



# How To Use A Multimeter

Every fixer should know their way around a...

Written By: Jeff Suovanen



# INTRODUCTION

Every fixer should know their way around a [multimeter](#), which has just north of a zillion uses for testing electronic components and circuits. Follow along to master the three most basic functions of a multimeter.

[Part 1: Testing Continuity](#)

[Part 2: Measuring Voltage](#)

[Part 3: Measuring Resistance](#)

To learn how to use your multimeter to make advanced measurements such as current and capacitance, [check out this guide](#).

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## TOOLS:

[Digital Multimeter](#) (1)

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### Step 1 — Testing Continuity



- A continuity test tells us whether two things are electrically connected: if something is **continuous**, an electric current can flow freely from one end to the other.
  - If there's no continuity, it means there is a break somewhere in the circuit. This could indicate anything from a blown fuse or bad solder joint to an incorrectly wired circuit.
- ① Continuity is one of the most useful tests for electronics repair.

## Step 2



⚠ To begin, make sure no current is running through the circuit or component you want to test. Switch it off, unplug it from the wall, and remove any batteries.

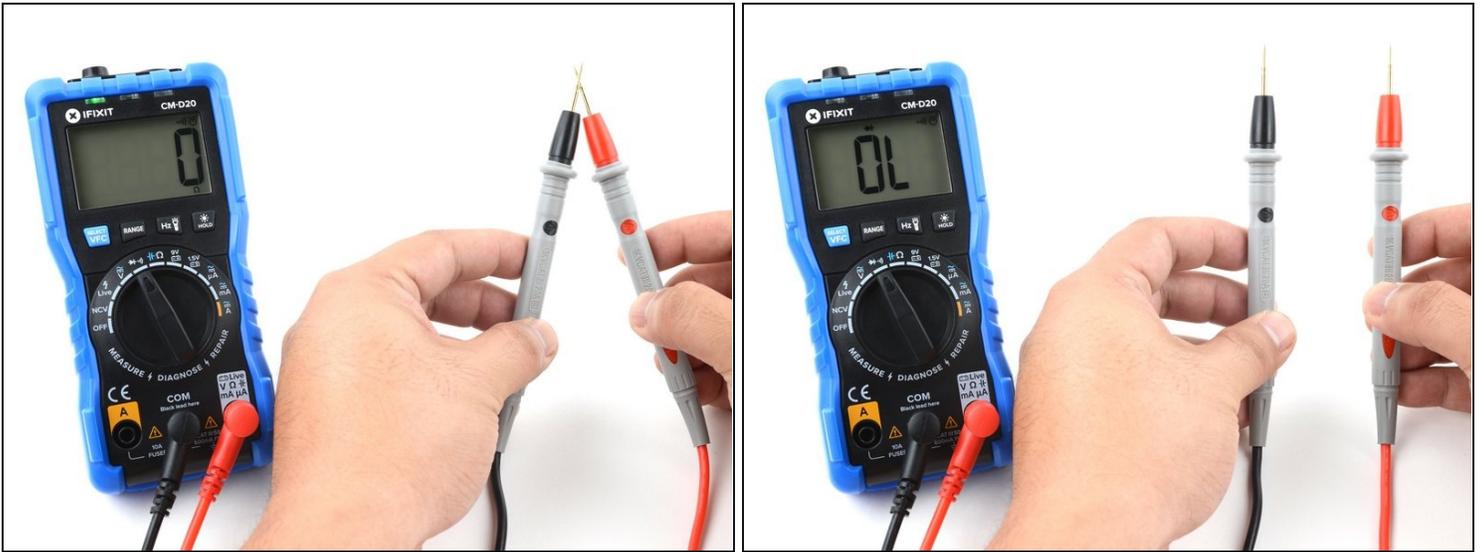
- Plug the black probe into the **COM** port on your multimeter.
- Plug the red probe into the port labeled with a **V symbol** (in this case, the right port).

## Step 3



- Switch on your multimeter, and set the dial to continuity mode (indicated by an icon that looks like a sound wave).
- ① Not all multimeters have a dedicated continuity mode. If yours doesn't, that's okay! Skip to [step 6](#) for an alternate way to perform a continuity test.

