinitely. That's all there is to setting up the synchronized sampling.

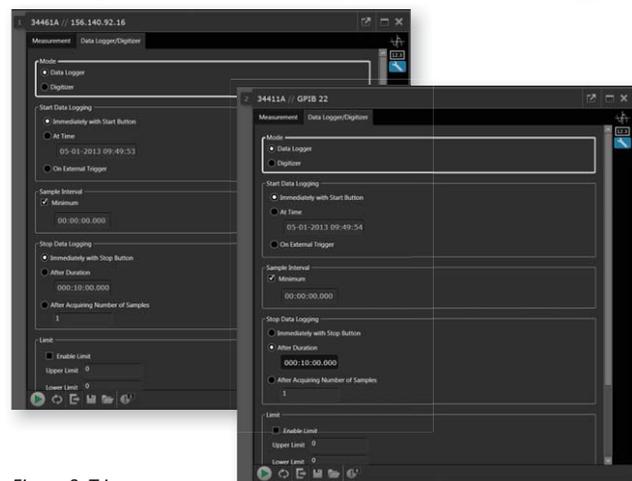


Figure 3. Trigger menus

To start gathering data, press the Start All Acquisitions key. This will automatically trigger all instruments you have set up. It also synchronizes measurements whether you are in single-tiled or multi-tiled bench mode. The data log chart is updated in real time, and you can see that the data points line up. The time stamp feature shows the time when the sample was taken. This allows for a quick understanding of measurement peaks, noise, or drift. Figure 4 shows the chart view of DMM1 (DCV) and DMM2 (DCI). This visualization allows us to understand the relationship between the two measurements graphically. You can control your DMMs and visualize the synchronous measurements in one program.

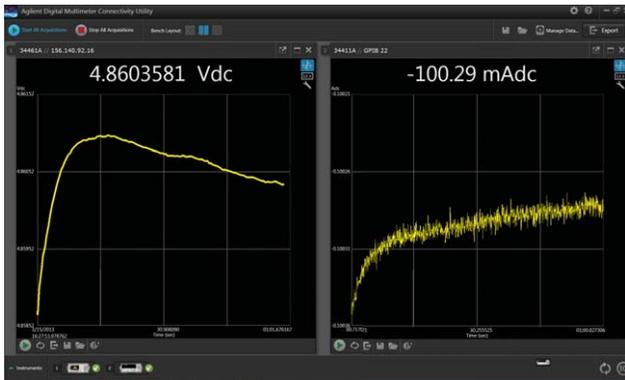


Figure 4. V and I curves with respect to time

In Multi-tiled view, the trend chart is the only graphing view available. You can set your bench layout to a single-tiled view and see the DMM's data as a histogram or table. You can toggle between multi-tiled view and single-tiled view modes without needing to re-acquire your data. You can do further analysis in single-tiled mode on the trend chart. Included in this mode are measurement markers that allow you to analyze the measurement between the markers, similar to an oscilloscope. Customizable features such as auto scale, zoom, and trace color allow you to modify your view of the data. You can annotate measurement events with in-program notes too.

You can also set up asynchronous measurements. To enable this mode, start with the single-tiled view. In the upper left-hand corner of the tile, you will see an icon that allows you to open the bench tile in a new window. This allows you to start the acquisition of this individual DMM separately from the rest of your bench.

What if you want to use your own program to look at the data? Once the measurements are finished, users can export the data into a variety of formats, as shown in Figure 5. Formats include Microsoft Excel, Microsoft Word, MATLAB, and .csv. The export menu also enables a quick screen capture. Exported data includes time stamps that indicate when measurements were taken, as shown in Figure 6.

The example we are using had different integration cycles for the two measurements, but how does this affect the data? Exported data, as shown in Excel in Figure 7 shows that the samples were taken at different intervals, with spaces in between samples. This makes it easier to understand that DMM1 is sampling faster than DMM2.

