FLUKE®

DMM vs. Clamp Meter

Application Note

A clamp meter with an inrush function can greatly reduce the time needed to troubleshoot a motor problem.

What you know about DMMs and clamp meters can make a big difference to your bottom line.

How well you equip yourself to do your work plays a big role in your success. When it comes to electrical test equipment, are you sure you have the right tools for the job? You can answer that question correctly, but only if you assess your measuring needs and know a few things about DMMs and clamp meters.

We often think of a DMM as a direct contact instrument and a clamp meter as an inductive instrument. This leads to the erroneous conclusion that the only real difference is the input method. However a clamp meter is not a DMM with a set of inductive jaws replacing the test leads. These are two distinctly different instruments, each with its own advantages. A DMM is essentially a voltage-measuring tool with some current abilities, while a clamp meter is essentially a current-measuring tool with some voltage abilities.

The DMM allows you to do *electronic* work, because of its high resolution—it measures in milli-units (e.g., millivolts, milliamps, and milliohms). It also allows you to do *electrical* measurements, except for current. You can do electrical current measurements with a DMM if you use a current clamp accessory. However, for about the same money, you can have a separate clamp meter to go with your DMM. This really pays off, in ways we will discuss in a moment.

The clamp meter measures to the nearest tenth of a unit, rather than in the milli-units you find in a DMM. In electronic work, this is rarely sufficient resolution, but in electrical work it's perfect.

Measuring situations

Using test leads rather than a clamp usually makes it easier to measure voltage on the load side of a breaker—and it's obvious you need leads to measure voltage at a wall receptacle. Many clamp meters have test lead jacks—does this mean a clamp meter with test lead jacks is all you need? Not if you consider some other measurement situations. What if you need to measure current on a cable and voltage at a terminal—simultaneously? Industrial situations often call for simultaneous measurements. For example, you may need to:

- Measure an analog conveyor speed signal and the respective motor current simultaneously, so you can calibrate the system for the required process flow.
- Monitor solenoid output, while monitoring input from the PLC, so you can test the solenoid.

- Simultaneously measure electronic voltages and electrical currents at a motor drive, to troubleshoot line speed fluctuations.
- Monitor feeder voltage and current simultaneously, to troubleshoot nuisance trips.

Simultaneous voltage and current measurements are simply part of troubleshooting. The catch? You can't do simultaneous measurements with one meter, unless you step up several price ranges into equipment used for power quality work. Thus, to be an effective troubleshooter, you need two meters: one to measure electrical current and one to measure voltage. Having both capabilities in the same instrument, whether built-in or via an accessory, doesn't give you two-instrument capability—nor is it the most cost-effective approach.

But, don't fall into the false economics of buying one good meter, then buying a second at the low end of the quality spectrum. A "cheap" meter might be accurate enough for low-level troubleshooting, but its "cheap" safety design may short-circuit your career—permanently.

A cost-effective and sensible approach is to buy one quality instrument designed primarily for voltage (DMM) and another quality instrument designed primarily for current (clamp meter). To implement this strategy, take a close look at what's available in each type of instrument and use what most closely fits your measurement needs.

The exact combination of test equipment depends on the type of equipment you work on, and the types of measurements you need to make. For example, you may want:

- A basic DMM, because your job requires only the basic voltage measurements.
- A high-end DMM, because your job involves power quality work-you need the high resolution and advanced features not found on clamp meters.
- A basic clamp meter, because you just need to ensure all three phases on your feeders are pulling the same current.
- An advanced clamp meter with some logging capability, because you have intermittent breaker trips that you need to resolve.
- A specialized clamp meter that can accurately measure motor inrush current If you do motor maintenance on production conveyor motors, HVAC motors, and plant air compressors, knowing motor inrush current is crucial for keeping these systems running.

Clamp meter "Special Forces"

Just as clamp meters differ from DMMs in measurement abilities, so do some clamp meters vary from others in measurement abilities. Did you know some clamp meters allow you to see what is going on in the power supply to a particular motor during start-up? For example, the Fluke 335, 336, and 337 clamp meters use a proprietary algorithm and high-speed digital signal processing to filter out noise and capture the starting current exactly as the circuit protector sees it.

Why did Fluke develop these specialized clamp meters? Existing meters didn't show end-users what motor circuit protectors experienced, even with peak hold, max hold, and min/max hold. Nobody had studied the current draw profile of a motor in start-up to see how that profile affects breakers and overload units. The industry needed a way of synchronizing the measurements with the motor start-up so the measurements would be accurate and predictable.

The result of this was a series of clamp meters that, when armed by the operator, will detect an inrush condition and immediately start recording a large number of samples during a 100 ms period. At the end of the sampling period, the meter processes the samples and tells you the actual starting current. This is more than just an indication of motor health. For example, you could see "that nuisance trip" is actually a correct breaker function. It's there because of an abnormal condition that you now know to fix before losing the process in the middle of a production run. You can also identify a breaker that *should have* tripped on excessive inrush—or that incorrectly tripped when inrush was normal.

Bottom line improvement

We all know it's costly not to have the right tools for the job. If you've been in this business a while, you've managed to accumulate a variety of screwdrivers. Why not just one screwdriver? Because you are already practicing the concept of having the right tool for the job—even with a tool as simple as that. So, it makes good sense to apply this same concept to your measuring tools.

A thoughtful assessment of your measurement needs—and the tools you use to fulfill those needs—is a good step toward reducing the number of equipment failures and the time it takes to get running again when failures do occur. If you haven't done this assessment in a while, now is probably a good to start doing one.

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