## Step 4



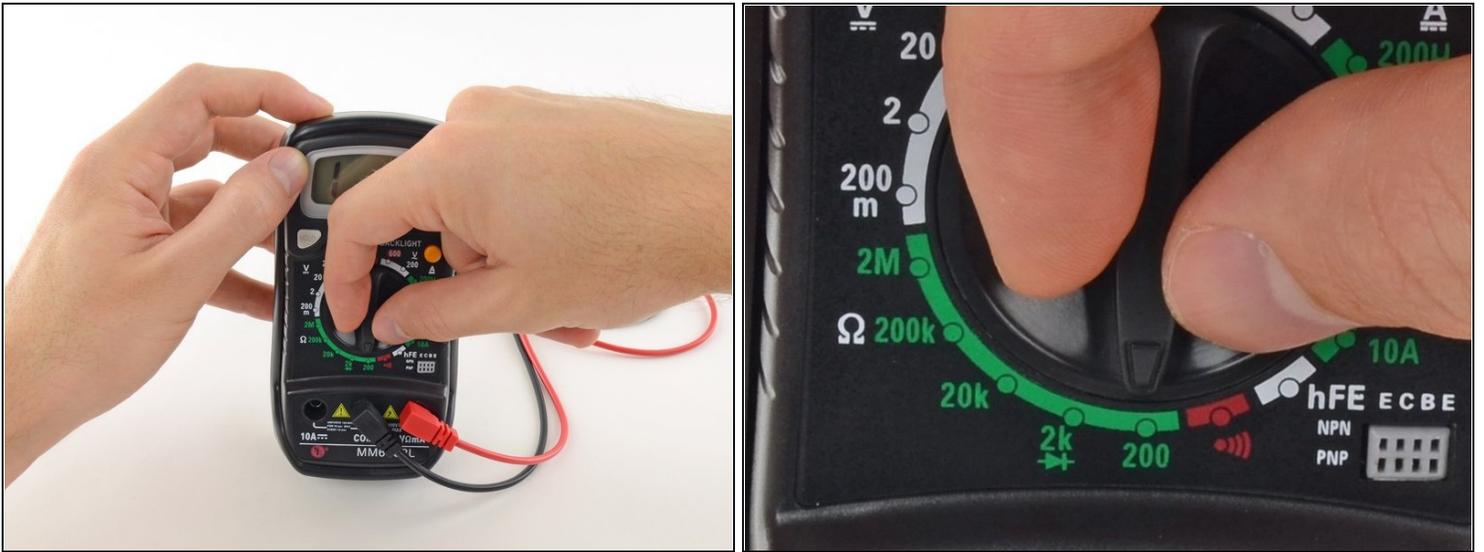
- ① The multimeter tests continuity by sending a little current through one probe, and checking whether the other probe receives it.
- ① If the probes are connected—either by a continuous circuit, or by touching each other directly—the test current flows through. The screen displays a value of zero (or near zero), and the multimeter **beeps**. Continuity!
- ① If the test current isn't detected, it means there's no continuity. The screen will display 1 or OL (open loop).

