

1(f). Wheatstone Bridge Circuit

The Wheatstone bridge can be used to measure an unknown resistance R_x . Switch S_2 applies battery voltage to the four resistors in the bridge. To balance the bridge the value of R_3 is varied. Balance is indicated by zero current in galvanometer G when switch S_1 is closed.

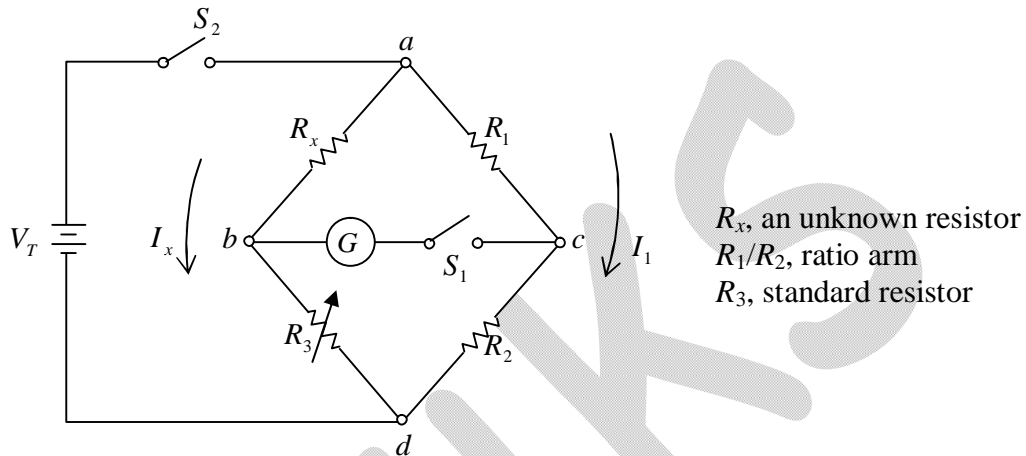


Figure: Wheatstone bridge

When the bridge, balanced, points b and c must be at the same potential. Therefore

$$I_x R_x = I_1 R_1 \quad (1)$$

$$I_x R_3 = I_1 R_2 \quad (2)$$

Divide equation (1) and (2). Note that I_x and I_1 cancel.

$$\frac{I_x R_x}{I_x R_3} = \frac{I_1 R_1}{I_1 R_2} \Rightarrow \frac{R_x}{R_3} = \frac{R_1}{R_2} \quad \Rightarrow R_x = \frac{R_1}{R_2} R_3$$

the ratio arm of the bridge is R_1/R_2 . The bridge is balanced by varying R_3 for zero current in the meter.

Note: When current flows through the meter path bc , the bridge circuit is unbalanced and must be analyzed by Kirchhoff's laws or network theorems.