

Heaven's Light is Our Guide



Rajshahi University of Engineering & Technology

Department of Electrical & Computer Engineering

Lab Report

❖ **Course Code** : ECE 1202
❖ **Course Title :** :Circuits and System II sessional
❖ **Date of experiment** : 22-09-2024
❖ **Date of Submission** : 30-09-2024

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Name of the Experiment: Power measurement in three-phase circuit with balanced load using two Wattmeter method

Objective:

The objective of this experiment is to measure the power consumed by a balanced 3-phase load using the two-wattmeter method and to analyze the power factor, total power, and phase angle.

Theory:

In a balanced 3-phase system, the total power delivered to a load can be measured using the two-wattmeter method. This technique is widely used in both star (Y) and delta (Δ) connected systems. The two-wattmeter method is advantageous because it requires only two wattmeters to measure the total power, regardless of the load configuration.

Active power is the actual power consumed by the load and is measured in watts (W). For a balanced three-phase system, the total active power can be given by:

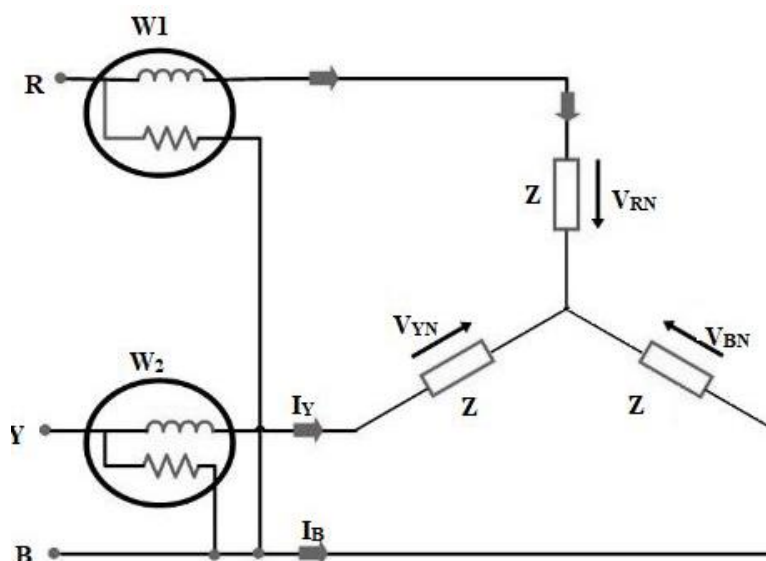
$$P = P_1 + P_2$$

$$\text{And } P_T = \sqrt{3} V_L I_L$$

Apparatus:

1. Variac
2. Multimeter
3. Resistor
4. Two wattmeters
5. Voltmeter
6. Ammeter
7. Connecting wires

Circuit Diagram:



Data Table:

| Sl no: | P ₁ | P ₂ | P _T = P ₁ + P ₂ | P _T (cal) | V _L | I _L (mA) | Error% |
|--------|----------------|----------------|--|----------------------|----------------|---------------------|--------|
| 1 | 22 | 23 | 45 | 58.97 | 68.1 | .5 | 23.69% |
| 2 | 30 | 28 | 58 | 53.97 | 77.9 | .4 | 7.46 |
| 3 | 36 | 35 | 71 | 90.41 | 84.2 | .62 | 21.468 |
| 4 | 42 | 42 | 84 | 103.97 | 89.6 | .67 | 19.207 |

Calculations:

Here, The first error is $E_1 = \left| \frac{58.97 - 45}{58.97} * 100\% \right| = 23.69\%$

The first error is $E_1 = \left| \frac{53.97 - 58}{53.97} * 100\% \right| = 7.46\%$

The first error is $E_1 = \left| \frac{90.41 - 71}{90.41} * 100\% \right| = 21.468\%$

The first error is $E_1 = \left| \frac{103.97 - 84}{103.97} * 100\% \right| = 19.207\%$

Results: From the calculation , we can see that the 1st error is 23.69%, 2nd is 7.46% ,3rd is 21.468% and the last one is 19.207%

Conclusion:

The two-wattmeter method effectively measures the power consumed by a balanced 3-phase load. The method also provides a means of calculating the power factor, which helps in determining the nature of the load (inductive, capacitive, or resistive). Through this experiment, the concept of balanced 3-phase power measurement has been practically demonstrated.

Precautions:

1. Ensure that the connections of the wattmeters are correct to avoid incorrect readings.
2. Avoid overloading the wattmeters beyond their rated capacity.
3. Use appropriate measuring instruments for voltage and current to ensure accuracy.

Discussion:

The two-wattmeter method shows a reliable way to measure power in a three-phase system using only two wattmeters. The experiment highlights how the power factor affects the readings and the importance of accurate measurement in industrial applications where power efficiency is crucial.