

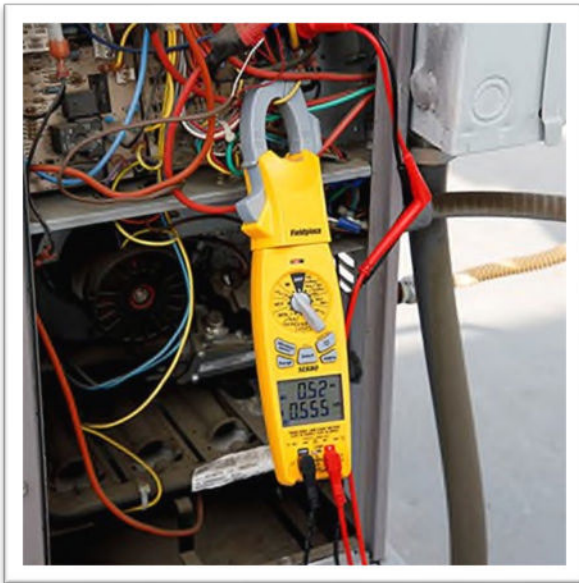
TECHNICIAN'S CORNER: Electrical Meter Operation & Safety

By Kelly McCann as featured in the PBACCA Newsletter, The Plenum

One of the most common tools we count on is our electrical meter. It can be a multimeter, amp clamp multimeter or a single function meter. A bit of trivia, the original multimeter was called an AVOMeter, a single tool that could measure Amps, Volts and Ohms (AVO). Some of us count on this tool daily, so we should know how they work, master their operation, and keep them in good working condition.

When discussing electrical meters safety should be the first topic. We are using the meter to detect the presence of electricity. Whether it's diagnostics or verifying safe working conditions we must be able to trust what we are reading on the meter. The batteries should be changed regularly, the meter should be clean, the test leads must be in good condition and not frayed. Even though we typically deal with lower voltages and currents, the values are never far away

from lethal levels. You can receive a shock or burn from any common electrical circuit. The severity of the electrical shock depends on different things such as the path, are you grounded or insulated? Is there a good path through you to ground? Are you wearing good work shoes or boots, or thin-soled flip flops? (I know it's a ridiculous example). Another factor is the type of voltage; is it alternating current (AC) or direct current (DC). AC voltage for example causes your muscles to contract, as an example, contact with an energized AC circuit will cause your hand to close around the circuit if touched. Considerations should be taken when working in different environments. Are you indoors? Are you exposed to the elements? Is there an

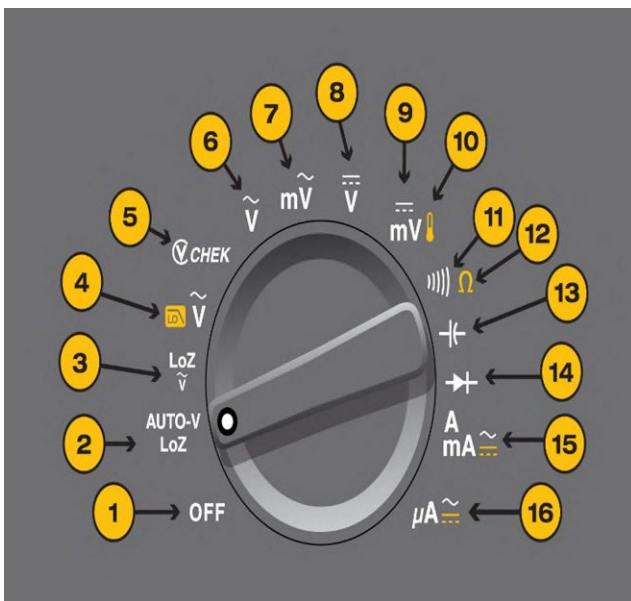


electrical storm nearby? This could result in high electrical transients on the equipment you are testing. This surge could exceed the rating of the meter possibly resulting in a dangerous arc flash. According to OSHA arc flash is defined as a phenomenon where a flashover of electric current leaves its intended path and travels through the air from one conductor to another, or to ground. The results are often violent and when a human is near the arc flash, serious injury or death can occur. Each of these factors should be considered while testing with a multimeter as they may affect how safe you are.

On to how a meter works. We can discuss a few of the more common functions: Direct Current, Alternating Current, Amperage, Continuity and Resistance. The DC voltage selection is used to find the difference in electrical potential between two points in a direct current circuit. That difference in potential is measured in units of VDC. Measuring AC voltage is like measuring VDC; however, this mode is used for measuring the voltage potential between two points of an alternating current circuit. The unit of measure for AC voltage is VAC. AC current

is the measurement of current that periodically changes directions. The unit of measure for AC current is amps. Like DC current measurements, AC current must be measured in series with the circuit to allow the electrons to flow through the multimeter to read the value. Measuring resistance with a multimeter can be done a few different ways, depending on the level of accuracy needed in the measurement. Measuring continuity with a multimeter is an extremely useful diagnostic tool. When a circuit is not working as expected, one of the first actions in finding the issue is to check to make sure all the expected connections are there and there are no shorts. A technician could use the resistance measurement mode of the multimeter to check these connections are present, but using the continuity mode makes it easier due to the multimeter giving an audible beep. Our last example is resistance. Multimeters measure resistance by injecting a small current into the circuit, and then measuring the voltage drop across those points in the circuit. The known current and the resulting voltage drop are then used to calculate the resistance using Ohm's Law.

Using an example from Fluke we can identify the symbology on the meter dial. This is a basic composite view of a multimeter dial indicator. This is shown as an explanation of the symbols only, consult your meter's manual for model specifics.



1. ON/OFF switch
2. AUTO-V/LoZ: prevents readings due to ghost voltage
3. AC voltage/LoZ: uses low-input impedance
4. AC voltage with low-pass filter
5. VCHEKTM: permits simultaneous testing for voltage or continuity
6. AC voltage
7. AC millivolts
8. DC voltage
9. DC millivolts
10. Temperature
11. Continuity: when combined with sound button
12. Resistance
13. Capacitance
14. Diode test
15. AC, DC amps and milliamps
16. AC, DC microamps

Getting to know your meter's functions is a valuable part of the process. As I like to do, I'll give you an example of an early mistake I made. My father was a lineman for Bellsouth. He was retired by the time I started in our industry; he gave me his old analog multimeter to use. I had no business using this meter when I did because it was prior to me attending the apprenticeship school. I did not understand how to use the tool. I tried to measure resistance on an energized circuit - the meter immediately "let out the factory smoke." The first rule to measure resistance, "turn the power off," also discharge any capacitors that are in the circuit. Lesson learned and fortunately I only burned the fuse and not the meter. As always, be safe in all you do, take your time when working around energized circuits. Complacency can be a

factor, like driving and working with ladders; we can get ourselves into a dangerous situation by being too comfortable with it. Always respect the electrical potential as a simple misstep can ruin your day or worse.

Kelly McCann is an accomplished Heating, Ventilation and Air Conditioning (HVAC) professional with over 30 years in the industry. He has experience in several capacities; installation, service, service management, O.E.M technical support and territory management. Kelly has also provided professional instruction since 2000, teaching at the Florida Air Conditioning Apprenticeship Association. His current position is Retail Sales Manager at Custom Mechanical Inc. in West Palm Beach, FL.