## Step 5



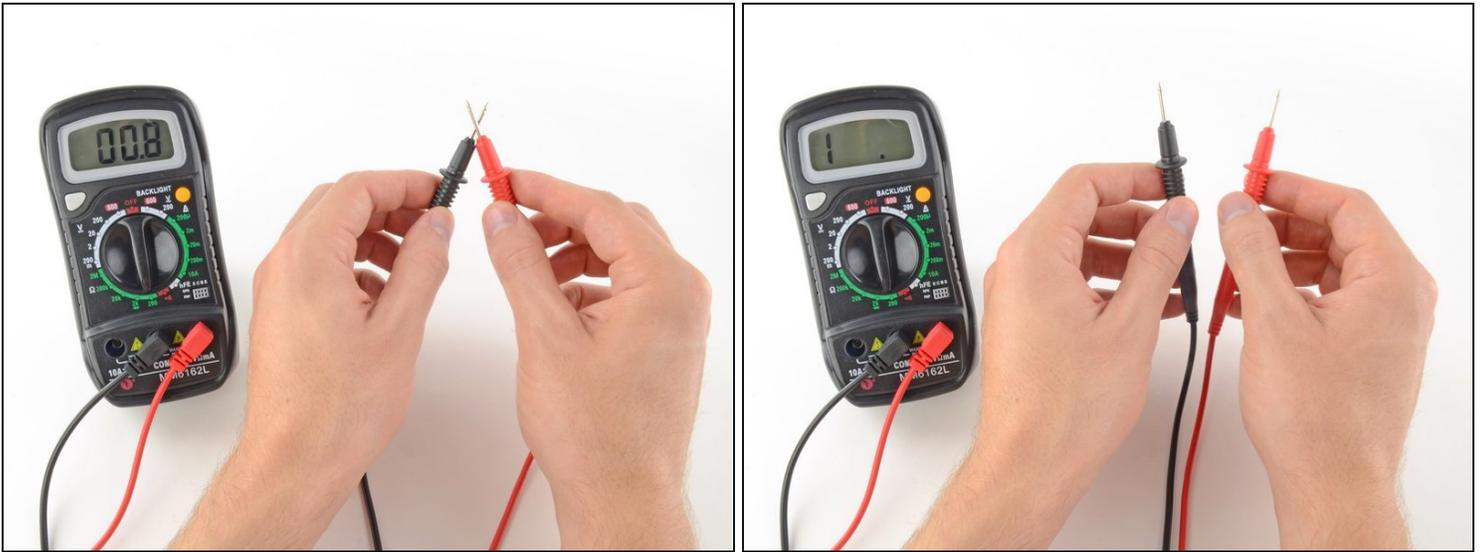
- To complete your continuity test, place one probe at each end of the circuit or component you want to test.
- ⓘ As before, if your circuit is continuous, the screen displays a value of zero (or near zero), and the multimeter **beeps**.
- ⓘ If the screen displays 1 or OL (open loop), there's no continuity—that is, there's no path for electric current to flow from one probe to the other.
- ⓘ Continuity is non-directional, meaning it doesn't matter which probe goes where. But there are exceptions—for instance, if there's a diode in your circuit. A diode is like a one-way valve for electricity, meaning it will show continuity in one direction, but *not* in the other.
- To check for this, reverse what the probes are touching and check for continuity. If the multimeter shows continuity, then it's possibly a diode.

## Step 6 — Test for continuity (alternate method)



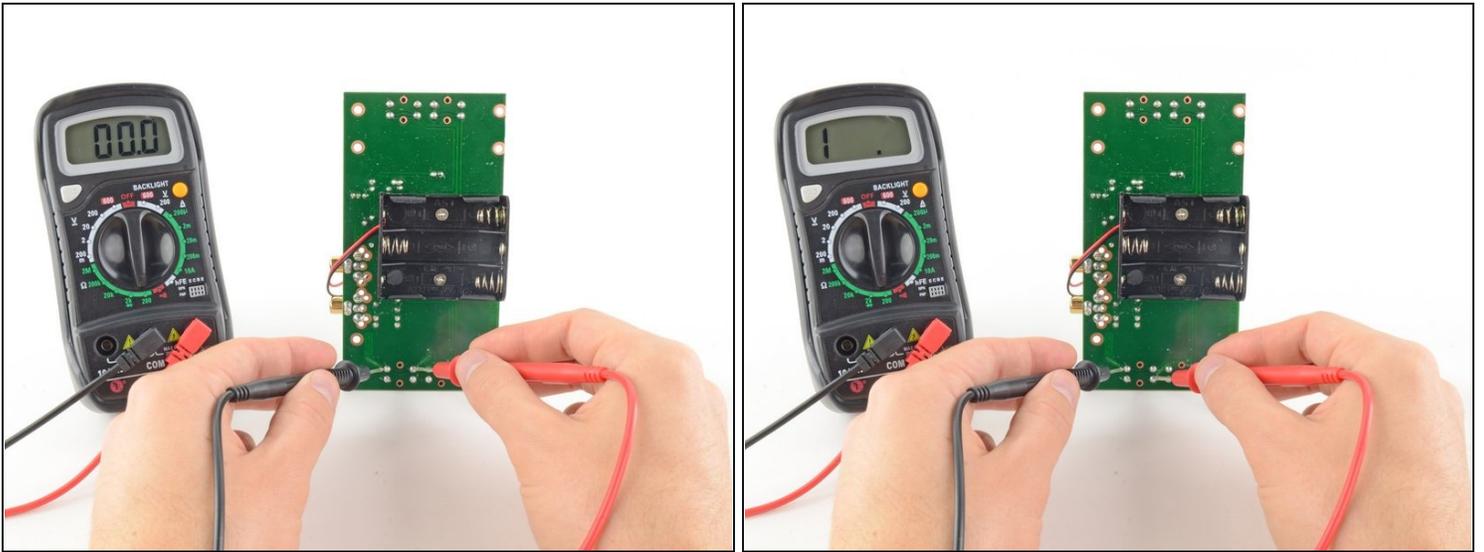
- ① If your multimeter doesn't have a dedicated continuity test mode, you can still perform a continuity test.
- Turn the dial to the resistance mode.
  - If your multimeter has manual ranging, set the resistance to the lowest setting.
- ① Resistance is measured in ohms, indicated by the symbol  $\Omega$ .

