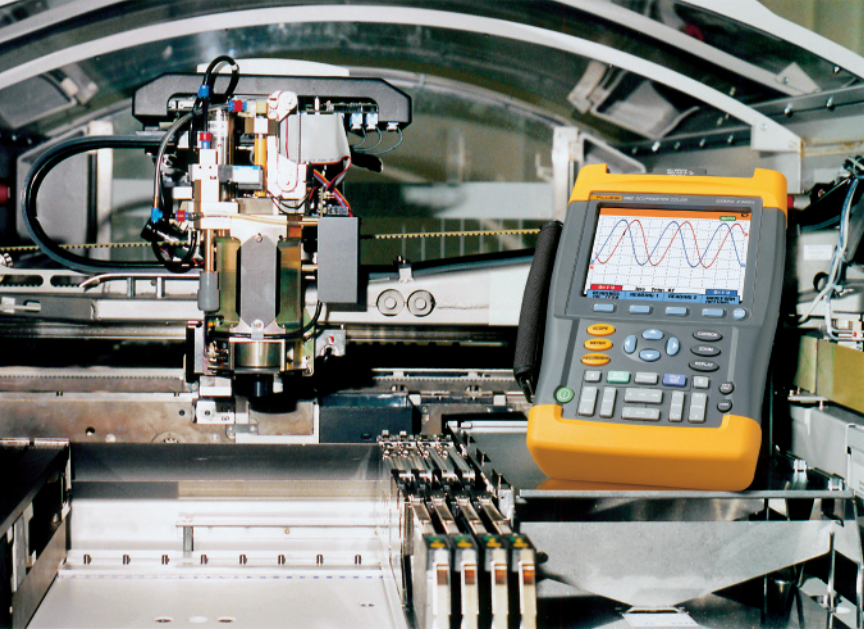

resistances, sometimes checking components like capacitors and diodes to see if they're in operation or not, or if they're shorted."

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.