ELECTRONIC WORKSHOP # 01

Power Supplies and Measuring Instruments

Roll. No:	**Date:**
Checked by:	**Grade:**

Objectives:

- To become familiar with various types of Power Supplies
- To become familiar with various types of Measuring Instruments.

Apparatus: Power Supply units and Measuring Instruments available in laboratory.

Power Supplies:

A power supply unit is a source of either a Constant Current or Constant Voltage irrespective of the load resistance. Power sources can be classified as either varying or non-varying, i-e AC or DC. AC stands for Alternating Current whereas DC stands for Direct current. Graphically speaking, the Alternating currents are those that vary in some periodic fashion electrically and reverse polarity several times. The voltage which causes an Alternating Current is called AC voltage. Figure-1 shows the wave shape of an alternating power source.

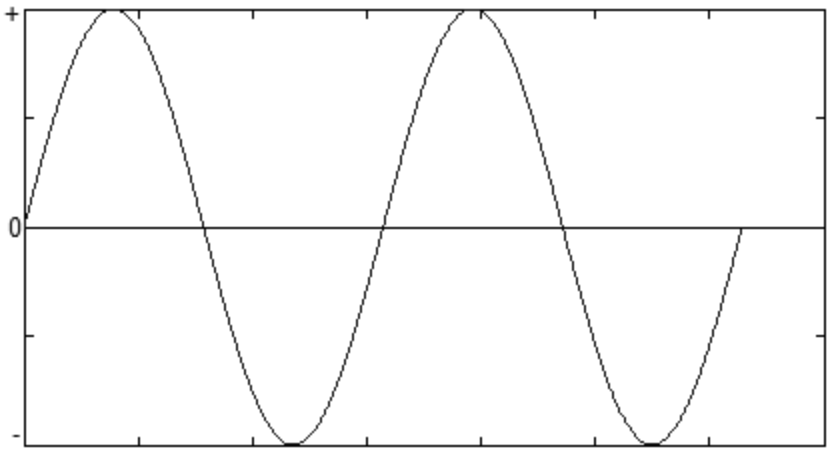

Figure-1: The AC Power Source

The sinusoidal waveform is the most popular, mostly because it is the waveform generated by alternators. Consequently, it is the form that comes in our house mains. It has a magnitude of

220V and a frequency of 50Hz, meaning that the voltage alternates polarity 50 times per second. The value 220V is the RMS (Root Mean Square) value of the incoming mains supply. The RMS value of an AC voltage is the equivalent DC energy delivered to the load.

The voltage that causes Direct Current is called DC Voltage. Unlike its AC counterpart, Direct Current flows with the same polarity at all times. An example of a Voltage source would be that of a battery or our home mains supply. The figure-2 shows the response of an ideal DC power source.

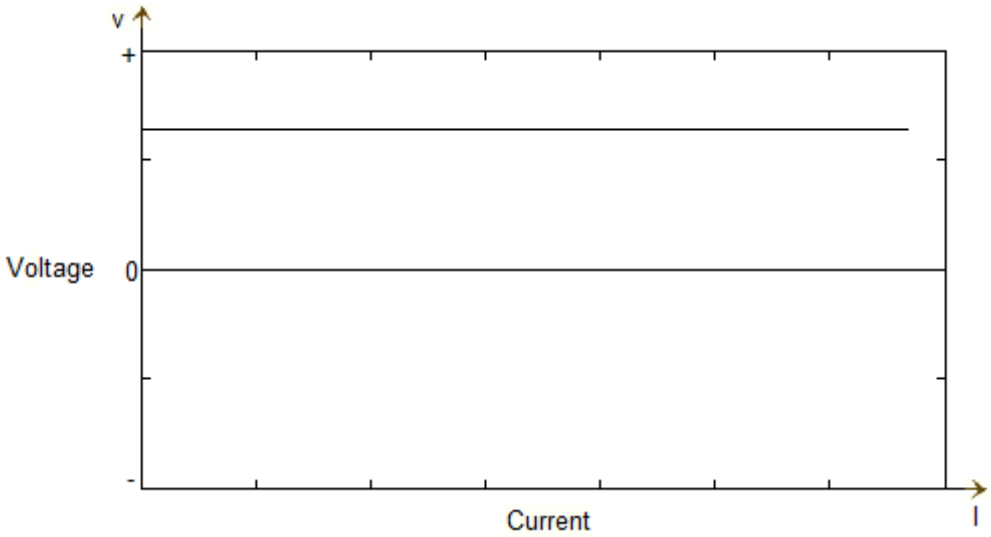

Figure-2: The Ideal DC Power

As seen in the above figure, the ideal voltage source is supposed to provide the same voltage for an infinite amount of time, but for a real voltage source (e.g. a battery), the voltage begins to droop as more and more current is taken from the source. This is because a voltage source (the battery), cannot contain an infinite amount of charge. The same is true for a current source too. Symbols of some Current/Voltage Sources are shown in figure-3.