Time	Elapsed Time	34411A // GPIB 22 [Adc]	34461A // 156.140.92.16 [Vdc]
2	3/15/2013 16:27:53.589	0	-0.100363354
3	3/15/2013 16:27:53.647	0.058006	-0.100356533
4	3/15/2013 16:27:53.707	0.118012	-0.100356764
5	3/15/2013 16:27:53.766	0.177018	-0.100357721
6	3/15/2013 16:27:53.824	0.235024	-0.10036162
7	3/15/2013 16:27:53.881	0.292529	-0.100360224
8	3/15/2013 16:27:53.940	0.351535	-0.100360405
9	3/15/2013 16:27:53.997	0.408541	-0.100361915
10	3/15/2013 16:27:54.059	0.470547	-0.100356306
11	3/15/2013 16:27:54.122	0.533053	-0.100352622
12	3/15/2013 16:27:54.182	0.593559	-0.100349105
13	3/15/2013 16:27:54.241	0.652565	-0.100351679
14	3/15/2013 16:27:54.306	0.717072	-0.100357106
15	3/15/2013 16:27:54.363	0.774577	-0.10035131
16	3/15/2013 16:27:54.424	0.835084	-0.100350051
17	3/15/2013 16:27:54.484	0.89559	-0.100349439
18	3/15/2013 16:27:54.541	0.952095	-0.100352013
19	3/15/2013 16:27:54.602	1.013101	-0.100349256
20	3/15/2013 16:27:54.666	1.077108	-0.100354935
21	3/15/2013 16:27:54.728	1.139114	-0.100351043
22	3/15/2013 16:27:54.784	1.19562	-0.100348784
23	3/15/2013 16:27:54.841	1.252125	-0.100347318

Figure 7. Raw data in Excel

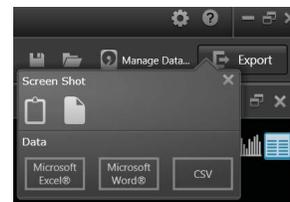


Figure 5. Export menu

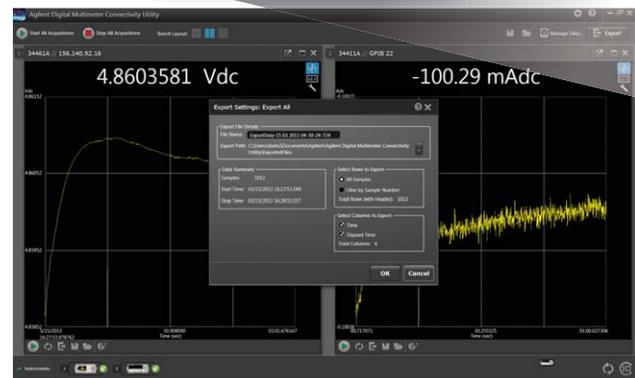


Figure 6. Exporting the data into a file

If you forget to save your data, Agilent's DMM application can help. The Data Manager (shown in Figure 8), accessed through the Manage Data button, keeps track of data from past sessions. This data is stored in a file on the PC and can be deleted or copied like other PC files. You can open past data sessions and use the same DMM tools to analyze your data just like if you had just acquired it. With this feature, you can go back 20 years and look at the measurements you made when you first started using a DMM. A more practical use case would be to transfer groups of measurements to another PC, then view the data in the familiar Agilent DMM application.

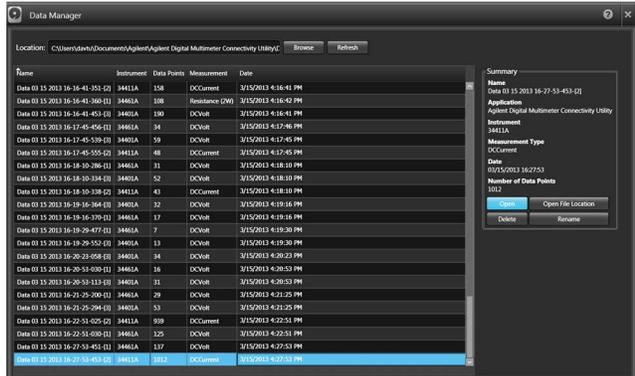


Figure 8. Data Manager

Summary

With the Agilent Digital Multimeter Connectivity Utility, you can save time and effort. Benefits include:

- Measuring multiple signals synchronously is simpler than ever.
- Synchronize your measurements in minutes.
- Set up your DMM and gather data in less time than you would spend for wiring up your measurement.
- Understanding your data just got easier; visualize it immediately or export it to popular tools such as Excel or Word.
- Understanding your sampling is simpler when you can see if the DMM's are measuring at different intervals.
- Go deeper into your data by looking at each instrument's measurements graphically or numerically without having to take the data all over again.

This application helps you use your equipment right away, without the learning curve. Agilent's DMM application is available for free download from Agilent.com.



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