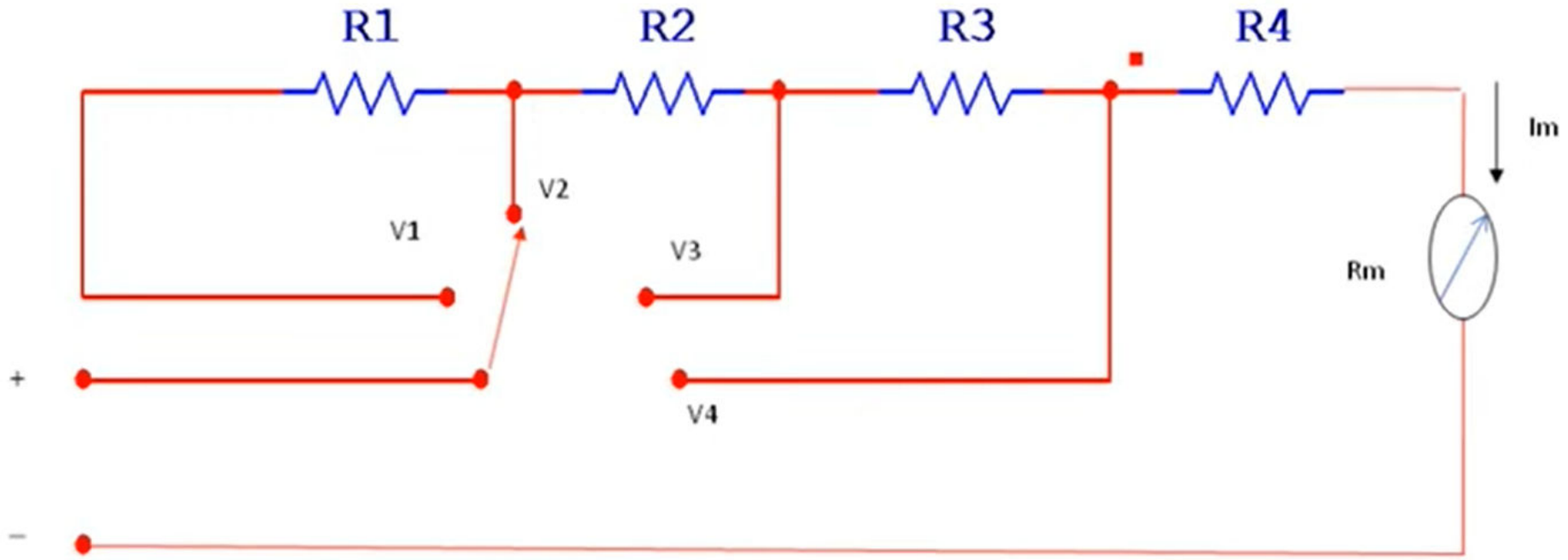
