

EE 448 Laboratory Preface
Laboratory Introduction

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2/26/2007

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I. INTRODUCTION

The electric machinery laboratory provides students with the opportunity to examine and experiment with different types of electromagnetic devices. The electric machinery laboratory is located in Room 1102 Coover Hall.

II. LABORATORY POLICIES

The lab grade comprises a percentage of the EE 448 course grade (as announced by the course instructor). The lab grade is derived from three components: pre-lab exercises, lab performance, and lab quizzes. The course or lab instructor will announce the relative weighting of each component. Include your name, section number, and lab bench number on all pre-lab exercises, lab summaries, and quizzes.

All labs have preliminary reading material containing pre-lab exercises. Pre-lab readings and exercises are important as they provide the “theoretical” answers to which the laboratory observations and values will be compared. Pre-lab exercises will be due at the beginning of the corresponding lab. Pre-labs will be graded on correctness and on the completeness of supporting work.

Each student is expected to actively participate in each lab experiment. Each student is encouraged to record all measurements and results individually in his/her own lab manual. These lab results will be consolidated into one brief lab summary for each team. This summary should contain answers to any questions posed in the lab exercise, a comparison of measured values with expected values (from the pre-lab), an analysis of why the observed values may have differed from the predicted values, and any other important results or conclusions you may have reached. The lab summary should be turned in at the end of the lab **before** the circuit is disconnected (to facilitate corrections if they are required). Lab performance grades will be based on the instructor’s observations of student preparation, participation, effort, and thoroughness as well as the measurement results, observations, and conclusions in the summary. A portion of the lab performance grade may also be based on the condition the students’ lab bench and work area is found after the lab.

Lab quizzes, approximately 10 to 15 minutes in length, will be given unannounced at the beginning of some lab periods. Quizzes may cover preliminary reading material and pre-lab exercises from the current lab as well as results, observations, and conclusions from previous labs.

All labs must be completed to pass this course. Students missing a scheduled lab due to an **unavoidable** circumstance should make every effort to

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make-up the lab **during the week (two day period for summer labs) in which it was originally scheduled** by attending any later, regularly scheduled lab. If time permits, notify the instructor of the lab you want to attend of your request to make-up a lab. If you are unable to notify the lab instructor ahead of time, talk him/her immediately at the start of the lab period. If you are unable to attend a later lab, contact your lab instructor **as soon as possible** to arrange a make-up time. Make-ups for absences due to known circumstances (such as class field trips, etc.) must be arranged **before** the absence occurs.

III. LABORATORY PRACTICES

The normal grouping of students is four separate groups with three students in each group. The laboratory instructor will make available all instruments and equipment used in this laboratory. If necessary, the instructor will unlock the instrument cabinet and/or the oscilloscope cabinet. Each group should get the required instruments and oscilloscope as necessary for the particular laboratory assignment. **All connecting leads used during an experiment must be returned to their proper location. Use only the proper type and size of connecting lead for each connection.**

A. Equipment Damage

The Department of Electrical Engineering and Computer Engineering recognizes its obligation to instruct students in the proper use and care of electrical instruments and machines. In this laboratory, students are not charged a laboratory fee, but in lieu thereof, they are held financially responsible for such damage as may occur where the damage is attributable directly to failure to follow instruction or procedure. Instructors should make it clear during the first laboratory period that all members of a group must share equally in the cost of repair of laboratory equipment that they damage due to negligence. The laboratory instructor and course supervisor are responsible for determining student liability and the amount of the damage assessment fee.

B. Personal Injury Action

1. Call an ambulance, if required (**911**). There is a telephone in the same corridor where the lab is located.
2. Stay with patient.
3. Send others to direct medical aid personnel.

C. Safety Rules

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The following safety rules must be observed for proper laboratory safety.

1. Do not apply power to a laboratory setup until the instructor has approved the connections.
2. Do not make any changes in the connections until after the power source has been turned off.
3. Use only one hand for component adjustments or switching operations that are performed with the power on. Adjustments with the power on are rarely necessary and should be done only when the laboratory instructions specifically require them.
4. Arcs may occur when operating load rack switches, circuit breakers, and manual motor starters. Exposure to electric arcs may cause burns or eye injury. Do not look directly at the contacts when operating these devices.
5. Avoid getting any part of your body across live terminals or from such terminals to ground.
6. Inform all group members to stay away from live terminals before applying power to the circuit and inform all group members that the circuit is dead after turning the power off.
7. Do not wear loose clothing that could become entangled in moving parts.
8. Do not touch the terminals of capacitors even after the power is turned off. Capacitors can hold a charge. Assume that a capacitor is charged unless you discharge it through a resistor.
9. Do not enter the lab without proper shoes.
10. Eating and drinking is not allowed in the lab.

