

Measurement Systems

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LAB 1: Conversion of galvanometer to voltmeter and ammeter

Handwritten calculations for converting a galvanometer to an ammeter:

$I_m = 1 \text{ mA}$

Galvanometer to voltmeter

$$R_{sh} = \frac{I_m R_m}{I_n - I_m}$$

1) $I_n = 2 \text{ A}$
 $I_m = 1 \text{ mA}$
 $R_m = 200 \Omega$

$$R_{sh} = \frac{0.001 \times 200}{2 - 0.001} = \frac{0.2}{1.999} = 0.1 \Omega$$

2) $I_n = 20 \text{ A}$
 $I_m = 1 \text{ mA}$
 $R_m = 200 \Omega$

$$R_{sh} = \frac{0.2}{19.999} = 0.01 \Omega$$

3) $I_n = 50 \text{ mA}$
 $I_m = 100 \mu\text{A}$
 $R_m = 200 \Omega$

$$R_{sh} = \frac{0.2 \times 10^{-3}}{0.05 - 0.0001} = \frac{0.2 \times 10^{-3}}{0.0499} = 4 \text{ m}\Omega$$



voltmeter

0-10V

0-100V

$$R_s + R_m = 10 \text{ k}$$

$$I_{fsp} = \frac{10}{10000} = 1 \text{ mA}$$

$$I_{fsp} = \frac{V_{fsp}}{R_{ext} + (R_s + R_m)}$$

$$2 \text{ mA} = \frac{100}{R_{ext} + 10000}$$

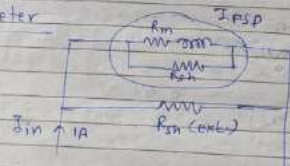
$$R_{ext} + 10000 = \frac{100}{0.002} = 50000$$

$$R_{ext} = 50000 - 10000 = 40000$$

$$= 40 \text{ k}$$

in series

ammeter



$$R_{sh} (ext) = \frac{I_m \cdot R_m}{I_{in} - I_m} = \frac{1 \times 0.3}{10 - 1}$$

$$= \frac{0.3}{9}$$

$$= 0.0333 \Omega$$

in parallel

0-1 to 10 v

$$R_s + R_m = 1 \text{ k}\Omega$$

$$I_{ASP} = \frac{1}{1000\Omega} = 1 \text{ mA}$$

$$I_{ASP} = \frac{V'_{ASP}}{R_{ext} + (R_s + R_m)}$$

$$1 \text{ mA} = \frac{10}{R_{ext} + 1000\Omega}$$

$$10^3 \quad R_{ext} + 1000\Omega = 10000$$

$$R_{ext} = 9 \text{ k}\Omega$$

0-1 to 10 A

$$R_{sh}(ext.) = \frac{I_m \cdot R_m}{I_{in(new)} - I_m}$$