

DMM vs. Clamp Meter

Application Note

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.



A flexible current probe allows you to measure the current in several conductors at one time—a difficult undertaking using only the clamp jaws.

We often think of a digital multimeter (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. They 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 (for example, 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.)

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

In the past, using test leads rather than a clamp usually made 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 had test lead jacks,

which worked in some (not all) measurement situations. The new generation of clamp meters utilizes the iFlex™ flexible current probe. With the iFlex™ you can squeeze between tightly packed wires or around large conductors.

Let's consider some specific measurement situations. For example, you might 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. For electricians, a clamp meter is the most versatile diagnostic tool available. Persons doing industrial troubleshooting benefit from a separate clamp and DMM.

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 might need a low-pass filter on your clamp meter to eliminate electronic interference that might distort readings. Here are some ideas on what you might 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 DMM or clamp meter with a detachable display that can be separated 30 feet from the body of the clamp, so you can take remote readings more safely and without having to wait for a co-worker to help you.
- A 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.
- A clamp meter with advanced signal processing to give you stable readings in voltage, current and frequency when measuring the output of a variable frequency motor drive in a noisy electrical environment.

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 374, 375, 376, and 381 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 millisecond 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.



Use the detachable display of a specialized DMM or clamp meter to take remote readings.

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 to occur. If you haven't done this assessment in a while, now is probably a good time to start doing one.

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