IV. EQUIPMENT LIST

1. Most of the experiments will be run using a versatile mobile workstation.
 - a. It has removable modules for various experiments.
 - b. It has many leads of various lengths but a connection on each end.
 - (1) Install and remove by using the "holder". Don't pull out the wire--that often results in an "open" underneath the insulation and frustrates the student "because of this lousy equipment."
2. The Electric Machines Lab "Lab Volt" Equipment
 - a. Power Modules (Combination of Direct Current and 60 Hertz, Alternating Current Systems).
 - (1) Alternating current, 60 Hertz, 120/208 volt, four terminal system. (Positions 1, 2, 3, N non-variable, 15 amperes and Positions 4, 5, 6, N variable, 5 amperes).
 - (2) Direct current 120 volts, two terminal system. (Positions 7, N variable, 8 amperes and Positions 8, N non-variable, 2 amperes.)

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- (3) A rheostat that controls both AC and DC.
 - (4) A main power switch for both AC and DC.
 - (5) A voltmeter that responds to a selector switch for various terminal combinations.
 - (6) Indicating lights to signal when module is energized.
 - (7) Plug in receptacle for 120 volt, 60 hertz AC, 15 amperes.
- b. Metering Modules
- (1) Three AC ammeters.
 - (2) Three AC voltmeters.
 - (3) One combination DC metering module with:
One voltmeter (0-200 volts)
One ammeter (0-500 milliamperes)
One ammeter (0-5 amperes)
 - (4) One watt-var meter, three phase. (See Figure 1 on page 7)
 - (5) One watt-watt meter, three phase. (See Figure 2 on page 7)
 - (6) One watt meter, single phase.
 - (7) One power transducer, single phase.
- c. Transformer Module (See Figure 3 on page 8)
- (1) One 2 winding, 117-10 volt (8 ampere secondary).
 - (2) One 3 winding, 120-208-120 volts with multiple taps and ratings.
- d. Resistance Module
- (1) Three combinations of three resistances of different values with toggle switches for paralleling. (Toggle switches closed in "up" position.)
- e. Inductance Module
- (1) Three combinations of three inductances of different impedances with toggle switches for paralleling.
- f. Capacitance Module
- (1) Three combinations of three capacitances of different impedances with toggle switches for paralleling.
- g. Squirrel Cage Induction Motor Module AC
- (1) Rated at 1/4 HP, 1670 RPM, 208 volts, 1.2 amps, 3 phase, 60 hertz.
 - (2) Stator windings are not connected internally.
- h. Synchronous Machine AC
- (1) As a generator rated at 120 voltamperes, 1800 RPM, 208 volts, 0.33 amps, 60 hertz, 3 phase.
 - (2) As a motor rated at 1/4 HP, 1800 RPM, 208 volts, 0.8 amps, 60 hertz, 3 phase.
 - (3) Stator winding not connected internally.
 - (4) Exciter winding rated at 120 volts DC equipped with 1 pole, toggle switch.

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- (5) Equipped with a 3 pole toggle switch (closed in "up" position).
 - i. Single Phase AC Motor Module, Capacitor Run
 - (1) Rated at 1/4 HP, 1715 RPM, 120 volts, 2.8 amps, 60 hertz.
 - j. Single Phase AC Motor Module Capacitor Start
 - (1) Rated at 1/4 HP, 1715 RPM, 120 volts, 4.6 amps, 60 hertz.
 - k. Direct Current Machine
 - (1) Rated at 1/4 HP, 1800 RPM, 120 volts, 2.8 amps, as a motor.
 - (2) Rated at 120 watts, 1800 RPM, 120 volts, 1 amp, as a generator.
 - (3) Windings not connected internally.
 - l. Electro-Dynamometer
 - (1) Torque variable from 0-27 lb-in.
 - (2) 120 volt, 60 hertz, AC supply.
3. Other Instruments and Devices
- a. Watt meters to measure power (analog).
 - b. Digital multimeters to measure voltage, current or resistance for either AC or DC.
 - (1) Caution: As an ammeter, use only when current values are less than 2 amperes.
 - c. Oscilloscopes to provide visual traces of voltage or current.
 - d. Operating Amplifier Circuit Board to enable observation of hysteresis loop of a transformer.
 - e. Strobotac to measure rotational speeds.
 - f. Resistance units.
 - g. Potential transformer, 2 winding, 4:1 ratio.

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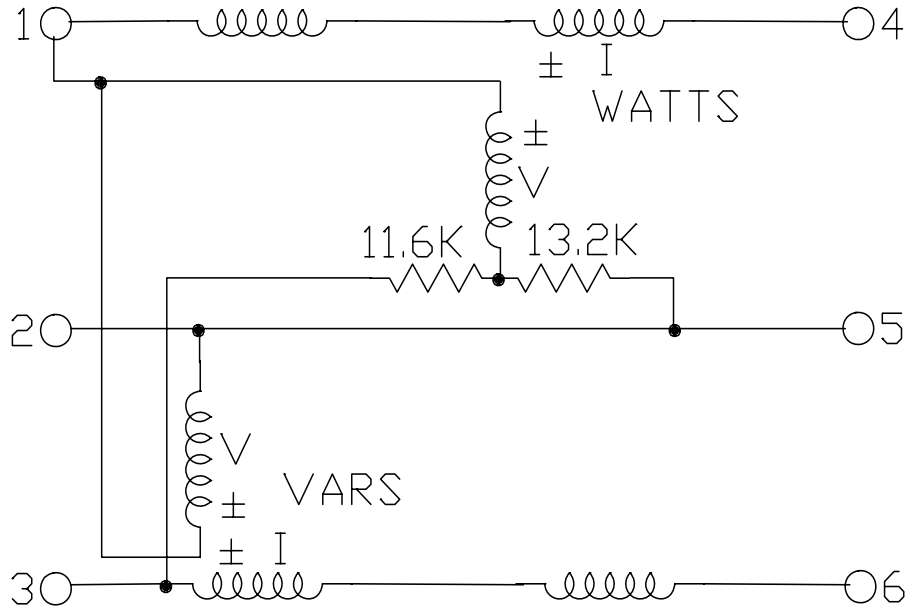


