Datalogging tools for manufacturing research, development, and test

Application Note

Testing Functions
Case Study

Measuring tools: Fluke ScopeMeter™ 190 Series Test Tool, 884X Precision DMM, and 189 handheld DMM

Operator: Steve Sakaki, Electronics Engineer, Sendx Medical; Steve Sparks, Entrepreneur; Gary Allen, Fluke Biomedical; Dr. James Stine, Professor

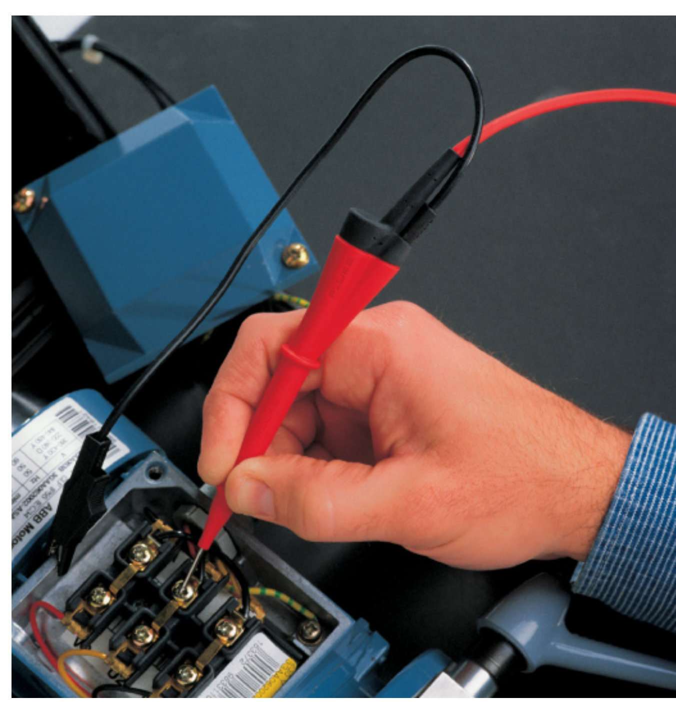
Tests performed: Measuring voltage, current and resistance; waveform analysis; checking for shorts in diodes and capacitors; datalogging with FlukeView Forms software

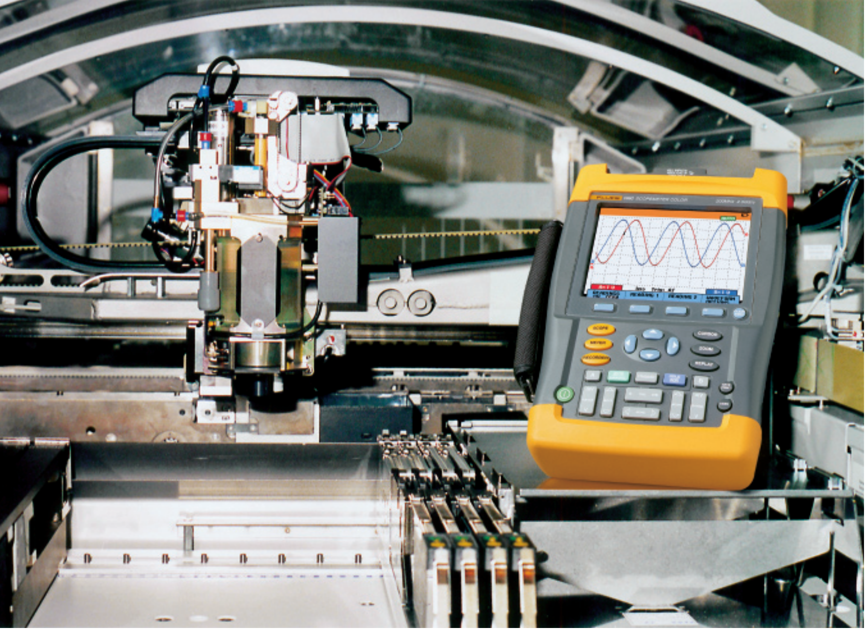
The ability to log and/or capture data is invaluable in tracking down elusive malfunctions and other fleeting phenomena. This group case study looks at how users in manufacturing, research, development, and test are using three Fluke instruments—the 884X precision DMM, the ScopeMeter 190 series, and the handheld 189 DMM—to log and retain measurement data for analysis.

Analyzing medical electronics

Steve Sakaki is an electronics engineer with Sendx Medical, in Carlsbad, CA, a maker of blood analyzers for laboratory and hospital use. The analyzers work with sensors—for blood oxygen, carbon dioxide, glucose, pH, sodium, potassium levels or pH—that produce a voltage output. "We process the signals on an analog-to-digital conversion," says Sakaki. "It sends the digital data up to the CPU and the software processes all the data to give you results." Sendx designs its own circuit boards, and the ability to make accurate measurements on all parts of a board is essential to producing a reliable product.

In the past, says Sakaki, Sendx used older model DMMs from Fluke, but felt the need for greater resolution and the ability to do data logging. He chose the Fluke 189 handheld DMM. "If there is a problem with the board," he says, "we use it as a voltage meter, measuring current,





resistances, sometimes checking components like capacitors and diodes to see if they're in operation or not, or if they're shorted."

