

Measurement Systems

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LAB 1: Conversion of galvanometer to voltmeter and ammeter

Handwritten calculations on lined paper showing the conversion of a galvanometer to an ammeter. The calculations are as follows:

$I_m = 1 \text{ mA}$

Galvanometer to voltmeter -

$$R_{sh} = \frac{I_m R_m}{I_{in} - I_m}$$

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

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

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

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

$$2 \text{ mA} = \frac{100}{R_{ext} + 1000}$$

$$R_{ext} + 1000 = \frac{100}{0.002} = 50000$$

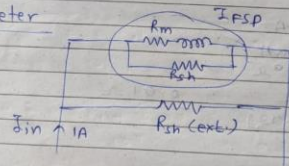
$$R_{ext} = 50000 - 1000$$

$$= 49000$$

$$= 49 \text{ k}$$

in series

Ammeter



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

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

$$= 0.0333 \Omega$$

in parallel

0-1 to 10 v

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

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

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

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

$$R_{ext.} + 1000 \Omega = 10000$$

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

0-1 to 10 A

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