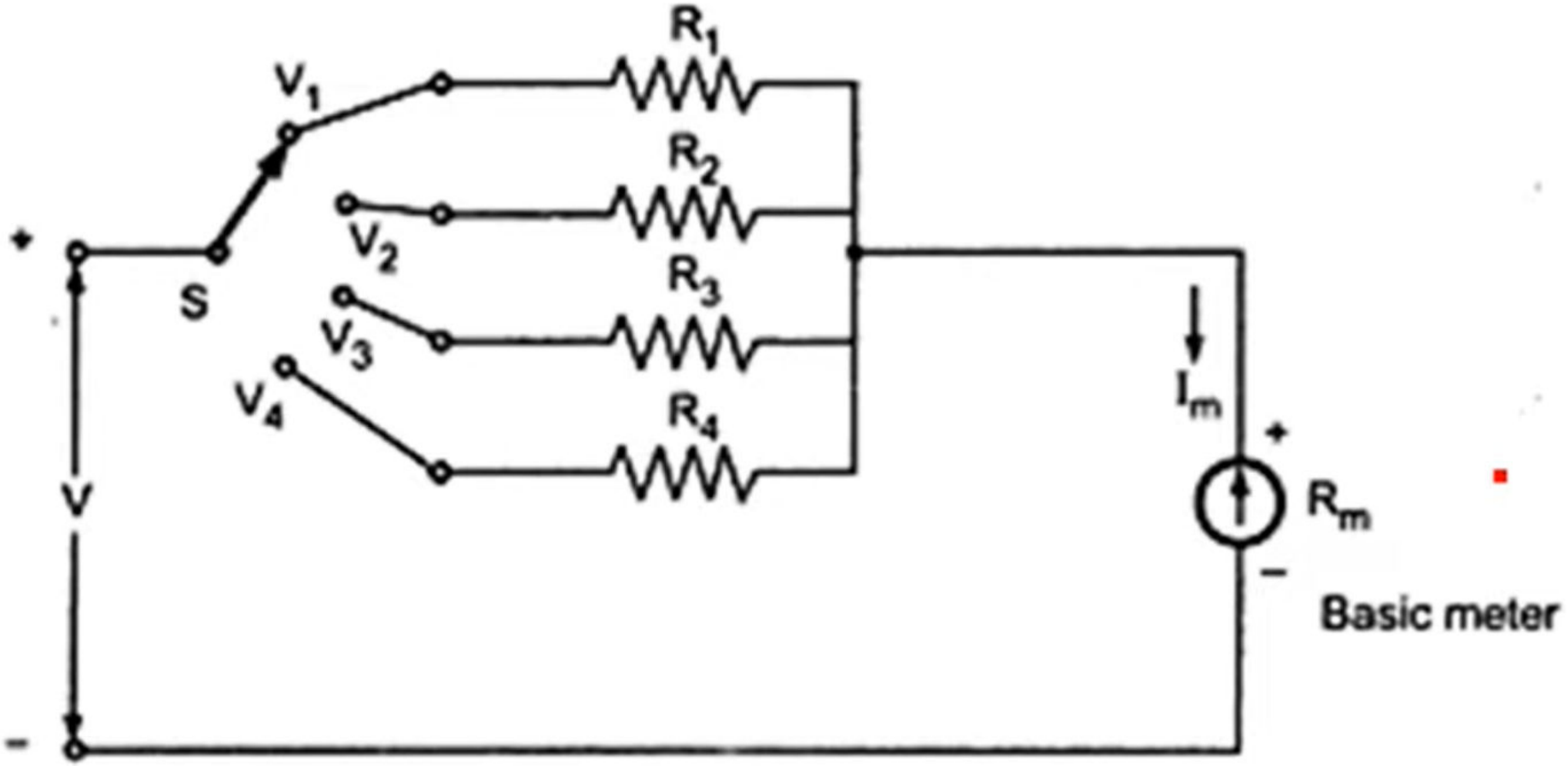
Multi-range DC voltmeter

