

Measuring Current, Voltage & Resistance



Automotive Service Technician, Electrician, Parts Technician, HVAC Technician

Grades

- Grade 9

Learning objective

Demonstrate an ability to use a multimeter (ammeter & voltmeter) to measure voltage, current, and resistance in electrical circuits

Concepts

- Digital clamp meter or multimeter usage
- Measuring voltage, current, and resistance
- Proper connections and readings
- Introduction to AC (Alternating Current) vs. DC (Direct Current)

Description and Trades Connection

In this lesson, students will learn to use a digital clamp meter or multimeter to measure voltage, current, and resistance in electrical circuits. They will explore the concepts of AC (Alternating Current) and DC (Direct Current), and gain hands-on experience with proper multimeter connections and readings. Through demonstrations and practice, students will develop essential skills for measuring and analyzing electrical quantities.

Using a multimeter to measure voltage, current, and resistance is a fundamental skill for many trades, especially electricians, heating, ventilation and air conditioning (HVAC) technicians, automotive and parts technicians. These professionals rely on multimeters to diagnose and troubleshoot electrical systems, ensuring they operate safely and efficiently. Understanding the difference between AC and DC is also an important skill, as it applies to various systems they encounter in their work. By learning to use a multimeter correctly, students gain practical skills that are directly applicable to real-world tasks in these trades.

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Scan to access video demonstrations, activities, classroom resources and more at learninginnovation.ca/k-12STEM

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QUESTIONS?

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Curriculum connections



Science 9, Unit D: Electrical Principles and Technologies

Outcome 2: Describe technologies for transfer and control of electrical energy

- use switches and resistors to control electrical flow, and predict the effects of these and other devices in given applications
- describe, using models, the nature of electrical current; and explain the relationship among current, resistance and voltage
- measure voltages and amperages in circuits
- investigate toys, models and household appliances; and draw circuit diagrams to show the flow of electricity through them

Measuring Current, Voltage & Resistance

Procedure



Preparation

Review how to use the automotive window motor box, the digital clamp meter or multimeter, as well as concepts of current, voltage, and resistance as needed.

Helpful videos:

- [Window motor box overview](#) [4:10] (Lethbridge Polytechnic, 2023)
- [How to use a digital clamp meter or multimeter](#) [12:29] (Lethbridge Polytechnic, 2025)

Feel free to show these videos to students as well (and revisit as needed)

Lesson Activities (30 minutes total)

Introduction (5 minutes):

- Begin by asking students what they know about digital clamp meters or multimeters.
- Introduce today's focus: learning how to use a digital clamp meter or multimeter to measure voltage, current, and resistance, and understanding the difference between AC and DC.
- Discuss this lesson's trades connection (included in the preamble to this lesson guide).

Review of Key Terms (5 minutes):

- Briefly review the concepts of voltage, current (amperage), and resistance from the previous lessons.
- Explain that a digital clamp meter or multimeter is a tool used to measure these quantities in electrical circuits.
- Show "[How to use a digital clamp meter or multimeter](#)" ([video](#)). [12:29] (Lethbridge Polytechnic, 2025)

Time

30 minutes

Materials

- Automotive window motor box (*included in kit*)
- 120v Power Cord (*included in kit*)
- A fused 12v battery pack (*included in kit*)
- Digital clamp meter (*included in kit*) or multimeter

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Procedure



Lesson Activities (continued)

Demonstration of Digital Clamp Meter or Multimeter Usage (10 minutes):

- Show students a digital clamp meter or multimeter and explain its different settings and functions.
- Demonstrate how to properly connect the digital clamp meter or multimeter to measure voltage, current, and resistance:
 - **Voltage:** Connect the multimeter digital clamp meter in parallel with the load.
 - **Current:** Connect the multimeter in series with the circuit (or clamp the digital clamp meter around a wire).
 - **Resistance:** Ensure the circuit is powered off and connect the multimeter across the load.
- Highlight the importance of proper connections (positive to positive, negative to negative) to get accurate readings.
- Use the automotive window motor box to demonstrate these measurements. Show how to measure the voltage across the motor, the current flowing through the circuit, and the resistance of the motor.

Introduction to AC vs. DC (5 minutes):

- Explain the difference between AC (Alternating Current) and DC (Direct Current):
 - **AC:** The current changes direction often (60 times per second in North America) (e.g., household electricity, appliances and powerlines).
 - **DC:** The current flows in one direction (e.g., batteries and solar panels).
- Discuss how the multimeter can be used to measure both AC and DC, but for today's lesson, they will focus on DC measurements with the automotive window motor box.

Student Practice (5 minutes):

- Have students take turns using a multimeter to measure voltage, current, and resistance on the automotive window motor box. Ensure they follow the proper procedures demonstrated earlier.
- Encourage students to record their measurements so they can be compared to calculated current, voltage and resistance after exploring Ohm's Law. (*See lesson on Ohm's Law*)

Conclusion (5 minutes):

- Recap the key points of the lesson, emphasizing the importance of using a multimeter correctly to measure electrical quantities.
- Ask students to think about how these measurements can help in diagnosing and troubleshooting electrical problems.

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Assessment and online resources



Assessment suggestions

- Discuss multimeters as a class. Possible discussion questions:
 - Why is it crucial for trades professionals, like electricians and automotive technicians, to take accurate measurements of electrical quantities?
 - How can understanding AC and DC help in real-world applications?
 - What challenges did you face while using the multimeter?

Online resources

- [Automotive Window Kit - Lethbridge Polytechnic STEM Website](#) (Lethbridge Polytechnic, 2023)
- [Window motor box overview](#) (Lethbridge Polytechnic, 2023)
- [How to use a digital clamp meter or multimeter](#) (Lethbridge Polytechnic, 2025)