Figure 1: Three Phase Watt/Var Meter

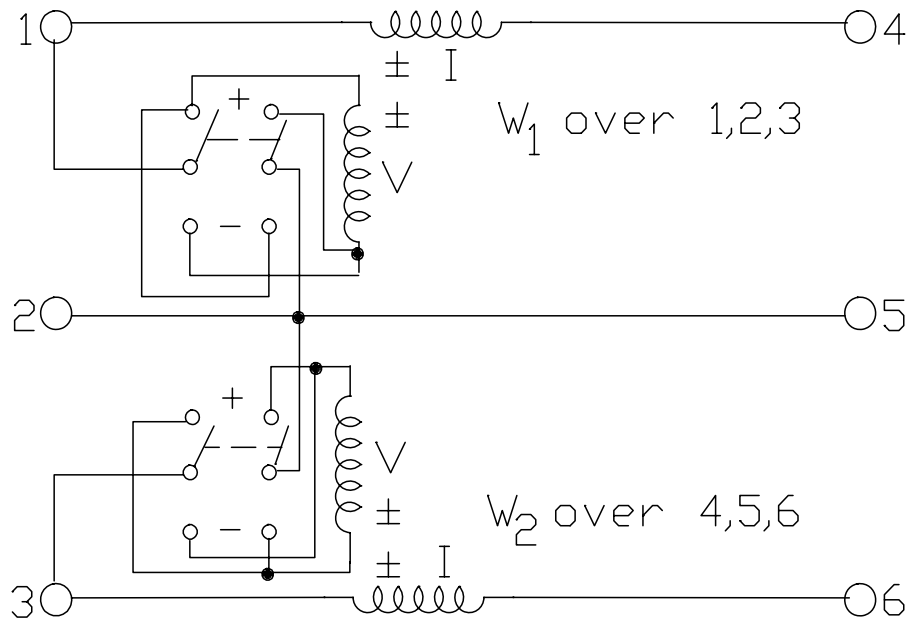


Figure 2: Three Phase Wattmeter

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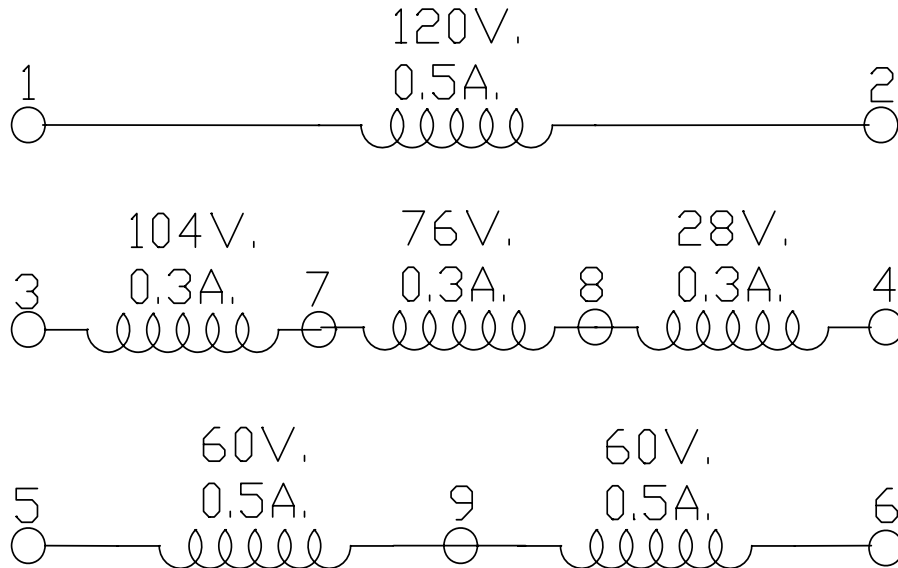


Figure 3: Transformer Module

V. CONNECTING LEADS

The types of leads available are:

1. Lab Volt Equipment - Stackable banana to banana leads located on the end of each unit.
2. Large Motor Equipment
 - a. Main leads - Male to female, spade to male, and spade to female (large diameter) located on center part of portable lead racks.
 - b. Voltmeter leads - Banana to spade and spade to spade (small diameter) located on end of portable lead racks.
 - c. Ammeter leads - Bayonet to spade and bayonet to bayonet (medium diameter) located on end of portable lead racks.