MEASUREMENT BRIEF

No Programming Required: Digitizing Signals and Analyzing Data with a DMM

Introduction

Agilent digital multimeters are ubiquitous on work benches and in automated test systems. You have most likely used one at some point in time. They measure basic electrical properties and give you a clear reading. More sophisticated DMMs have higher precision, data logging capability, and higher measurement speeds. If your DMM has these capabilities, you can use it to digitize your signals. Digitizing is useful to understand your signal better, and you can plot the data for a visual representation of your signal. Digitizing with your DMM has been simplified with the Agilent DMM Connectivity Utility.

This measurement brief explains how the new Agilent DMM app can help you digitize your signals and understand your data faster. In a couple of clicks, it can graph your measurements. The app also synchronizes multiple DMMs and allows you to put together a multichannel DMM system.

Snapshot

A mechanical engineering student was designing an airplane wing for his fluid dynamics class. In order to evaluate the flex of the wing under different conditions, he needed to be able to measure forces on the wing in at least four different locations. He had some force transducers that change resistance depending on strain, these sensors were as old as he is. Since he is an undergrad, he did not have access to the really expensive equipment that the Graduate students use. He realized that he had access to the electronics' lab equipment to borrow a few DMMs. The student downloaded the Agilent DMM Connectivity Utility and used the app to setup his measurement. He was going to take lot of discrete data points then put the data together in Excel later. But he found out that he can use this app to digitize all four points and graph the data right away. In an afternoon, he's able to digitize the tranducer outputs in parallel and sweep through all of the test conditions. He then spent the rest of the weekend "studying".

Simplified Digitizing

If you digitize your signals, you can analyze transients, non-repetitive signals, and other AC waveforms in the time and frequency domains. You use fast sampling techniques to understand your signals better. Focused off-the-shelf solutions, such as a digitizer or high-precision scope, often cost more than $10K and they may not offer the resolution you need for your measurement.

A general-purpose DMM can digitize signals, but it is not the first instrument that comes to mind when you think of digitizing. Historically, DMMs were set up to make discrete measurements with varying sample intervals. Newer DMMs have deterministic sample intervals and sampling models that allow for digitizing your signal. DMMs are flexible, have up to 22 bits of resolution, and are relatively inexpensive. The DMM has the added advantage of being able to digitize resistance, current, and temperature straight out of the box. A new Agilent DMM software app makes it easier to set up your test, gather your digitized data, and visualize it in the time domain.

The app supports DMMs with digitizing capabilities which include the 34410A, 34411A, 34460A, and 34461A. The PC DMM app can communicate to these DMMs over GPIB, USB, or LAN. With this app you can now use the same intuitive interface to set up digitizing for those DMMs.

Agilent's DMM app will help you set up for your measurement functions. The app presents the DMMs as bench tiles on your computer screen. With this new app, you can now visualize signals on up to four different DMMs at the same time. Using the application, you can control and make measurements with up to nine DMMs.

MEASUREMENT TIP #1

Sample Intervals

When you use a DMM for data logging or digitizing, you will want to minimize the variation in the timing between samples. Eliminating the sources of additional delays can improve the consistency between readings. The time required for autoranging, range changes, auto zero, performing math functions and updating the display can add to the variability between measurements. See measurement tip "Improving Digital Multimeter Throughput", 5990-3218EN

Rather than insert a trigger delay between one sample and the next, use a sample interval. A sample interval specifies the time to wait after a trigger event has occurred before making the next measurement. Using a DMM that allows you to specify a sample interval instead of a trigger delay allows precise sampling times, even when you are using features such as autoranging and auto zero. For more information, see "Data Logging and Digitizing Using a Digital Multimeter", 5990-3220EN

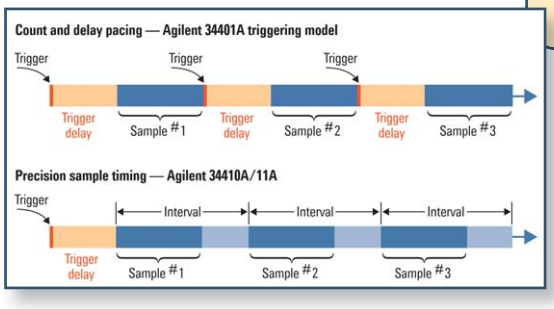

Figure 1. Setting the sample interval specifies the timing of the measurements rather than the delay between samples.

Setup for Digitizing Measurements

To change parameters for each DMM, press the configuration wrench in each tile. This brings up a Measurement menu and a Data logger/Digitizer menu in tabbed windows. Let's go through a simple example: digitizing a simple waveform. The waveform we want to capture is a model of a cardiac pulse.

In this example, we want to make DCV measurements. Use the Measurement menu to select DC Voltage as the measurement function. The context-sensitive Measurement tab now presents you with all the parameters you would want to use for DCV measurements for your DMM. Figure 2 illustrates a typical setup for DCV measurements.

