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In a pinch, use your DMM and clamp as a gauss meter

Application Note

Put a handful of guys who use tools together, leave them alone for 20 minutes and watch the ideas fly.

That's what happened when Chuck Newcombe, a power quality specialist, happened to end up talking with a group of colleagues at a power quality conference. Before you could say "transformer," Newcombe and the group were figuring out how to use a couple of test tools you likely own right now – a digital multimeter and a basic current clamp – as a rough gauss meter.

It turns out these two common test tools can do a pretty fair job of basic electrical field troubleshooting. That probably comes under the heading of "cool things I didn't know I could do with my DMM but will never try" – until you happen to suspect faulty wiring deep in a wall or harmonics in an industrial power supply panel. Then it might be handier to grab your DMM and current-transformer current clamp to do a quick bit of assessment. The tools, working together, will give you some rough information. Enough to know if you're going to have to go find that gauss meter or call in a specialist.

The basic idea is simple. Correctly wired electrical systems are pretty self-contained. Properly routed and grounded circuits allow currents to flow back and forth in ways that neutralize strong electrical fields outside the system's conduits. If a building is mis-wired, however, as it could be if its electrical system was improperly grounded or if it had been incorrectly installed, electrical field readings can extend significantly beyond the conduit system itself, even through walls. That's the type of problem that can be quickly pinpointed, if not diagnosed.

Basic electrical field readings can be useful in the broader environments of office and light industrial electrical and electronic monitoring, as well. "People are concerned about electrical fields radiating from video terminals and computer screens," Newcombe said. "This will give you a rough idea of what's going on and how far those fields extend from the monitors themselves. Typically not far. The readings should drop quickly. If they don't, you'll know you've got a problem."

The readings you receive with a DMM and clamp accessory won't be calibrated. They're primarily presence indicators. You'll know whether something is there or not; something that might require a closer look. Then once you know you might have a problem, you can start homing in on the solution.

It's easy. All you need is a DMM with an ac millivolt function and a halfway modern current transformer-type current clamp. Plug the clamp accessory into the volts jack and set the DMM to read ac millivolts. (Note that this is not the usual hookup for a current transformer. You would normally use the mA function.) Even with its jaws shut, the clamp will provide some level of voltage reading. Open its jaws and the two prongs act as an antenna, allowing it to make more sensitive readings of ac electromagnetic fields. To increase the sensitivity even further, use insulated wire to make a multi-turn coil about 12 inches in diameter. Close the ends and stick the closed-loop coil in the clamp meter's jaws. You've created a pickup coil that can be slipped into narrow spaces.

It's also possible to switch the DMM to its Hz setting to see what Hz readings you pick up. A reading of 60 Hz tells you the electrical field is caused by the building's power system. Higher frequencies may indicate harmonics (180 Hz = the third harmonic of 60 Hz) or suggest that the fields may be coming from an electronic device.

Theoretically, you could take the same types of basic electrical field readings with an oscilloscope or ScopeMeter®, but those tools typically are less readily available during ordinary service operations, and their higher level of sensitivity, while providing more information, almost makes them harder to use for basic detection purposes.

To demonstrate the DMM/clamp meter system, Newcombe approached a closed power panel in an industrial manufacturing plant. Readings quickly appeared – first basic hash from a mish-mash of surrounding low-level fields typical of any setting powered by electricity, then significantly higher readings as he approached one of the building's main transformers.

He next switched to the Hz function and 180 Hz flashed on the meter's display.

"This tells me there are some harmonics coming out of this transformer," he said. "It's a higher harmonic level than I'd expect to see. If I took a series of readings over time and these levels persisted or got larger, I'd want to look at the voltages and currents in the panel with my ScopeMeter or power quality analyzer to get more in-depth information."

Moving around the building, the DMM/clamp meter registered low-level fields around another panel's main switches. Readings climbed near the closed panel of a large variable speed motor drive. "You'd see all kinds of hash here with an oscilloscope," Newcombe said, moving the clamp meter over the closed panel door with its jaws held open. Later, in front of a computer monitor, readings climbed a bit when held within an inch or so of the screen, then dropped dramatically a few inches out. "They go down real fast the further away you get," he said.

This seat-of-your-pants system will never replace a gauss meter, but it's a quick way to see if an electrical field is out of whack if all you happen to have with you are your basic test tools. And it's worth a wager or two if you have work mates who haven't run across the trick.

"You don't have to bring along an extra tool. That's the advantage," Newcombe said.

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