- A DC voltmeter can be converted into a multirange voltmeter by connecting a number of resistors (multipliers) in series with the meter movement.
- A practical multi-range DC voltmeter is shown in Figure.



Other type of Multi-range DC voltmeter



Example problem

1. Convert a basic D' Arsonval movement with an internal resistance of 50Ω and a full scale deflection current of 2 mA into a multirange dc voltmeter with voltage ranges of 0-10V, 0-50V, 0-100V and 0-250V.

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1. Convert a basic D' Arsonval movement with an internal resistance of 50Ω and a full scale deflection current of 2 mA into a multirange dc voltmeter with voltage ranges of 0-10V, 0-50V, 0-100V and 0-250V.

$I_m = 2mA$, $R_m = 50\Omega$, $V_1 = 10V$, $V_2 = 50V$

$V_3 = 100V$, $V_4 = 250V$.

Shunt :-

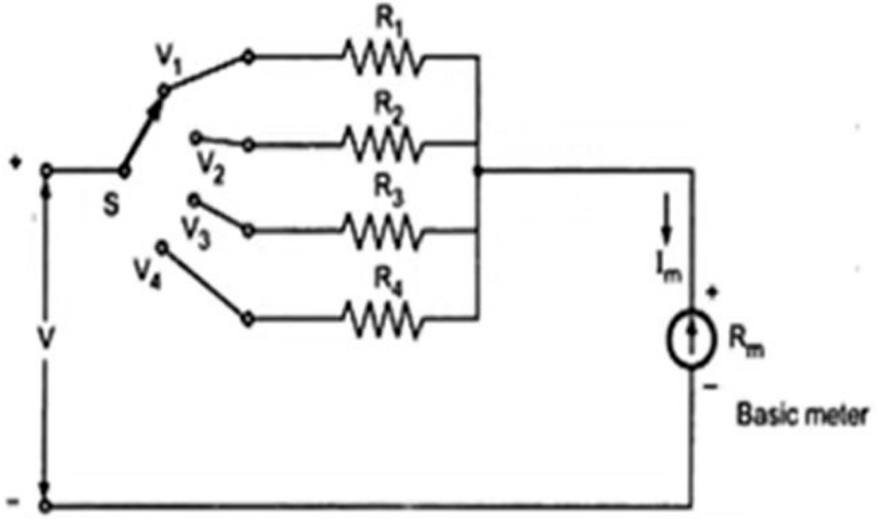
case1 : $S \rightarrow V_1$ $\quad R_{S_1} = \frac{V_1}{I_m} - R_m = \frac{10}{2m} - 50$

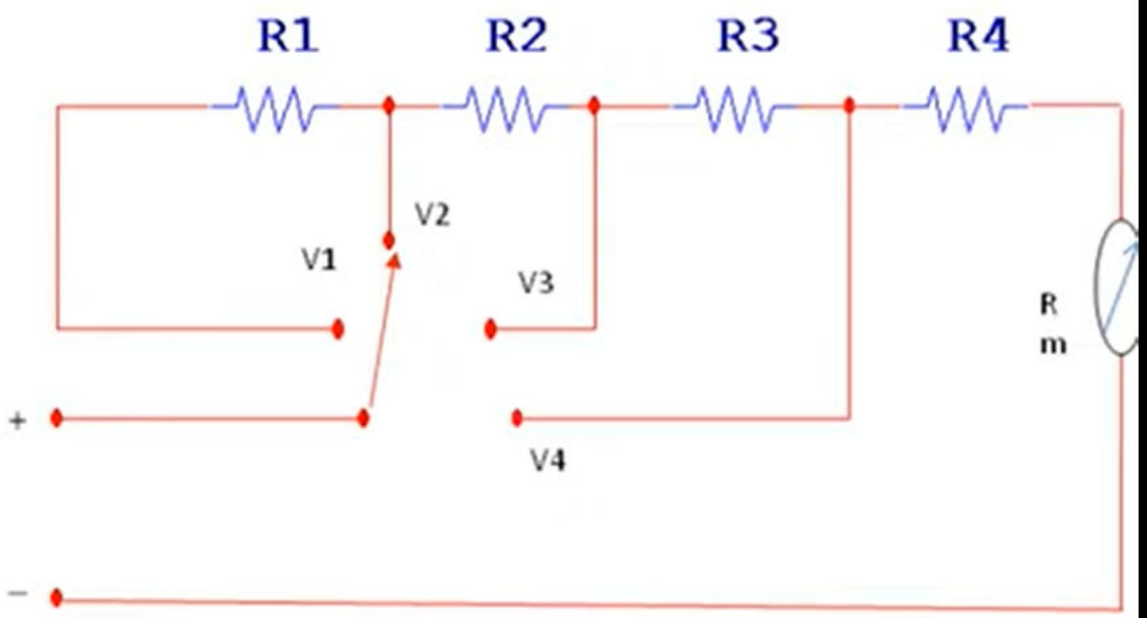
$= 4.95k\Omega$.

