West Virginia University Lane Department of Computer Science and Electrical Engineering

Experiment #3 Three Phase Circuit Measurements

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Date Performed: 09/13/23

Due Date: 09/20/23

Table of Contents:

Lab Handout:

No handout was provided for this lab

Objective & Equipment List for Each Experiment:

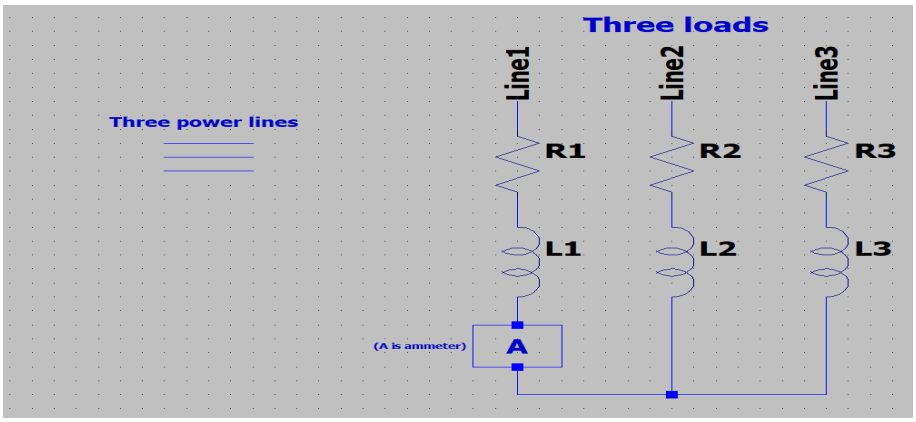
Objective: Analyze voltage current and power values for a three phase balanced system.

Equipment

- Wires
- Variable resistor box
- Bulbs 1 and 2 (bulb 3 is the resistor box)
- Power supply unit
- Value measuring unit

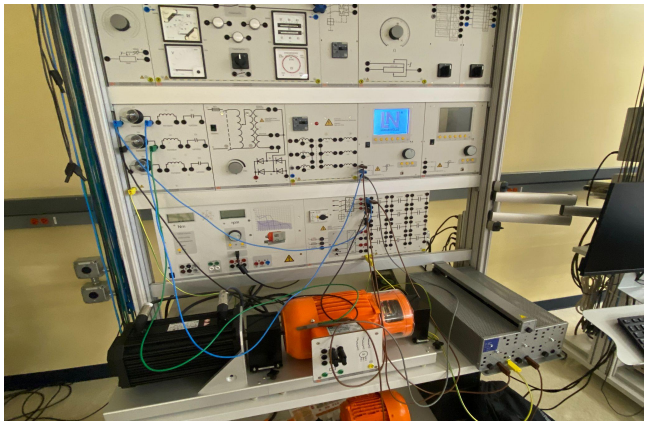
Procedure & Wiring Diagram

Figure 1: Diagram for Lab 3



The loads are intended to resemble bulbs at our work station. Since bulb 3 does not work, line 3 (R3+L3) was simulated with a variable resistor box. Line 1 has an ammeter attached and line 2 is without the ammeter nor the resistor box.

Figure 2: Experiment 3 Set - Up (wiring in this picture was later fixed)



Observed and/or Measured Results:

Table 1: Values for Line 1

Resistance (Ω)	Voltage (v)	Current (A)	Real Power P (watts)	Reactive Power Q (VAR)	Apparent Power |S| (VA)	Power Factor (cos(θ))
5k	109.2	0.07	8.1	-1.2	8.2	0.98
2.5k	125.9	0.08	10.1	1.2	10.2	1
0.4k	155.9	0.09	13.9	1.6	14	1

Table 2: Values for Line 2

Resistance (Ω)	Voltage (v)	Current (A)	Real Power P (watts)	Reactive Power Q (VAR)	Apparent Power |S| (VA)	Power Factor (cos(θ))
5k	107.4	0.08	8.2	1.1	8.3	1
2.5k	128.2	0.08	10.6	1.4	10.7	1
0.4k	156.5	0.09	14.3	1.8	14.4	1

Table 3: Values for Line 3

Resistance (Ω)	Voltage (v)	Current (A)	Real Power P (watts)	Reactive Power Q (VAR)	Apparent Power |S| (VA)	Power Factor (cos(θ))
5k	158.8	0.03	5.2	-1.5	5.4	-1
2.5k	111.7	0.09	10.1	1.1	10.1	1
0.4k	66.8	0.13	8.9	0.7	8.9	1

Observations and Conclusions:

As the resistance values were decremented, line 1 and line 2 observed an increase in all columns. This is consistent with Ohm's Law as V and I increase, the R must decrease. Line 3 did not behave this way; focusing on real power for 5k ohms 5.2 watts were produced, for 2.5k ohms 10.1 watts were produced and for 0.4k ohms, 8.9 watts were produced. This implies that line 1 and line 2 produce more power when the resistance is the least and line 3 produces the most power when the resistance is "optimized".

Focusing on the unexpected behavior of line 3, the load of line 3 being reactive may explain why the power factor is negative. This means that instead of current lagging voltage as for lines 1 and line 2, in line 3 current leads the voltage in terms of phase angle resulting in a negative power factor.

Line three's differences are an educated guess of the resistor box being replaced with the bulb. This may be the reason that the trends are different from the first two experiments. Another observation is at some point as the resistance decreases the reactive power flows from negative to positive because in table one and table three have the 5k Ohm resistance in the negative for Q. This also may be due to error because line 1 of the results the power factor remains positive like the rest and line 3 stays negative like the reactive power.