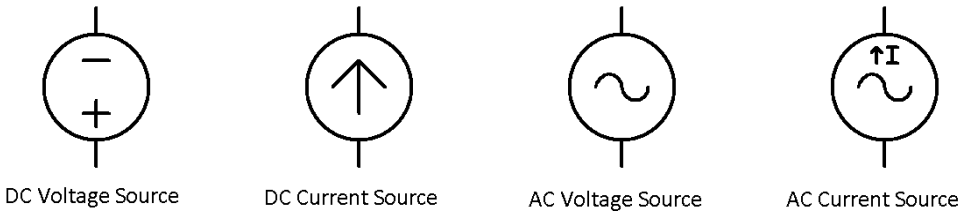

Figure-3: Symbols of Power Sources

Measuring Instruments:

Measuring instruments allow us to get an estimate of some physical quantity. An instrument that can measure Potential Difference (voltage) is known as a Voltmeter, one that measures

current is known as an Ampere Meter (Ammeter for short) and resistance is measured using an Ohmmeter. An instrument which can measure all three quantities is known as a Multimeter or sometimes an AVO (Ampere-Volt-Ohm) Meter. Traditionally all of the instruments consisted of a dial and a deflection pointer and thus were called Analog instruments. These devices required the correction of errors which showed up in them from time to time. This process of correcting the error is known as Calibration. Now digital instruments have replaced their old analog counterparts, un-necessitating the process of calibration. Also, Digital Instruments display readings on a Liquid Crystal Display making them easier to read as compared to analog instruments which often consist of multiple and/or nonlinear scales.

Voltmeters have high impedance and hence are connected in parallel across the points between which potential difference is to be measured. The reason that they have high impedance is that they do not steal away any current from the measured circuit. Ammeters, on the other hand exhibit a very small resistance, and hence are connected in series, they should never be connected in parallel since they may short out the circuit and result in it getting damaged. Figure-4 illustrates how to connect Voltmeters and Ammeters in a circuit.

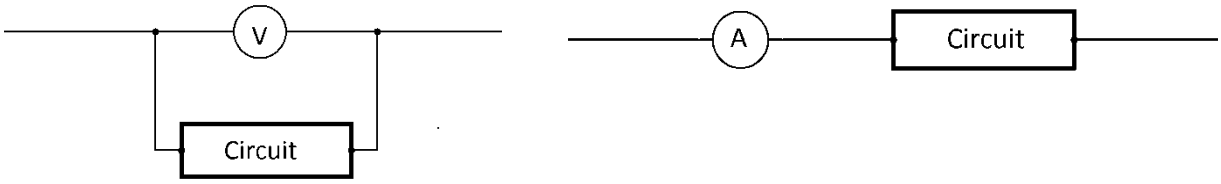

Figure-4: Connecting a Voltmeter and an Ammeter in a circuit

Multimeters usually have a selectable switch which allows you to select the quantity that you want to measure and the maximum value called Range, of that quantity that you want to measure as shown in figure-5:

Procedure:

1. Look for of Power Supply Units of any kind in laboratory, like AC Current Source, AC Voltage Source, DC Current Source, DC Voltage Source, and list them in Table-1. Note down their Type, Model, and the Range. Some of the power supplies have digital display; some of them might have a scale with a pointing needle.

2. Look for various kinds of Measuring Instruments e.g. Voltmeter, Ammeter, Ohmmeter etc, available in laboratory. Note down their Model No's, Type and the Quantity which they can measure and the range of measurement of each quantity in Table-2.

