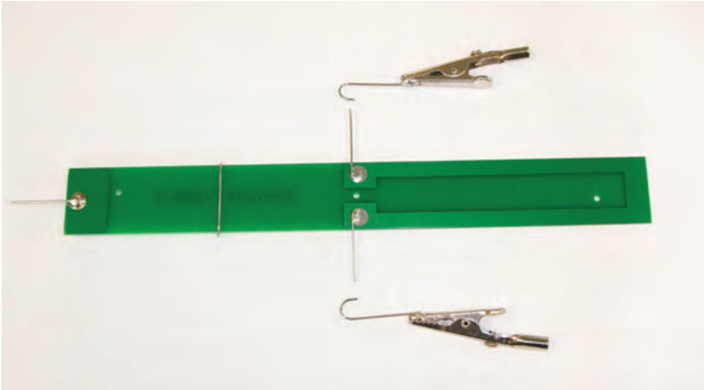
615-4645 (10-146) Current Balance



The Current Balance is used to demonstrate the effect of a magnetic force on a current-carrying wire. This effect is used to measure the strength of the magnetic field ant the center of a solenoid. The Current Balance consists of a balanced, printed conductive blade or armature, 16.5 cm in length, bounded by a conducting loop that is wired to two conducting axles.

Warranty and Parts: We replace all defective or missing parts free of charge. Additional replacement parts may be ordered toll-free. We accept MasterCard, Visa, checks and School P.O.s. All products warranted to be free from defect for 90 days. Does not apply to accident, misuse or normal wear and tear. Intended for children 13 years of age and up. This item is not a toy. It may contain small parts that can be choking hazards. Adult supervision is required.

How to Teach with Current Balance:
Concepts Taught: Currents; magnetic fields
Curriculum Fit: Phyusics Sequence; Magnetic Field
Grades 6-8 and up.

Materials recommended but not included:
- 615-4640 Air Core Solenoid (required)
- Voltage source (required)
- Two ammeters
- Eight leads
- Two rheostats
- Balance to measure mass of string

Theory:
What is current?
What is a solenoid?
What is a magnetic field?
What is Lorentz' Law?

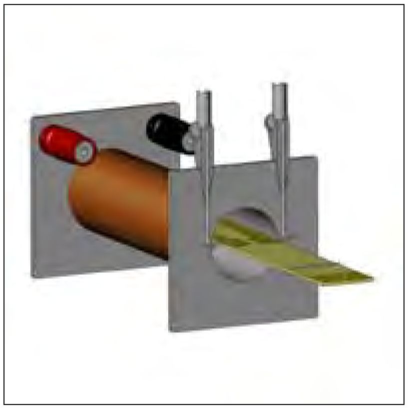


Diagram 1

Activities:
Investigation I: Magnetic Force
Activity 1: Current Balance and Air Core Solenoid
Note: It is important not to exceed 5 amperes of current in this device at any time during the experiment. Excess current can destroy the apparatus.

1. Insert the balanced blade (armature) into the solenoid with the shiny side facing down and the U-shaped loop facing upward inside the solenoid.

2. Attach the metal hangers to one end of the plastic cheek of the solenoid using the attached alligator clips. The clips should protrude from either side of the hole in the solenoid for the pivot points of the armature to swing freely on them. See Diagram 1 above right.

3. Balance the armature (horizontally) on its pivot points by adjusting the wire weight on the end of the armature which is outside the solenoid. No current should be flowing in the circuit at this point!

4. Set up the rest of the circuit according to Diagram 2.

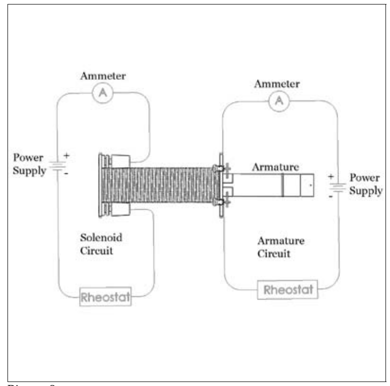


Diagram 2

5. Compare the effect on the armature when varying amounts of current are passed through the solenoid. Use values in table below.

Current (amperes)
1
2
3
4

Record your qualitative observations below.

____

____

____

____

6. Calculate the magnetic field intensity (B) at the center of the solenoid by measuring the force exerted on the rectangular current-carrying loop of wire. See diagram 3 to right.

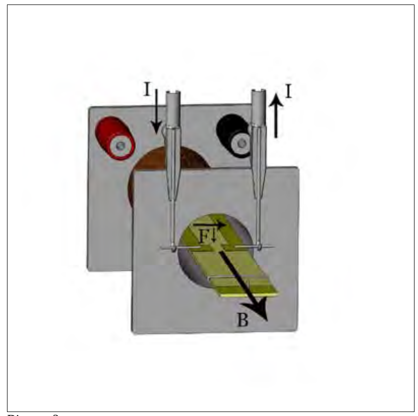


Diagram 3

A. Set the amperage for 1 amp. Turn on the power and observe how the internal part of the armature (the one with the rectangular current-carrying loop of wire) is pushed

B. Place short lengths of string as counter-balancing weights on the exposed end of the armature until it is balanced horizontally. Make sure that the piece of string is placed at an equal distance from the pivotal points when compared with the end section of the loop affected by the magnetic field inside the solenoid.

C. Measure the mass of the string required to achieve balance on a top loading balance. Record the mass (kg) below.
Mass = ____________________(kg)
Convert mass to Newton (N) as follows:
Mass (kg) x 9.8 m/s2 = mass (N)
Mass = ____________________(N)

D. Calculate the magnetic field intensity (B) according to the equation below.
$F = B \times I \times l \times \sin\theta$
F = Force (N)
B = Magnetic Field (N/A·m)
I = Current (amps)
l = length of the wire across the end of the armature (m)
$\theta = 90°$

E. Repeat steps A – D using 2, 3, and 4 amps.

F. Make a plot of F versus I. The slope of the graph will be a measure of B·l.