Figure 2. DCV setup

MEASUREMENT TIP #2

Easier Connections

Use Agilent IO Libraries Suite to make identifying DMMs connected to your PC easier. Instruments with direct connections like USB and GPIB will auto-identify and be recognized upon boot-up of the program. DMMs connected via LAN and RS-232 require a configuration step in Agilent Connection Expert, which you can access through the DMM utility.

Agilent DMM Connectivity Utility's unified interface supports Agilent DMMs released in the last 25 years. It supports older models, including 34401A, 34405A, 34410A, and 34411A as well as our latest-generation 34450A, 34460A, and 34461A DMMs.

The Data Logger/Digitizer tab presents you with more advanced functionality such as data logging and digitizing setups. The content of this context-sensitive menu is dependent on your DMM model. Under the data logging menu you can find trigger menus, in-program limit testing options and sample interval settings. New functionality allows you to set up the apps to email you when a measurement exceeds a limit. Using this mode, you can visualize live data as the measurements are taken.

Under the Digitizing menu, you'll find the settings for the most common digitizing configuration using a single trigger to sample multiple readings (see Figure 3). By using this menu, your sample interval is set to the minimum value. In this mode, the samples are taken and stored inside the DMM. After the data has been acquired, it is transferred to the app. This minimizes any sample timing error due to data transfer rates.

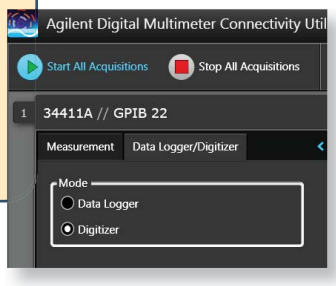

Figure 3. Digitizer Configuration menu

As we mentioned earlier, you can set up your bench to digitize multiple signals using this app. For more information see "No Programming Required: Multisignal Capture and Analysis with DMMs", 5991-2283. After setting up your digitizing configuration, pressing Start All Acquisitions will start the measurements for all DMMs you have on your bench. Once you have the data, you can visualize it using the app's graph mode, as shown in Figure 4.

Figure 4. Digitized data

Analyzing Digitized Data

The Agilent DMM apps can help you understand your data visually in real time. The application has a trend chart mode that displays your data across time. This capability allows for a quick understanding of measurement peaks, noise, or drift. Similar to an oscilloscope, this mode features measurement markers that allow you to analyze the measurement between the markers,. Customizable features such as autoscale, zoom, and trace color allow you to modify your view of the data. You can annotate measurement events with in-program notes too.

What if you want to use your own program to analyze data? Once the measurements are finished, you can export the data into a variety of formats (see 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 of when measurements were taken.

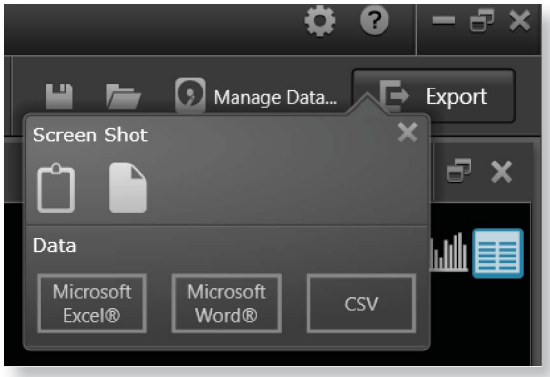

Figure 5. Export menu

If you forget to save your data, Agilent's DMM application can help. The Data Manager (shown in Figure 6), accessed through the Manage Data button, keeps track of data from past sessions. The data is stored in a file on the PC and can be managed like other PC files. You can open past data sessions and use the same DMM tools to analyze your data as 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. You also can use this capability to transfer groups of measurements to another PC, and then view the data in the familiar Agilent DMM application.

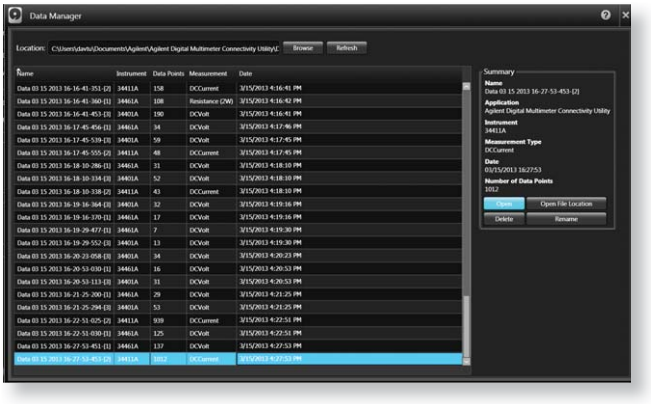

Figure 6. Data Manager

Summary

Simple digitizing can be done using a DMM. The Agilent Digital Multimeter Connectivity Utility enables you to save time and effort. You can digitize multiple channels in parallel with synchronized measurements and set up your DMM and gather data in less time than you would spend wiring up your measurement. Understanding your data just got easier; you can visualize it immediately or export it to popular tools such as Excel or Word. This application enables you to use your equipment right away, without a long learning curve. Agilent's DMM application is available for free download from Agilent.com.

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