## Step 7



- In this mode, the multimeter sends a little current through one probe, and measures what (if anything) is received by the other probe.
- If the probes are connected—either by a continuous circuit, or by touching each other directly—the test current flows through. The screen displays a value of zero (or near zero—in this case, 0.8). Very low resistance is another way of saying that we have continuity.
- If no current is detected, it means there's no continuity. The screen will display 1 or OL (open loop).

## Step 8



- To complete your continuity test, place one probe at each end of the circuit or component you want to test.
  - ⓘ It doesn't matter which probe goes where; continuity is non-directional.
- As before, if your circuit is continuous, the screen displays a value of zero (or near zero).
- If the screen displays 1 or OL (open loop), there's no continuity—that is, there's no path for electric current to flow from one probe to the other.

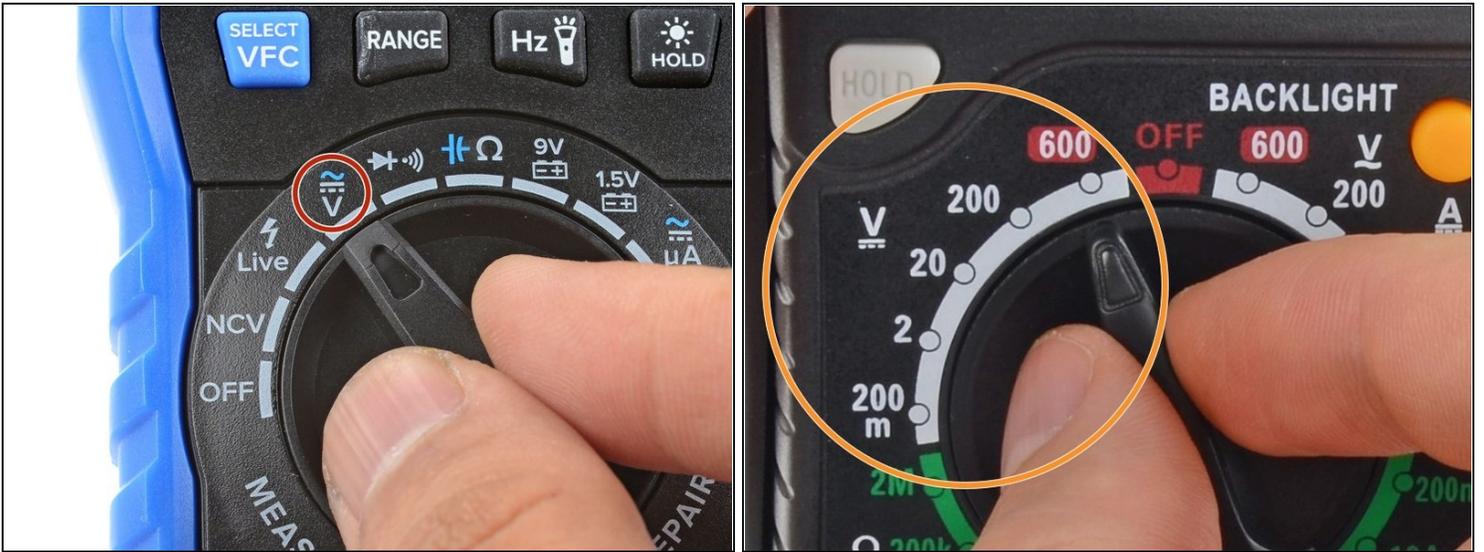
## Step 9 — Measuring voltage



① The next four steps will show you how to measure voltage.

