

Electrical Engineering Laboratory (1)

Introduction

In this laboratory, the student will deal with such matters as; laboratory reports, safety issues, , the breadboard, the Lab. measuring equipment's

Laboratory Equipment's

This handout is intended to provide a brief technical overview of the mostly used laboratory instruments in the Electrical Eng. Lab.

The multi-meter, the oscilloscope, and the function generator.

The Multi-meter

The multi-meter is a device capable of measuring electrical physical quantities such as; voltages, currents, and resistances. Given the wide range of measurements that are possible with this device, it is an indispensable tool in any electrical engineering lab. The multi-meter is mostly used for measuring voltage (as voltmeter), measuring current (as an ammeter), and measuring resistance (an ohmmeter). The following is brief description of each function.

Voltmeter

Configures the multi-meter to measure the magnitude of voltages in the electrical circuit. This configuration is selected by either pressing the DC V or the AC V buttons. It is connected in parallel with the element across which the voltage is to be measured.

Ammeter

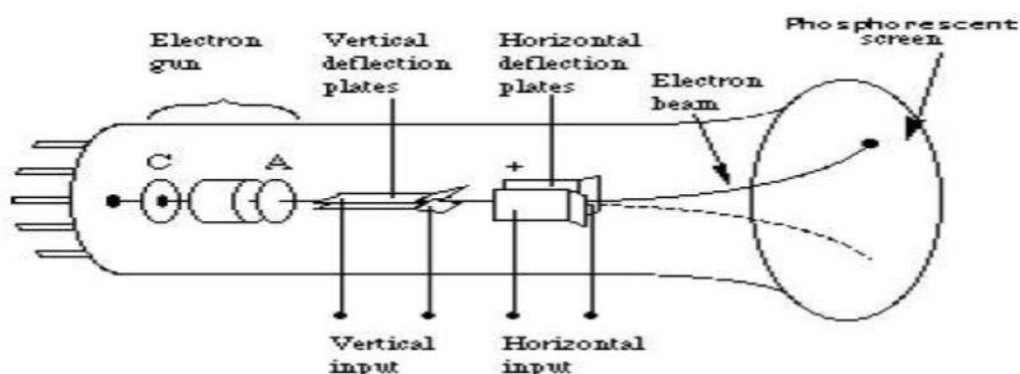
Configures the multi-meter to measure the magnitude of currents, It is connected in series with the circuit in which the current is to be measured (why). This configuration is selected by pressing either the DC I (SHIFT, DC V) or AC I (SHIFT, AC V) buttons.

Ohmmeter

Configures the multi-meter to measure the resistance in low, mid or high ranges. This configuration is selected by pressing the Ω button. It is different from the ammeter and voltmeter in that, it will show full scale deflection for zero Ohms (zero resistance or short circuit) and no deflection for infinite resistance.

The Oscilloscope

The oscilloscope is an electronic instrument based on the cathode ray tube (CRT) which is capable of generating a graph of an input signal versus a second variable. In most applications the vertical (Y) axis represents voltage and the horizontal (X) axis represents time (although other configurations are possible). Essentially, the oscilloscope consists of four main parts (see Fig. (1)): An electron gun, a time-base generator (this serves as a clock), two sets of deflection plates used to steer the electron beam and a phosphorescent screen which lights up when struck by electrons. The electron gun, deflection plates, and the phosphorescent screen are all enclosed in a glass envelope which has been sealed and evacuated. The visible part of the CRT tube, the "screen", is the outside of the glass wall on whose inner surface lays the phosphorescent film. The screen is inscribed with a set of axes enclosed by a grid. As the oscilloscope operates, the electron beam traces a graph of the input voltage versus time on the phosphorescent film behind these axes. The horizontal axis is the time axis, and the vertical axis is the voltage axis.

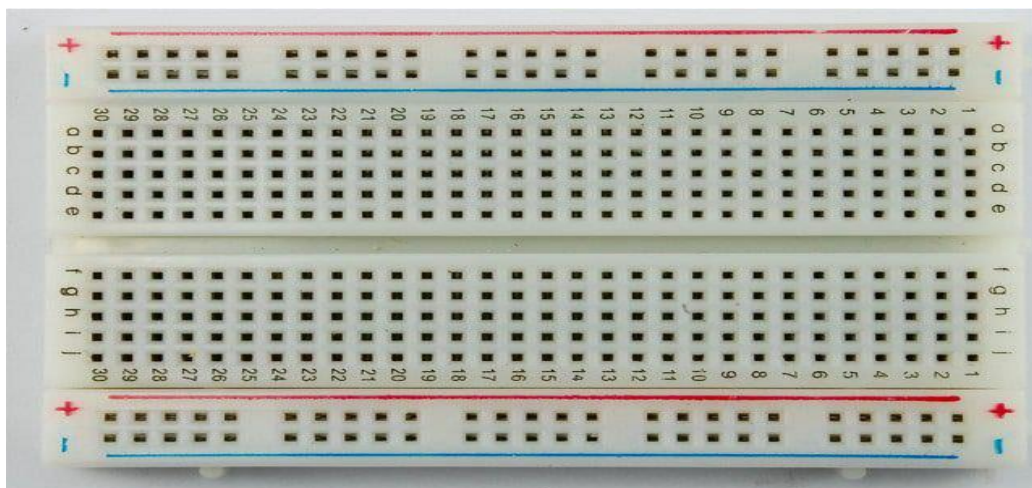


The Function Generator

The Function Generators are used for generating most of the waveforms that can be used to test the circuits under study. It presents the main interface for controlling wave shape, frequency, amplitude, and offset. By combining all of these features it is possible to create almost any necessary test waveform. The sine-wave, square wave, triangle wave, and ramp buttons generate the respective waveforms at the output of the function generator.

Breadboard Description

Most of the circuits built and tested in this laboratory will be assembled on a “breadboard,” which looks like a piece of plastic with holes in it. Electrical components (resistors, capacitors, wires, etc.) are inserted into the holes. What makes a breadboard unique is that certain combinations of the holes are electrically connected with each other. Since these connections are inside the plastic, they cannot be seen. Thus, a user must know which holes are connected. Most breadboards have a similar pattern of interconnections as shown in Fig. (2)



Laboratory Safety

When working in any electrical laboratory, always keep electrical safety in mind. Following are some safety rules that each student should be aware of

before beginning a laboratory experiment. Some of the rules do not apply to this laboratory, but to other electrical laboratories.

1. Use only the equipment provided. Do not use other equipment unless the laboratory instructor approves the use.
2. Keep all equipment properly grounded.
3. Avoid handling of exposed leads and conductors.
4. Turn off the power before changing components or connections.
5. To decrease the chances of being electrically shocked, wear dry shoes and do not stand on metal or wet concrete. Also, do not wear any metal or jewelry. Moreover, do not handle wires, components, or equipment with wet hands.
6. Always check and re-check circuit wiring before applying power. Always have a single switch or button that will immediately switch off power from the circuit in case of trouble.
7. Always ask for directions or help if you are unsure of the correct measurement procedure or circuit connection. If you don't understand what you are doing, seek assistance from the Lab. instructor