

# How Does a Multimeter Work in Different Modes?

A multimeter can measure **voltage**, **current (amps)**, and **resistance**, but it does so in **different ways** depending on the mode selected. Let's break it down step by step:

## Measuring Amperage (Current Mode)

### What Happens When You Set the Multimeter to Amps (A) and Connect It to a Battery?

- When set to **amps (A)**, the multimeter is designed to measure **current flow** by **acting like a wire (low resistance)**.
- If you put the probes **directly** across a battery (one probe on +, one on -) in **current mode**, you create a **short circuit**.
- **Result:**
  - The battery **discharges at maximum current**.
  - The current **depends on the battery's capability** (e.g., a 9V battery might deliver **several amps** before voltage drops).
  - You might **damage** the battery or even the multimeter fuse (if it has one).

⚠ **Rule: Never connect a multimeter in current mode directly across a power source (e.g., battery, power supply) without a load!**

✓ **Instead, place it in series with a circuit to measure current properly.**

## Measuring Voltage (Voltage Mode)

### What Happens When You Set the Multimeter to Volts (V) and Connect It to a Wire?

- When set to **voltage (V)**, the multimeter **has a very high resistance** (usually **1 MΩ or more**).
- This means it **draws almost no current** (a tiny amount flows, but it's negligible).
- **You're only measuring the electrical potential difference between two points.**



#### Example:

- If you put the **positive probe on the + terminal** of a 9V battery and the **negative probe on the - terminal**, it will show **9V**.
- **No current flows through the multimeter** in this mode because the multimeter isn't completing a circuit—it's just sensing voltage.

## Key Difference Between Measuring Current and Voltage

Mode	How the Multimeter Connects	Internal Resistance	Effect on Circuit
Current (A)	<b>In series</b> with the circuit	Very low ( $\sim 0\Omega$ )	Draws <b>all the current</b> —risk of short circuit if connected across a battery
Voltage (V)	<b>In parallel</b> with the circuit	Very high ( $\sim 1M\Omega$ )	Draws <b>almost no current</b> —just measures voltage without disturbing the circuit

## Summary

- **Amps Mode:**  
 **Creates a short circuit** if connected directly across a power source. Always place in **series** with a circuit!
- **Voltage Mode:**  
 **Does not draw current**, only measures voltage across two points. Always place in **parallel**!