

But Walstad had extra help. The Fluke 117 Digital Multimeter he was using that day has dual impedance capability; incorporating both regular high impedance test capabilities and low impedance functions for detecting ghost voltages. By switching to the meter's Auto-V/LoZ (low impedance) test setting, Walstad could see instantly that the 73 volts was only a ghost. "It saved me a trip back to the truck to get another meter," Walstad says.

Ghost voltage can look real

Ghost voltages are caused when energized circuits and non-energized wiring are located in close proximity to each other, such as in the same conduit or raceway. This condition forms a capacitor and allows capacitive coupling between the energized wiring and the adjacent unused wiring.

When you place your multimeter leads between the open circuit and the neutral conductor, you effectively complete the circuit through the input of the multimeter. The capacitance between the connected, hot conductor and the floating conductor forms a voltage divider in conjunction with the multimeter input impedance. The multimeter then measures and displays the resulting voltage value.

Most digital multimeters today have an input impedance that's high enough to show this ghost voltage, giving a false impression of a live conductor. The meter is actually measuring voltage coupled into the disconnected conductor. But at times, these voltages can be 80–85 % of what the "hard" voltage should be. If not recognized as a ghost voltage, additional time, effort and money will be lost troubleshooting circuit problems.

How impedance affects testing

Most digital multimeters for testing industrial, electrical and electronic systems have high impedance input circuits greater than 1 megohm. This means that when the DMM is placed across a circuit for a measurement, it will have little impact on circuit performance. This is the desired effect for most voltage measurement applications, and is especially important for sensitive electronics or control circuits.

Older troubleshooting tools such as analog multimeters and solenoid testers generally have low impedance input circuitry around 10 kilohms or less. While these tools aren't fooled by ghost voltages, they should only be used for testing power circuits or other circuits where the low impedance will not negatively impact or alter circuit performance. They rarely comply with the current IEC 61010 safety standards and North American regulatory requirements.

The best of both worlds

With dual impedance meters, technicians can safely troubleshoot sensitive electronic or control circuits, as well as circuits that may contain ghost voltages, and can more reliably determine whether voltage is present on a circuit.

On the Fluke 114, 116 and 117 DMMs, the meter's regular Vac and Vdc switch positions are high impedance. Use these switch positions for most troubleshooting scenarios and especially on sensitive electronic loads.

The Fluke low impedance function is called Auto-V/LoZ.

- Auto-V stands for automatic volts. This feature automatically determines whether the measured signal is ac voltage or dc voltage, selects the correct function and range, and displays the correct information.
- LoZ stands for Low Impedance (Z). This feature presents a low impedance input to the circuit under test. This reduces the possibility of false readings due to ghost voltages and improves accuracy when testing to determine absence or presence of voltage.

