

10. MEASUREMENT OF ACTIVE AND REACTIVE POWER BY 1- WATTMETER METHOD

Objective:

Measurement of active and reactive power using 1-wattmeter at different R, L & C loads.

Apparatus:

Hardware:	Name of the apparatus	Quantity
	32 Amps, 3 pole Fuse Switch	1 No
	0-300 W, U.P.F. Wattmeters	1 No
	0 – 10 A, A.C Ammeter	1 No
	0-300 V, A.C Voltmeter	1 No

Theory:

The active power is obtained by taking the integration of function between a particular time interval from t_1 to t_2

$$P = \frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} P(t) dt$$



By integrating the instantaneous power over one cycle, we get average power.

The average power dissipated is

$$P_{av} = V_{eff} [I_{eff} \cos\theta]$$

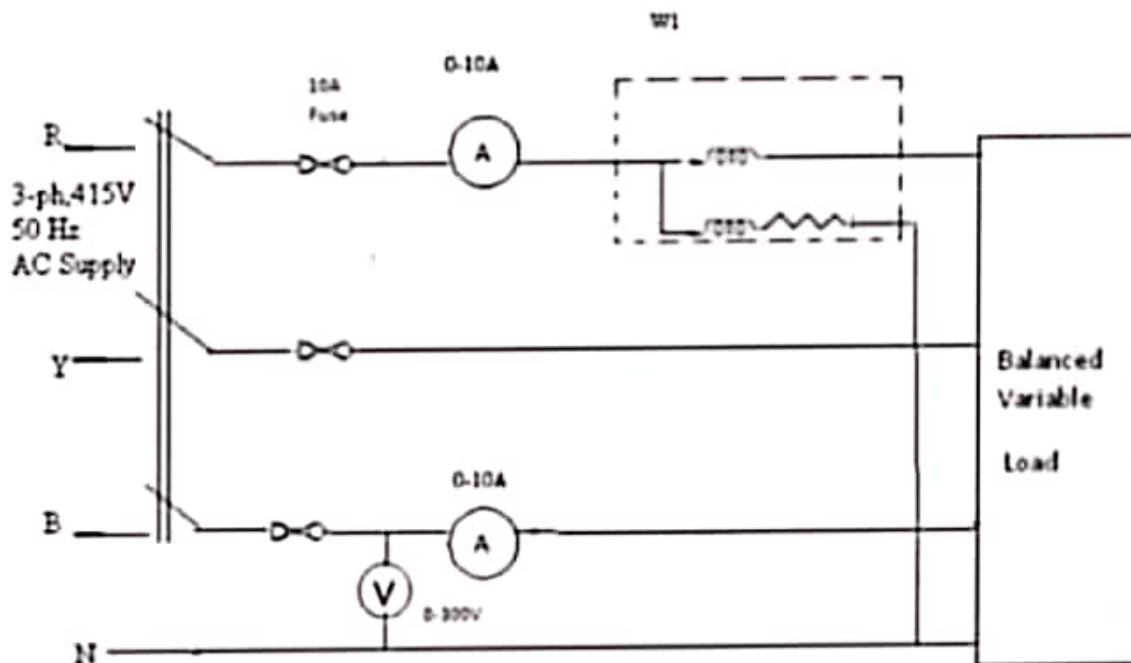
From impedance triangle,

$$\cos\theta = R/Z$$

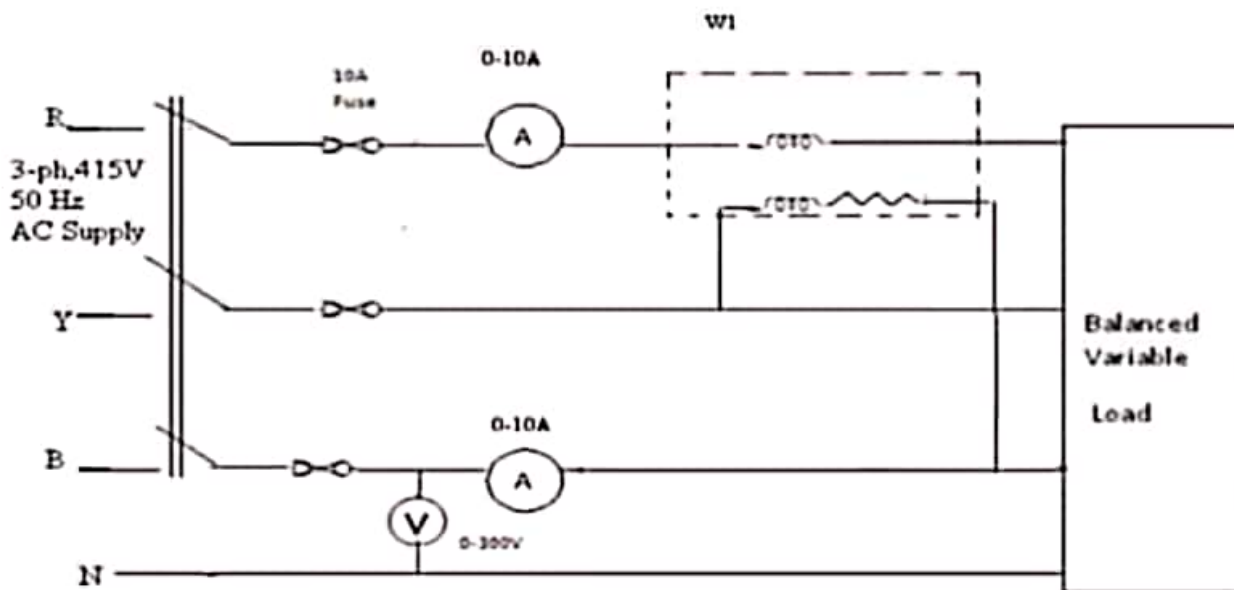
Substituting, we get

$$\text{Reactive Power } P_r = V_{eff} [I_{eff} \sin\theta]$$

Active power measurement:



Reactive power measurement:



Procedure:

- g) Connect the circuit as shown in the circuit diagram.
- h) Keep all the toggle switches in ON condition.
- i) Switch on equal loads on each phase i.e. balanced load must be maintained with different load combinations.
- j) Connect the ammeter in R-Phase and then switch OFF the toggle switch connected across the ammeter symbol.
- k) Connect the pressure coil of the wattmeter across R-Y phase and current coil in R-phase to measure active power.



Observations:

Load: Balanced load

Type of the load	V_{ph}	I_L	P_{ph}	P_{actual} $P = 3 \times P_{ph}$	$\cos \theta$ $= P / (\sqrt{3} V_L I_L)$

Result:

Active and Reactive powers were measured using 1-wattmeter at R, L and C Loads.