

Measuring Voltage Drop and Current

To check whether a circuit is working, electricians must measure voltage and current. Because electricity is not visible, they use special instruments. Measurements of electric current and voltage can only be made using voltmeters and ammeters.

A voltmeter (Figure 1) measures the voltage drop in a circuit. The SI unit for voltage is the volt (V).

Figure 2 shows a typical ammeter. An ammeter measures the amount of electric current flowing past a point in a circuit. Depending on the electrical appliance, the current varies. The SI unit for current is the ampere (A).

How Does a Voltmeter Work?

A voltmeter measures the voltage drop between two points of an electric circuit. The voltage drop is measured by connecting the voltmeter in parallel between two points in a circuit. The positive terminal of the voltmeter is connected to the positive side of the circuit and the negative terminal to the negative side. The voltmeter indicates, in volts, the amount of energy lost or gained between the two points of the circuit. The voltmeter could be digital (giving a digital readout) or analog (using a needle moving across a scale).

Figure 3 shows two voltmeters being used to measure the voltage at two locations in an electric circuit—the voltage rise across a cell which is the source of energy, and the voltage drop across a light bulb which is using the energy. Note that the readings are both 1.5 V. The voltage within the circuit is the same. This shows that the circuit has a strong energy source and is working properly.

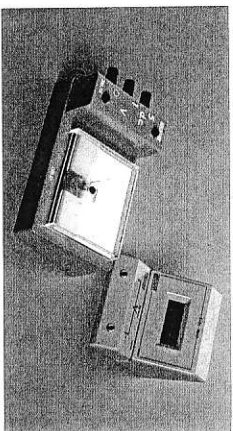


Figure 1
Analog and digital voltmeters

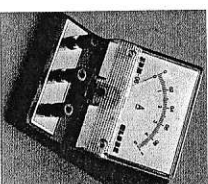


Figure 2
An ammeter indicates the amount of electric current at a point in the circuit.

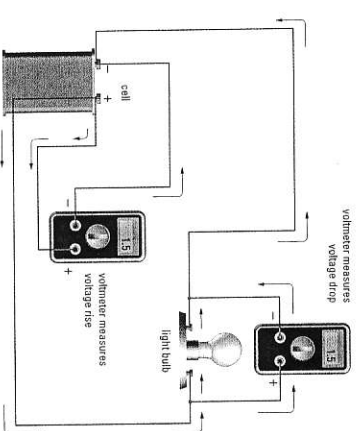


Figure 3
A voltmeter is connected in parallel in an electric circuit and measures the voltage drop (or rise) between two points in the circuit.

How Does an Ammeter Work?

An ammeter measures the amount of current flowing past a point in a circuit. An ammeter is not used in the same way as a voltmeter. An ammeter is connected to an electric circuit in series. In Figure 4 an ammeter is connected to a circuit that includes a dry cell and a light bulb. The positive terminal of the ammeter is connected to the positive terminal of the battery. The reading in this circuit is 1.5 A. Reading digital or analogue ammeters is very similar to reading digital or analog voltmeters.

Some typical current ratings for some electrical appliances are shown in Table 1. Notice that devices that produce heat, such as a toaster, use a great deal of electric current to work.

Table 1

Appliance	Current rating (A) (with 120-V supply)
toaster	8.3
fluorescent lighting	0.5
power drill	2.5
television	3.0
vacuum	4.3
microwave oven	5.0
iron	10.0
clothes dryer	40.0
stove	*

*Stoves operate at 240 V and draw currents in the range of 25 A to 40 A.

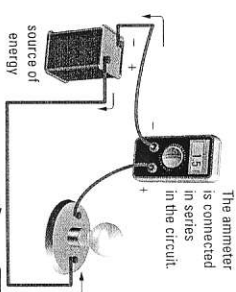


Figure 4
An ammeter, connected in series, measures the amount of electric current flowing in an electric circuit.

Understanding Concepts

- How are a voltmeter and an ammeter arranged differently in a circuit?
- Draw a circuit diagram of a dry cell, an open switch, a light bulb, and a voltmeter connected across the light bulb.
- Draw a circuit diagram of the same electrical circuit in question 1, but insert an ammeter after the light bulb.

Making Connections

- When would an electrician use a voltmeter? When would an electrician use an ammeter?
- Homes in Canada are supplied with electricity at 120 V. What might a reading lower than 120 V mean?

Exploring

- Electrical devices are labelled with their current ratings. Find the current ratings of four different devices in your home. Make sure that the devices are unplugged first. Which device requires the most current?

Challenge

- Develop questions and answers for your electric game show that focus on the proper use of voltmeters and ammeters.