- Plug the black probe into the **COM** port on your multimeter.
- Plug the red probe into the port labeled with a **V symbol** (in this case, the right port).

## Step 10



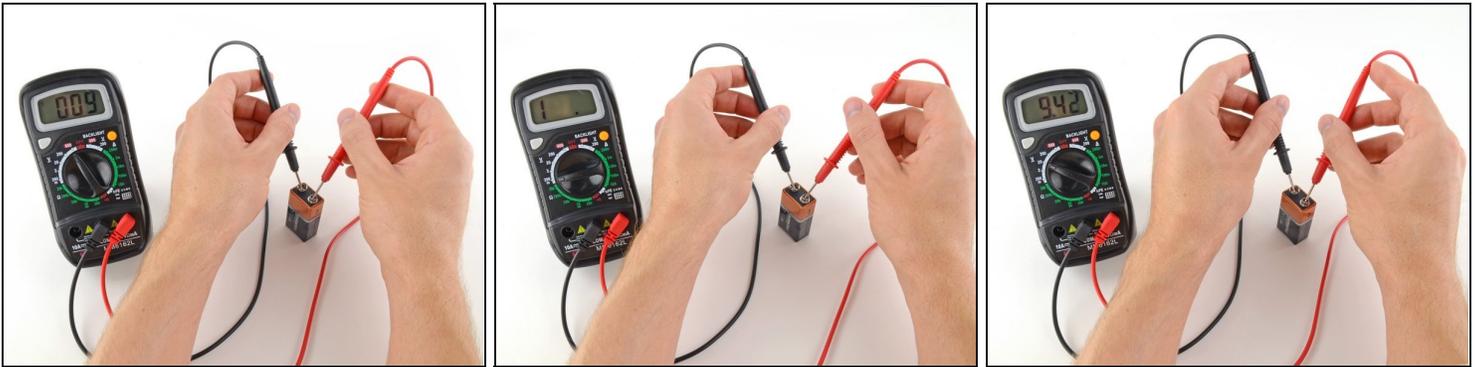
- Switch on your multimeter, and set the dial to DC voltage mode (indicated by a V with a straight line, or the symbol ).
  - ⓘ Virtually all consumer electronic devices run on DC voltage. AC voltage—the kind that runs through the lines to your house—is considerably more dangerous, and beyond the scope of this guide.
  - ⓘ Your multimeter may be auto-ranging or manual ranging. An auto-ranging multimeter (such as the iFixit multimeter) will automatically determine the best measuring range. All you have to do is set what kind of measurement you want to take.
  - ⓘ If your multimeter is manual ranging, you'll also need to set the correct range for the voltage you expect to measure.
    - Each setting on the dial lists the maximum voltage it can measure. So for example, if you expect to measure more than 2 volts but less than 20, use the 20 volt setting.
    - If you're not sure, start with the highest setting.

## Step 11 — Auto-ranging voltage measurement



- ① If your multimeter is manual ranging, skip to the next step.
- Place the red probe on the positive terminal, and the black probe on the negative terminal. The multimeter will display the measured voltage.
  - ① Reversing the probes won't do any harm; it just gives a negative reading.
- Skip the next step, which describes how to measure voltage using manual ranging multimeters.

## Step 12 — Manual ranging voltage measurement



① Follow this step to measure voltage with a manual ranging multimeter.

- Place the red probe on the positive terminal, and the black probe on the negative terminal.
- If your range was set too high, you may not get a very precise reading. Here the multimeter reads 9 volts. That's fine, but we can turn the dial to a lower range to get a more precise.
- If you set the range too low, the multimeter simply reads 1 or OL, indicating that it is overloaded or out of range. This won't hurt the multimeter, but we need to set the dial to a higher range.

① With the range set correctly, we get a reading of 9.42 volts.