Sakaki finds one of the most useful aspects of the 189 DMM is its built-in data logger. There have been times, he says, that it was necessary to look for momentary voltage drops in the analyzer's power supply. "Using FlukeView Forms software I'm able to data log, say, about 8 to 10 hours of data and then graph it out and show people what's going on," he explains, "for just drops and noise in voltages and things like that over long periods of time."

Catching bad waveforms

Steve Sparks is an entrepreneur working to bring a new low-cost soil moisture meter of his own design to market. Given the increasing cost of water and other inputs, the ability to "close the loop" on the irrigation process is essential to prevent both under and overwatering.

During the development of his moisture meter, Sparks makes use of a Fluke 199C ScopeMeter® Test Tool. One example he cites is the discovery of subtle malfunctions inside his unit. The problem couldn't be detected with a voltmeter or ammeter because it involved distorted waveforms that such an instrument can't pick up. With the 199C, however, the problem was immediately apparent.

There are other places, like triggering signals, where only the ScopeMeter will work. "If I measure with a meter I'm just getting an average reading," he says, "because the response time is so slow." With the ScopeMeter, on the other hand, "I'm going to see that little blip."

Sparks also uses the 199C to measure current, using a clamp-on ammeter probe connected to the meter input. "I preferred this setup because there were some signals I wanted to measure and I didn't want to break the circuit topology every time, and the clamp had the 1 mA resolution I needed. By using the clamp-on ammeter plugged into the scope probe input BNC connector, which supported the "Scope Record" for waveforms, I could see current changes in relation to voltage changes as waveforms thereby getting very clear switching relationships."

The 199C's waveform acquisition memory allows Sparks to store and print out images of waveforms so they can be analyzed and e-mailed. "With the scope I can record a waveform and then use that waveform to talk to experts on a certain device or certain area," he says. Attempting to explain all the details of a waveform in words is difficult. "I can describe something to you and you kind of have a picture," he says. "I can't describe to you the magnitude, the crispness of the waveform, how much noise is on the waveform." The ability to store and output a waveform plot changes everything "if I can show you that waveform."

Sparks finds the 199C's memory useful in other areas as well. "I can do a time sequence, meaning I can capture it over maybe 10 or 15 seconds," he says, "and then I can zoom into a particular area of that waveform. Yet, I have the whole waveform over a period of ten seconds, which allows me to show what this thing's doing over time; is there a drift problem, is there anything I don't like over time, not just an instantaneous transition point."

Validating medical equipment with a bench DMM

Gary Allen is a product validation engineer at Fluke Biomedical, where he tests biomedical instrumentation. One of the devices he uses frequently is a so-called patient load, which simulates the resistance across human skin at mains voltage and is used for checking for current levels that hospital equipment under test might apply to an actual patient. Many of the pieces of equipment he tests contain switching power supplies, which operate at high frequencies, so instrument bandwidth is important.

The effect of electricity on a human varies considerably with frequency. The heart, for example, is exceedingly sensitive to currents at 60 Hz, and many of the tests required by U.S. and European safety standards are centered there. As the frequency increases, the sensitivity of the patient load decreases, "because our nervous system stops responding at higher frequencies," says Allen. Of course, high frequency currents can still be dangerous, he adds; they're just perceived as heat, rather than as a shock, and tissue damage can occur without immediate pain. For that reason both ANSI/AAMI ES1 and IEC 60601-1 require measurements to beyond 100 kHz.

Allen had been using an old 4 1/2-digit bench-type DMM, but it was too low resolution, and its maximum input frequency was 20 kHz. That forced him to use several piece of equipment to complete his tests. With his new Fluke 8846 6 1/2-digit bench DMM he can measure out to 1 MHz, if necessary, and use just one tool for the job. The new 8846 is also just plain easier to use. "The interface is very intuitive," says Allen, "and that's huge on my list of nice features. The 8846A is so easy to use, it can spin circles around my other tools. Personally, I think that's priceless."

Allen plans to make use of the new DMM's Agilent 34401 emulation mode for remote control. "There's a driver for that instrument in National Instruments LabView, a test automation tool that I plan to use for automating my frequency response, voltage, current and resistance tests. Because of that, I won't have to write my own instrument driver for LabView. That's an important time saving feature for me."

Looking to the future, he says "I think if I get to the point where I do remote black box testing, or if I just want to automate my frequency response test, the patient load frequency response test could be automated without compromising the effectiveness of the product validation."

Using a handheld DMM in VLSI development.

Dr. James Stine is an associate professor in the Department of Electrical and Computer Engineering at Oklahoma State University, where he directs the VLSI Computer Architecture Research Group. He uses logic analyzers and high-speed oscilloscopes in his work, but one of his most versatile instruments is a Fluke 189 handheld DMM, which he uses to measure voltages on all parts of the chips he's developing.

Some low-speed designs may use as much as five volts, but where high speed is important the levels are around one volt. And in those circuits, he says, "the noise margins between the circuits are very small, sometimes 0.5 V and downwards."

Sometimes he uses the 189 DMM in a test setup and other times by itself. With the 189, he says, "I can use it whenever I want. It's very useful. Even though I'm not really in the field, I can use it on whatever bench I want."

Dr. Stine also uses FlukeView software for datalogging with the handheld DMM. "I can measure off the port, and I'll measure certain values to see how it reacts during certain switching activity."

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