

Student Notes

In this investigation, you will learn how a potentiometer can be used in an electronic circuit as a variable resistor or as a voltage divider. You will construct simple electronic circuits that use a DC voltage source, a fixed value resistor, and a rotary potentiometer. You will conduct a series of experiments demonstrating how the potentiometer can serve both as a variable resistor and as a voltage divider.

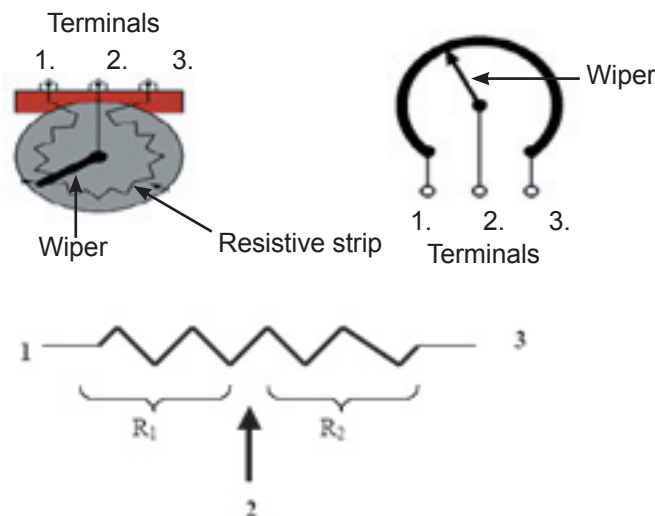
You will work in teams of two or three on each of the four exercises. You will have to first gather the components, parts, and equipment necessary to perform each of the investigations.

Introduction to potentiometers

A potentiometer is a modified resistor. Unlike a typical resistor, which has two terminals, a potentiometer is a three terminal device. Some examples of potentiometers are below. The top image is of a rotary potentiometer of the type used in this lesson.



The resistance between the two outer terminals, terminals 1 and 3, is fixed to the specified potentiometer value. This value is usually indicated on the body of the potentiometer. The middle terminal (wiper) can be moved over the whole range of the potentiometer. This movement is caused by turning a shaft arm or a screw on the potentiometer. The image to the left illustrates what goes on inside the potentiometer as a shaft arm is turned. The resistance between terminals 1 and 2 (designated as R_1) plus the resistance between terminals 2 and 3 (R_2) is equal to the total resistance of the potentiometer.



The electronic symbol is shown immediately above. This lesson will show how a potentiometer may be used as both a variable resistor and as a voltage divider.

Student Notes *continued*

Linear and Logarithmic Potentiometers

In linear potentiometers, the relationship between the electrical resistance from the wiper to one of the other terminals of the potentiometer is linearly proportional to the displacement amount of the wiper from the terminal. This type of potentiometer becomes a good candidate to be a displacement sensor.

In logarithmic potentiometers, the distance between the wiper and one of the terminals is proportional to the logarithmic of the resistance between them. This type of potentiometer is sometimes referred to as an audio potentiometer since it is used in audio volume control. The reason for its use in audio volume control is that the response of the human ear is logarithmic. Therefore, on a volume control that is labeled from 0 to 10, when the volume knob is set at 4, the volume will sound twice as loud when the volume knob is set at 2.

Some Practical Applications of Potentiometers

Potentiometers (as variable resistors or voltage dividers) have many applications in our lives. Examples include:

- sensitivity adjustment** sensitivity of a home motion detector, smoke detectors
- level sensor** liquid level sensor
- angular position** mechanical arm angular position, wind direction sensing
- volume control** audio systems
- displacement/position sensing**

Resistors

Resistors are the most widely used components in a typical electronic circuit. When a resistor is placed in a circuit, the amount of current flow in the circuit is limited. The word *resistance* refers to the amount of opposition to the current flow. As one increases the amount of resistance in a circuit, the resulting amount of current in the circuit drops. Current and resistance are inversely related. Resistance is measured in units of Ohms. In an electronic circuit, the letter "R" denotes a resistor. In a circuit, the resulting amount of current in the circuit drops. Current and resistance are inversely related. Resistance is measured in units of Ohms. In an electronic circuit, the letter "R" denotes a resistor.