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# Experiment No.1

# AC Measurement

## 1. Theory

The Alternating current (AC Current) changes its direction periodically, it's time dependent. In this experiment, explain and understand the characteristics by plotting the instantaneous values of the AC current. This wave form plot is named as 'AC wave form'. To measure the different parameters of AC wave form there are different methods. All these are explained it his experiment.

The oscilloscope is an instrument for analyzing of electrical circuits by observation of voltage waves. It may be used to study frequency, phase angle, and time, and to compare the relation between two variables directly on the display screen. Perhaps the greatest advantage of the oscilloscope is its ability to display the periodic waveforms being studied.

## 2. Objectives

- To understand the characterize of alternating current (Ac current).
- To measure the different parameters of alternating current wave.

## 3. Sinusoidal Power Sources

Any AC sinusoidal voltage (or current) shown in Figure (1) can be define in following formula: $V(t) = V_p \sin(2\pi f t \mp \emptyset)$ where:

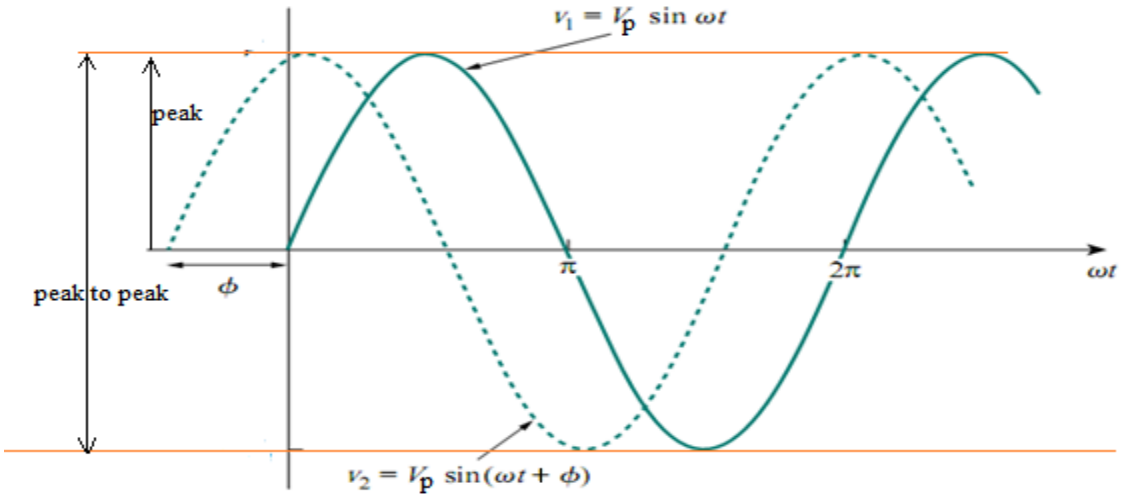
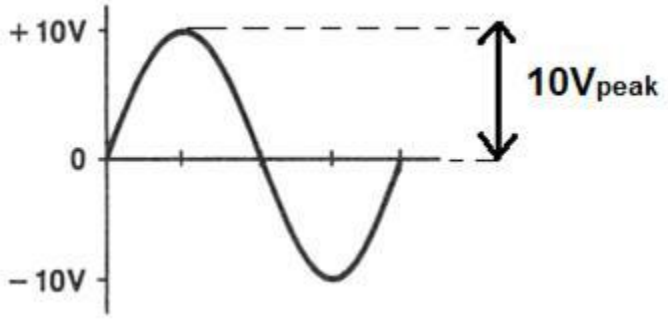



Figure (1): Illustrating for sinusoid signal attributes

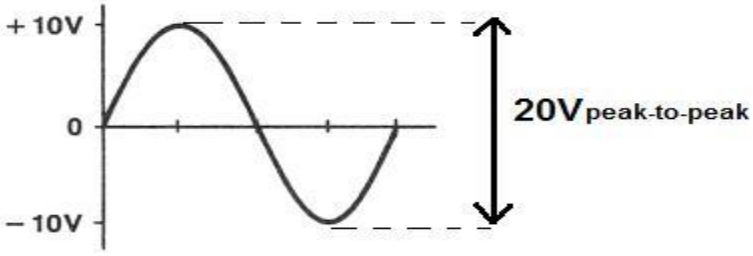
*Peak Value of an AC Waveform:*

The maximum value of a positive half cycle or a negative half cycle is called as "Peak value". It is represented by Im. It is the maximum voltage attained by the AC wave or RMS.




*Peak – to – Peak Value:*

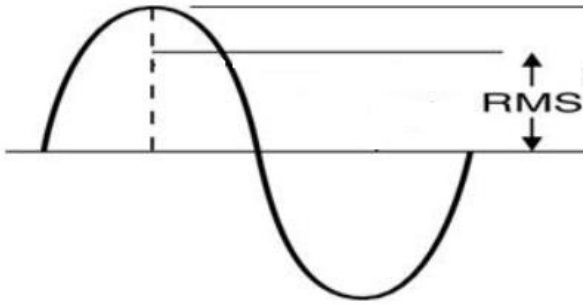
Peak – to – peak" voltage is the voltage measured between the maximum positive and negative amplitudes of a sine wave. It is double that of amplitude of the AC wave form. This is the maximum voltage value of the wave form. It is denoted by VPK.



