

Troubleshooting HVAC systems

with the Fluke 233 True-rms Remote Display Multimeter

Application Note

I heard audible gasps from the assembled maintenance techs at a large university in the southeastern United States when I showed them how I used my new Fluke 233 True-rms Remote Display Multimeter.

Of all the great Fluke products I have seen and used, this one has the potential to revolutionize the troubleshooting of HVAC systems.

The HVAC industry has a bad habit of locating mechanical devices where they are very hard to gain access to, including on rooftops, in crawl spaces and above ceilings. These mechanical units often have controls located inside the building on interior walls or inside control panels. Speaking for myself, I am not getting any younger, so it is not as easy for me to climb up and down ladders repeatedly to check multiple readings in different locations.

Using standard multimeters, people like me must somehow be in two places at the same time in order to check the unit operation in both places. The Fluke 233 True-rms Remote Display Multimeter has a detachable display that allows the technician to locate the meter, probes and accessories on the electrical device being checked, then detach the remote display to permit viewing of the values at another location, such as a controller. When combined with the features present in these meters, quick troubleshooting of

HVAC system problems becomes easier. Some common examples are as follows:

1. Remote voltage measurement and troubleshooting.
2. Remote continuity measurement to check wiring integrity.
3. Remote temperature readings while at a thermostat.
4. Remote min/max voltage quality troubleshooting.
5. Control system sensor reading calibration.

Here are troubleshooting scenarios for each of these examples:

1. Remote voltage measurement and troubleshooting.

An HVAC technician receives a too-hot complaint from a residence. Upon arrival, he determines the unit is not running. The tech desires to test the operation of the contactor while adjusting the thermostat into the cooling mode. He turns off the unit at the thermostat and connects the meter probes at the load side of the contactor. Then he detaches the remote display and takes it inside the home.



The main section of the 233 meter stays in place while the technician uses the detachable display to check results elsewhere.



A technician can compare the results on the 233's detachable display to the reading on a remote thermostat.

He places the system switch at the thermostat baseplate into the cooling mode. The voltage reading is zero, indicating that the contactor did not engage. He inserts the remote display into the meter and does further checks at the contactor, which he then determines has failed. The tech replaces the contactor and puts the system back into service.

2. Remote continuity measurement to check wiring integrity. A tech is called into a medical office building due to a too-cold complaint. The unit does not operate at all, regardless of any adjustments at the thermostat. The building owner tells the tech that an electrician had been doing some unrelated work in a junction box close to the unit. The tech decides to check control continuity at the HVAC unit. He disconnects and locks out/tags out the power. Then he connects the 233 meter probes at the thermostat heating wiring. The tech removes the remote display and takes it indoors. He switches the unit into the heating mode and the meter does not beep (beeping indicates continuity). He removes the junction box cover and discovers that the thermostat wires were inadvertently cut. He repairs the wires and checks the system again. This time the continuity function beeps when he places the thermostat into the heating mode. He removes the 233 meter, removes the lockout/tagout and turns on the power. The unit then operates normally.

3. Remote temperature readings while at a thermostat. A tech wants to check the discharge air temperature of a unit while working on the unit thermostat. In the past this was difficult, but the 233 meter now makes

it easier. The tech plugs the temperature probe into the meter and inserts the probe into the unit supply duct. He detaches the remote display from the meter and carries it into the thermostat location. From that location the tech can make any adjustments needed while checking both the space temperature and the supply air temperature at the same time.

4. Remote min/max voltage quality troubleshooting. One of the most difficult problems to catch on a unit is a momentary voltage spike at the unit. An HVAC tech receives a complaint the unit has shut down. A low voltage condition is suspected. The tech places the 233 meter leads on the incoming power supply and then selects the Min/Max function. He detaches the remote display and carries it into the thermostat location. While in this mode the unit will beep every time the unit reaches a new min or max voltage reading level. Over a period of time the tech cycles the unit on and off a number of times. After a few minutes of operation the unit beeps and the tech records a low voltage reading. The utility is contacted and an intermittent loose neutral wire is found. It is corrected and the unit then runs flawlessly.

5. Control system sensor reading calibration. A controls technician needs to check a sensor reading at a DDC Controller. The sensor is 0-10 VDC. The reading needs to be checked against the computer readout. The tech connects the 233 meter leads at the sensor terminals at the controller. He detaches the remote display and carries it over to the computer workstation. The tech checks the reading at the 233 display against the known range of



The technician can leave the 233 meter connected to the controller while he carries the detachable display to a computer workstation.

the sensor, and notes a difference. He checks the controller software and finds that the sensor has been defined as the wrong type. The tech performs a quick correction and the voltage reading is exactly what the computer workstation indicates.

It is possible to come up with many more scenarios like the ones listed above. As you can see, the Fluke 233 True-rms Remote Display Multimeter is incredibly useful in a whole range of common troubleshooting scenarios encountered in today's buildings.

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Printed in U.S.A. 8/2010 3850205A A-EN-N

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