The power of a waveform:

Expanded troubleshooting options with the Fluke 345 Power Quality Clamp Meter

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Application Note

Electricians are discovering that the new Fluke 345 goes beyond simply monitoring voltage or current. It displays waveforms and harmonics, performs power measurements for power-factor evaluations, measures inrush current, and logs data over time for later analysis.

Like other test and measurement equipment from Fluke Corporation, the Fluke 345 Power Quality Clamp Meter was designed based on input from electricians, electrical contractors, maintenance personnel, and other test tool users.

What customers requested

- **More capabilities in a single meter.** The Regional Justice Center for King County, Washington, served as a Beta test site for the Fluke 345 Clamp Meter. Before receiving the instrument, Paul Swanson, a lead electrician at the site, used a digital multimeter (DMM) and a clamp meter to do his job. He says, "The 345 adds a visual representation of what I'm monitoring. When I use a DMM, I might be able to detect a little variation in voltage or current, but there's no indication of what's causing it."

  By contrast, the Fluke 345 simultaneously displays readings and waveforms for voltage and current. "You can see things with the 345 you can't see with a DMM," Swanson observes. "I probably could log the same data with a ScopeMeter® test tool, but it wouldn't be as easy. With the 345, I simply clamp on, set the function selector, and read both the current and the voltage simultaneously. That really helps with troubleshooting."

- **A clearer, more easily read display.** According to Frank Healy, marketing manager for Fluke power quality products, the improved, color display is a direct result of customer feedback. The clarity and color allow users to distinctly view multi-channel information. In waveform mode, for example, current and voltage waveforms are separate and clearly defined. The color also improves other current and voltage views, harmonics, and load.

- **An external power supply.** While an external power supply may not seem like a breakthrough, engineering a tool to be both CAT IV 600 V safety rated and externally powered is no small feat. But why an external power supply?

- **Long-term logging capability.** Strictly battery-powered instruments can't perform long-term sampling. The batteries run down. But customers needed long-term sampling to track intermittent faults and other hidden power quality problems. When the Fluke 345 is connected to an external power source, sampling time is limited only by the memory capacity of the instrument and the sampling rate.

- **The ability to monitor both ac and dc loads.** When it comes to long-term data logging, users of earlier meters said they needed to monitor single-phase ac and dc loads. Healy notes that most loggers only read ac. Some are dc-only loggers. By contrast, the Fluke 345 offers ac current monitoring up to 1400 A and dc up to 2,000 A.

  The dual-current capability could only be engineered into a clamp meter. Healy explains: "There is no technology available for measuring dc current using a flexible probe. So, the clamp itself is a Hall-effect sensor, and it can measure ac and dc current simultaneously. By contrast, a Rogowski-type device can only measure ac. We wanted one self-contained tool that didn't need extra leads to measure current."

- **A large, flexible memory configuration.** The Fluke 345 has three distinct memory locations, where three separate logs can be stored at the same time. Using this feature, an electrician can go into the field and make a log of, say, twenty minutes and then hour-long logs in two other places, all without returning to the office to download data.

  Alternatively, if the electrician needs to sample data for a longer period, the logger can be left at a single location for an extended period of time. There, it can store data in all three memory areas during the sampling period. According to Healy, an electrician could record for hundreds of days, depending upon the averaging period (sample frequency). The data is stored in memory, and, following downloading to a PC via USB, can be analyzed using the Power Log software shipped with the instrument.

- **The ability to easily measure inrush.** When a motor starts, some electrical systems may experience a surge in load demand called inrush. It can be enough to trip breakers, dim the lights, and cause other anomalies. To log inrush data on the Fluke 345, says Healy, "just set the trigger level for current and put the instrument in pulse. Then, when the meter sees a high level of current, it finds it and captures its characteristics."

  Swanson ties the easy monitoring of power-switching events—the rapid adding or removing of loads from a system—to the Fluke 345's versatile data storage capabilities. "I was happy to discover that regardless of the sample frequency, the instrument records peak, low, and average readings—all three. If I take the time to do the math, I can even figure out the duration of an event."

Who's the Fluke 345 designed for?