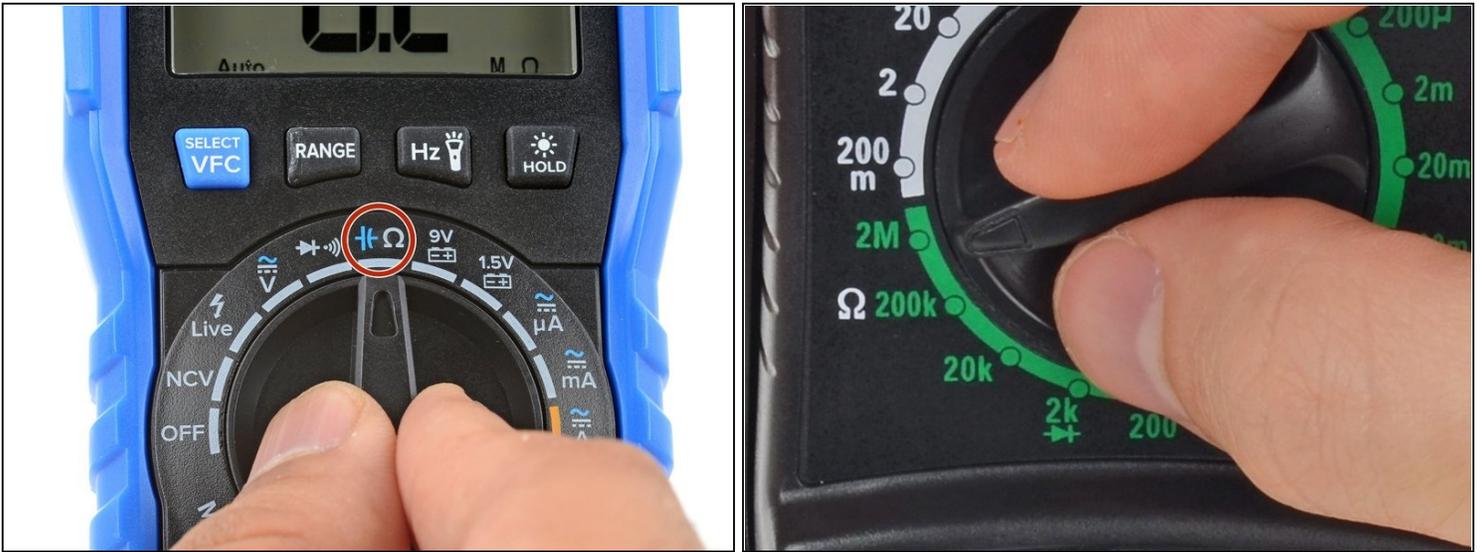
① Reversing the probes won't do any harm; it just gives us a negative reading.

## Step 13 — Measuring resistance



- i** The next three steps will show you how to measure resistance with your multimeter.
- **To begin, make sure no current is running through the circuit or component you want to measure.** Switch it off, unplug it from the wall, and remove any batteries.
  - i** Remember that you'll be measuring the resistance of the entire circuit. If you want to measure an individual component such as a resistor, measure it by itself—not with it soldered in place!
  - Plug the black probe into the **COM** port on your multimeter.
  - Plug the red probe into the port labeled with **an Ω symbol** (in this case, the right port).

## Step 14



- Switch on your multimeter, and set the dial to resistance mode.
  - ⓘ Resistance is measured in ohms, indicated by the  $\Omega$  symbol.
- ⓘ The iFixit multimeter is auto-ranging, meaning it will automatically determine the best measuring range.
  - ⓘ If your multimeter is manual ranging, you will need to set the correct range for the resistance you expect to measure. If you're not sure, start with the highest setting.

## Step 15



- Place one probe at each end of the circuit or component you want to measure.
    - ⓘ It doesn't matter which probe goes where; resistance is non-directional.
  - If your multimeter is manual ranging:
    - If your multimeter reads close to zero, the range is set too high for a good measurement. Turn the dial to a lower resistance range.
    - If you set the range too low, the multimeter simply reads 1 or OL, indicating that it is overloaded or out of range. This won't hurt the multimeter, but we need to set the dial to a higher range.
      - ⓘ The other possibility is that the circuit or component you are measuring doesn't have [continuity](#)—that is, it has infinite resistance. A non continuous circuit will always read 1 or OL on a resistance test.
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