case2 : $S \rightarrow V_2$, $\quad R_{S_2} = \frac{V_2}{I_m} - R_m = 24.95k\Omega$

case3 : $S \rightarrow V_3$ $\quad R_{S_3} = \frac{V_3}{I_m} - R_m = 49.95k\Omega$

case4 : $S \rightarrow V_4$; $\quad R_{S_4} = \frac{V_4}{I_m} - R_m = 124.95k\Omega$




R1
R2
R3
R4
V2
V1
V3
R
m
+
V4
–

Series

Case1: $S \rightarrow V_4$; $R_{s4} = \frac{V_4}{I_m} - R_m$

$= 4.95 k\Omega$

Case2: $S \rightarrow V_3$; $R_3 = ?$

Total Voltage $\rightarrow V_3$

" Current $\rightarrow I_m$

" Resistance $\rightarrow R_t$

$R_t = R_3 + R_4 + R_m$.

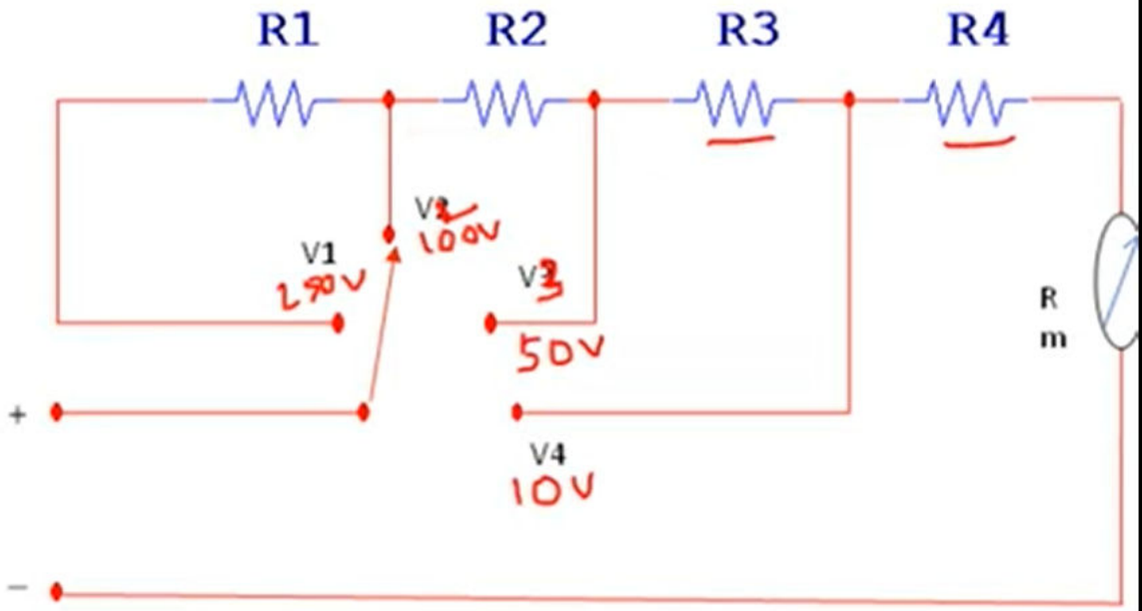
$R_t = \frac{V_3}{I_m} = ?$

$R_3 = 20 k\Omega$

Case3: $S \rightarrow V_2$, $R_2 = ?$

$R_t = R_2 + R_3 + R_4 + R_m$

$R_t = \frac{V_2}{I_m}$



$R_2 = 25 k\Omega$

Case4: $S \rightarrow V_3$; $R_1 = ?$

$R_t = R_1 + R_2 + R_3 + R_4 + R_m$

$R_t = \frac{V_1}{I_m}$

$R_1 = 75 k\Omega$.

Shunt	Series
→ R_1 = 4.95Ω (one)	R_1 = 4.95Ω (one)
→ R_2 = 24.95Ω (one)	R_2 = 20Ω (two)
→ R_3 = 49.95Ω	R_3 = 25Ω
→ R_4 = 124.95Ω	R_4 = 75Ω