While the Fluke 345 Power Quality Clamp Meter was designed with many users in mind, Frank Healy says utility trouble-shooters and field install/service techs will find it especially useful.

Utility personnel can use the Fluke 345 to measure high current on large cables, thanks to the oversized jaws and current rating to 2,000 A dc. Most clamp meters are limited to 1,000 A.

Electrical maintenance personnel can use the Fluke 345 as a predictive maintenance tool. "With this meter," says Paul Swanson, "we could regularly measure the secondary on our VFDs, establish operational bench marks, and watch for conditioning issues and other potential problems. We'd establish the nominal operating parameters for each drive's output, like taking snapshots and storing them. Then, we'd go back every six months or every year to see if there had been any noticeable deterioration on the drive output waveform."

Installers and maintainers of UPSs, VFDs, and other switching loads will appreciate the meter's ability to measure both ac and dc, as well as its low-pass filter. With a 345, an electrical technician could go through a UPS checking the input currents and inrush and look for harmonics. Inside the UPS, the tech could check the dc link and see the dc current prior to conversion into ac on the opposite side.

Swanson explains that instead of one large, centralized UPS, the King County Justice Center has 38 UPS units throughout the facility. They supply backup power to the computerized security and alarm systems and to various computer networks. "We've spread out the UPSs," Swanson explains. "We have more points of potential failure, but when one does fail it takes less out of our system."

In monitoring a UPS, Swanson asks questions that the Fluke 345 waveform display can answer: What do my input and output look like? Do I have harmonics? Is the UPS deteriorating in any way? "Both on the input and the output, I can see if anything's being pushed out onto the lines," Swanson says, "and I can determine whether the UPS is actually doing its job. I might be able to do some of that with a DMM, but the findings would be much less clear."

Swanson, who has responsibility for a large number of VFDs as well as all those UPSs, says that the Fluke 345 would help him keep the motor drives performing well and protect against problems the drives might cause in the rest of the facility. "The scope function on the 345 gives me an opportunity to look at waveforms, which can show me irregularities," Swanson notes. "I could detect any kind of distortion that may be coming in on the power line or harmonics that could be generated by the drive itself and going back onto the grid. I need to know if the drive is creating anything that could be detrimental to other equipment." With the low-pass filter, the 345 can accurately read VFD output without interference.

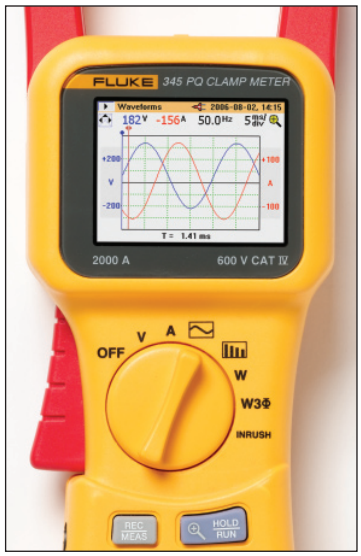
The Fluke 345 is also useful for low-power applications. "I'm often looking at the low-power end of things," Swanson acknowledges, "and asking, 'What noise is hitting my electronics?' If something affects my alarm system or my essential computer systems, I've got problems. That's my primary concern."

Adding new loads

Whenever a facility brings in new pieces of production or process equipment, that adds new loads to existing electrical supply systems. Because the Fluke 345 can take power measurements (watts, VA, VAR, volts, amps, and power factor) in both single-phase and balanced three-phase power systems, the instrument allows users to determine circuit loading and thereby judge whether it is safe to add more load or if a new circuit is required

Then, while connecting the new equipment, the electricians can use the Fluke 345 to measure the loading of the equipment as it is installed. Finally, they can check post-installation harmonics to see whether the new equipment is operating as predicted or if it is producing new, possibly harmful harmonics or contributing to other problems. For initial installations of new plant and equipment, plant personnel will want to look at current waveforms and voltage waveforms to how the installed equipment is affecting supply components and other equipment.

Power measurements are also essential for identifying and correcting low power factor, a cause of high utility bills. In fact, the Fluke 345 offers the ease of use, portability and flexibility needed to solve most electrical problems in commercial, industrial, and residential settings, when standard instruments do not provide answers.



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