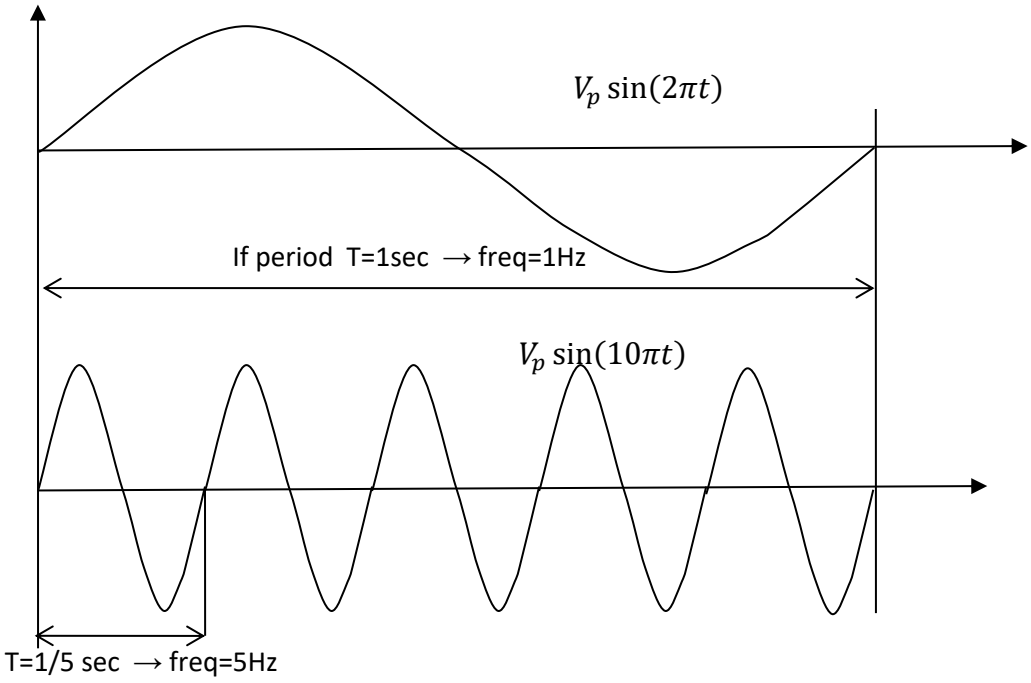
*RMS Value*:

This stands for Root Mean Square and it is the standard way of measuring and reporting alternating current and voltage. The RMS can be calculated by multiplying the peak to peak voltage by the square root of 2 (approximately 0.707).

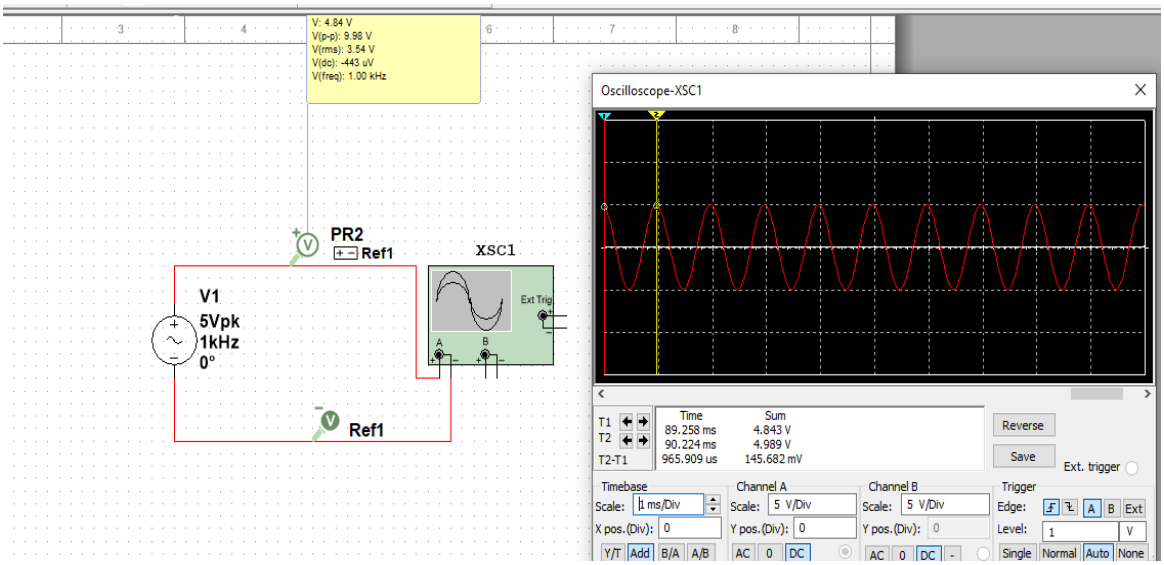
$$V_{rms} = \frac{V_p}{\sqrt{2}} = 0.707 \times V_p$$




The other important attribute for any sinusoidal signal its frequency which could be defined as number of cycle per second and measure in Hertz. Signal period could be defined as time needed to complete one cycle.




From above figure it's obvious that signal period is reciprocal of its frequency. Finally the phase shift between any two equal frequency signals (∅ ).



## 4. Procedure

1- Use function generator to generate a sinusoidal signal with any amplitude and any frequency.

2- Apply the signal to the input terminals of the oscilloscope then measure peak voltage, Vp.p and period then sketch the signal.

3- Write the time equation for this signal.

4- Use AC voltmeter to measure RMS voltage then show if :

$$V_{rms} = 0.707 \times V_p$$

5- Use frequency meter to find signal frequency then show if:

$period = \frac{1}{frequency}$ .