

Lab 3.1.3 Resistance Measurement – Instructor Version



Objective

- Demonstrate the ability to measure resistance and continuity with the multimeter.

Background

The digital multimeter is a versatile testing and troubleshooting device. This lab covers resistance measurements and related measurements called, continuity. Resistance is measured in Ohms, indicated by the Greek letter Omega or Ω . Copper wire conductors such as those commonly used in network cabling, normally have very low resistance or good continuity when checked from end to end. If there is a break in the wire, it is called “open,” which creates very high resistance. Air has nearly infinite resistance, indicated by the infinity symbol or ∞ .

The multimeter has a battery inside. The battery is used to test the resistance of a wire conductor or wire sheathing insulator. When the probes are applied to the ends of a conductor, the battery current flows and the meter measures the resistance encountered. If the battery in the multimeter is low or dead, it must be replaced or the multimeter will not be able to take resistance measurements.

With this lab, test common networking materials to become familiar with them and their resistance characteristics. First learn to use the resistance setting on the multimeter. Note the continuity feature as small resistances are measured. The instructions provided are for the Fluke 110 and 12B. Other meters will function in a similar way.

Prior to starting the lab, the teacher or lab assistant should have one multimeter available for each team and various networking-related items for testing resistance. Work in teams of two. The following resources will be required:

- Fluke 110 Series or 12B multimeter (or equivalent)
- 1000 Ohm resistor
- 10,000 Ohm resistor
- Pencil for creating graphite paths on paper
- Category 5 jack
- 0.2m, or approximately 6 to 8 inch, section of Category 5 UTP solid cable
- BNC terminated coaxial cable
- Unconnected DB9 to RJ-45 adapter
- Terminated Category 5 UTP patch cable

Step 1 Select the Resistance Scale on the Multimeter

Fluke 110:

Resistance Measurements: Move the rotary selector to the Omega symbol for Ohms (Ω) in order to measure resistance. Use the Range button to change the range of resistance to be measured based on what resistance is expected. The screen will show ohms (Ω), kilohms ($K\Omega$ = thousands of Ohms) or megohms ($M\Omega$ = millions of Ohms).

Continuity Measurements: Move the rotary selector to the Beeper Sound symbol to the left of the Ohms symbol. The Beeper Sound symbol is the setting to measure continuity. When there are less than 20 Ohms, the beep will sound. The beep means that the continuity is good. The continuity setting is used when there is a need for a good path for electricity, but no need for the exact amount of resistance.

Fluke 12B:

Resistance Measurements: Move the rotary selector to the Omega symbol for Ohms (Ω). The Omega symbol is the setting to measure resistance. Press the button with the Ohms symbol on it to select resistance mode instead of continuity. The screen should not show a diode symbol, a small black triangle pointing to a vertical bar. Use the Range button to change the range of resistance to be measured based on what resistance is expected.

Continuity Measurements: Move the rotary selector to the Omega symbol for Ohms (Ω). The Omega symbol is the setting to measure resistance. Press the button with the Ohms symbol on it to select continuity mode. The screen will show a diode symbol, a small black triangle pointing to a vertical bar. A diode is an electronic device that either passes or blocks electrical current. When there is good continuity the beep will sound. Good continuity means low resistance. The continuity setting is used when there is a need for a good path for electricity, but no need for the exact amount of resistance.

Step 2

Check the following resistances. Turn the meter off when finished or the battery will drain.

Item to Measure	Set Selector and Range Scale to	Resistance Reading
1000 Ω Resistor	<u>Answers will vary. For Fluke 12B, selector is set to Ω, and range is 0.1 $K\Omega$. For Sperry DM-350A, set to 2 $K\Omega$. For other meters requiring a range scale, set to the next resistance level above 1000 Ω.</u>	<u>Answers will vary, typical results are .95 to 1.05 $K\Omega$.</u>

10 k Ω Resistor	Answers will vary. For Fluke 12B, selector is set to Ω , and range is 0.1 k Ω . For Sperry DM-350A, set to 20 k Ω . For other meters requiring a range scale, set to the next resistance level above 10 k Ω .	Answers will vary, but typical results are 9.5 to 10.5 k Ω .
Graphite marking from a pencil on a piece of paper	Answers will vary. For Fluke 12B, selector is set to Ω , and range is 0.1 k Ω . For Sperry DM-350A, set to 20 k Ω . For other meters requiring a range scale, set to the next resistance level above 10 k Ω .	Answers will vary, but typical results are 10 to 100 k Ω , depending on length of marking. Longer markings give higher resistance readings.
Category 5 jack	Answers will vary. For Fluke 12B, selector is set to Ω , and range is 0.1 Ω . For other meters requiring a range scale, set to the lowest available resistance setting.	Answers will vary, but typical results are less than 0.3 Ω .
0.2 m section of Category 5 UTP solid cable	Answers will vary. For Fluke 12B, selector is set to Ω , and range is 0.1 Ω . For other meters requiring a range scale, set to the lowest available resistance setting.	Answers will vary, but typical results are less than 0.3 Ω .
Touch red and black probe contacts together	Answers will vary. For Fluke 12B, selector is set to Ω , and range is 0.1 Ω . For other meters requiring a range scale, set to the lowest available resistance setting.	Answers will vary, but typical results are less than 0.3 Ω .
A human body (touch the tips of the probes with the fingers)	Answers will vary. For Fluke 12B, selector is set to Ω , and range is 0.1 M Ω . For other meters requiring a range scale, set to the highest available resistance setting.	Answers will vary, but typical results are 0.1 to 1.0 M Ω . It is typical for the values displayed on the meter to vary even as the measurement is taken.
BNC terminated coaxial cable	Answers will vary. For Fluke 12B, selector is set to Ω , and range is 0.1 Ω . For other meters requiring a range scale, set to the lowest available resistance setting. The diode symbol can also be used.	Answers will vary, but typical results are nearly 0 Ω . If the diode symbol is selected, a beeping sound will be audible if available on the multimeter.
Unconnected DB9 to RJ-45 adapter	Answers will vary. For Fluke 12B, selector is set to Ω , and range is 0.1 Ω . For other meters requiring a range scale, set to the lowest available resistance setting. The diode symbol can also be used.	Answers will vary, but typical results are nearly 0 Ω . If the diode symbol is selected, a beeping sound will be audible if available on the multimeter.
Terminated Category 5 UTP patch cable	Answers will vary. For Fluke 12B, selector is set to Ω , and range is 0.1 Ω . For other meters requiring a range scale, set to the lowest available resistance setting. The diode symbol can also be used.	Answers will vary, but typical results are less than 0.3 Ω . If the diode symbol is selected, a beeping sound will be audible if available on the multimeter.

Reflection

What purpose might the multimeter serve in maintaining and troubleshooting a computer network?

When used to measure resistance, multimeters can determine connectivity between network devices, or networking cables that contain open circuits.