

11.4.6: Ammeters and Voltmeters



Figure 16.4.1

This photo is of the interior of the control room for a nuclear power plant. Many of the meters are reading information about the water temperature and the nuclear reaction that is occurring, but the majority of the meters are reading data about the electric energy being generated.

Ammeters and Voltmeters

Ammeters and **voltmeters** are cleverly designed for the way they are used. Ammeters measure the current of a circuit, and voltmeters measure the voltage drop across a resistor. It is important in the design and use of these meters that they don't change the circuit in such a way as to influence the readings. While both types of meters are technically resistors, they are specifically designed to make their readings without changing the circuit itself.


 Diagram of a circuit with an ammeter and a voltmeter inserted

Figure 16.4.2

Ammeter

An ammeter measures the current traveling through the circuit. They are designed to be connected to the circuit in series, and have an extremely low resistance. If an ammeter were connected in parallel, all of the current would go through the ammeter and very little through any other resistor. As such, it is necessary for the ammeter to be connected in series with the resistors. This allows the ammeter to accurately measure the current flow without causing any disruptions. In the circuit sketched above, the ammeter is m2.

Voltmeter

In contrast, a voltmeter is designed to be connected to a circuit in parallel, and has a very high resistance. A voltmeter measures the voltage drop across a resistor, and does not need to have the current travel through it to do so. When a voltmeter is placed in parallel with a resistor, all the current continues to travel through the resistor, avoiding the very high resistance of the voltmeter. However, we know that the voltage drop across all resistors in parallel is the same, so connecting a voltmeter in parallel allows it to accurately measure the voltage drop. In the sketch, the voltmeter is m1.

A galvanometer is a device that uses the magnetic field generated by a flowing electric current to push a needle. When placed in parallel with a resistor, it can act as an ammeter and be used to measure the amount of current flowing through a circuit. When placed in series with a resistor, it can act as a voltmeter and measure the voltage across the device. Launch the Galvanometer simulation below to learn more:

Summary

- Ammeters measure the current through a resistor.
- Ammeters have low resistances and are placed in the circuit in series.
- Voltmeters measure the voltage drop across a resistor.
- Voltmeters have high resistances and are placed in the circuit in parallel.

Review


 Practice problem for identifying correct and incorrect positions of voltmeters and ammeters

Figure 16.4.3

1. In the sketch at above, there are four positions available for the placement of meters. Which position(s) would be appropriate for placement of an ammeter?
 1. 1
 2. 3
 3. 4
 4. All of them.
 5. None of them.
2. Which position(s) would be appropriate for placement of a voltmeter?
 1. 1
 2. 2
 3. 3
 4. All of them.
 5. None of them.
3. Which position could hold an ammeter that would read the total current through the circuit?
 1. 1
 2. 2
 3. 3
 4. 4
 5. None of them.
4. Which position could hold a voltmeter that would read the total voltage drop through the circuit?
 1. 1
 2. 2
 3. 3 or 4
 4. All of them.
 5. None of them.

Explore More

Use this resource to answer the questions that follow.

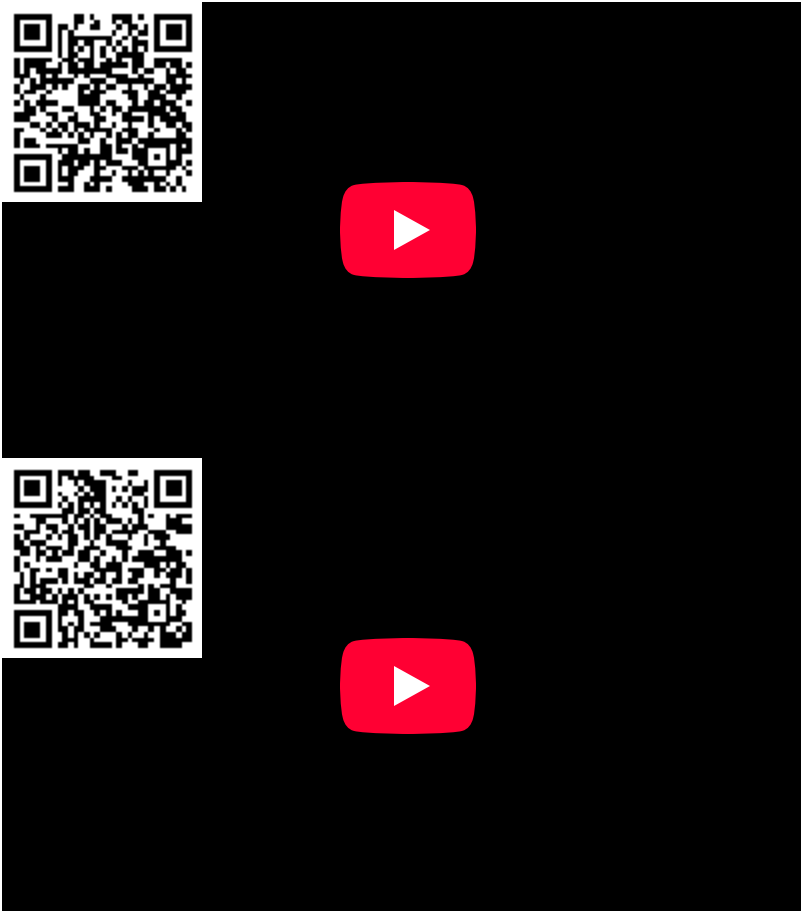


1. What happens when the ammeter is connected in parallel with the lamp?
2. Why do the problems occur when the narrator places the ammeter in parallel with the lamp?

Additional Resources

Study Guide: Electrical Systems Study Guide

Videos:



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