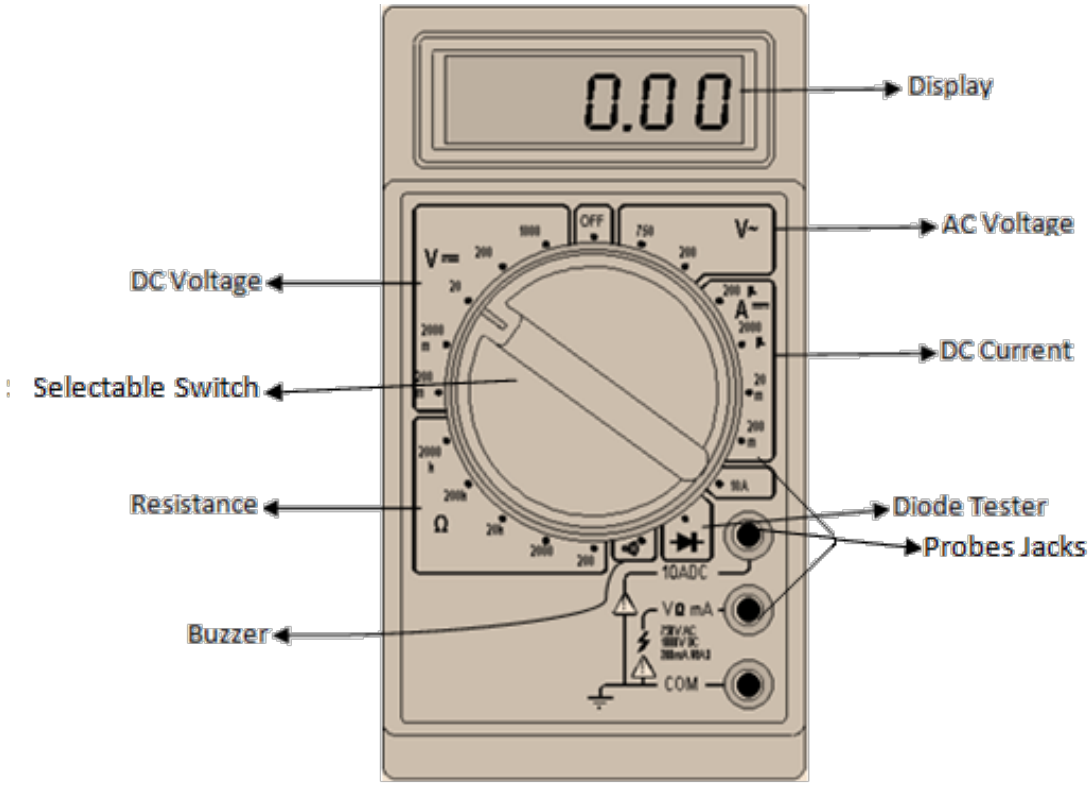

Figure-5: Multimeter Functions

3. Take any voltage source, connect a Voltmeter to its output terminals and turn it ON. Select any voltage from the voltage source, note down the selected value from its scale or display, against the value that you measure, in Table-3. Is the value exactly the same as selected? Repeat the same by selecting different magnitudes of voltage each time.

4. Finally, try measuring the mains AC Voltage. Take a Digital Multimeter (DMM), and set it to measure AC voltage. Select the measurement range higher than 220 Volts, and insert the DMM probes in any of the AC plugs in the laboratory.

Observations:

1. List all the Power Supply Units available in the laboratory.

S. N.o	Model	Type (Tick the Relevant Choice)				Range
		AC	DC	Voltage	Current	
1.						
2.						
3.						
4.						
5.						

Table-1: Determining the ranges and types of power supplies

2. List few of the Measuring Instruments available in the Workshop.

S. N.o	Model	Type (Analog Digital)	Measured Quantities				
			V AC	I AC	V DC	I DC	R
1.							
2.							
3.							
4.							
5.							

Table-2: Determining the ranges and types of Measuring Instruments

3. Fill in the following table for any of the Voltage Sources

S N.o	Selected Voltage (a)	Measured Voltage (b)	Percent Error $\frac{\lvert a-b \rvert}{a} \times 100$
1.			
2.			
3.			
4.			

Table-3: Determining the error in voltage output of a voltage source

Review Questions

1. Why AC voltage is supplied to our houses not DC despite most of the appliances run on DC?

_____
_____
_____
_____

2. Write down the voltage and current ratings of a few appliances in your home.

_____
_____
_____
_____

3. How can one use the multimeter to find shorts in a circuit?

_____
_____
_____
_____

4. Fill in the following table for the value of the quantity provided the Range is chosen as given in the table.

S No	Range	Reading on Multimeter	Value of quantity
1	10KΩ	2.5	
2	100Ω	25	
3	200 mV	20.00	
4	2V	0.02	
5	20µA	7.8	
6	10mA	0.2	

5. Describe a simple method of increasing the range of Ammeters and Voltmeters.

_____
_____
_____
_____

Assignment Question

Why the AC voltage supplied in our homes has magnitude 220v and frequency 50 HZ?