# Measuring Waveform Values Using an Oscilloscope

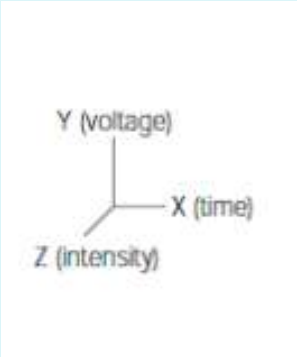
Lesson 11 EET 150

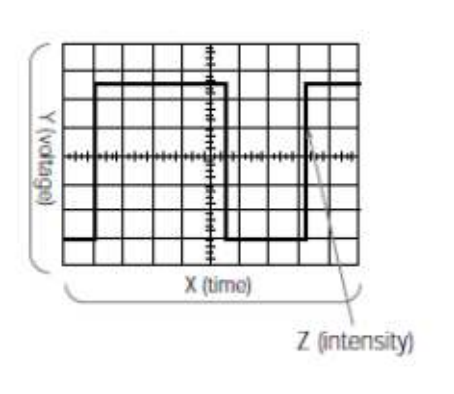
## Scope Measurement Learning Objectives

- In this lesson you will:
- what measurements an oscilloscope can make.
- how to interpret an oscilloscope display.
- how to measure signal amplitudes.
- how to measure signal frequency.
- see phase shift of waveforms.
- measure the phase shift between two waveforms.

## What Is an Oscilloscope?

An oscilloscope is an instrument that graphs electrical waveforms



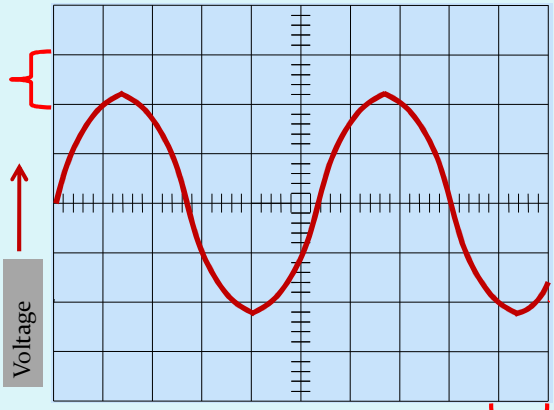




Axis Definitions

## Oscilloscope Measurements

- Period and voltage values of signal waveforms
- Frequency of oscillating signals
- Circuit operation represented by signal waveforms
- Phase shift of one circuit signal relative to another signal
- If a malfunctioning component is distorting a signal
- How much of a signal is ac and how much is dc.
- Circuit noise levels

## Making Voltage and Time Measurements with Oscilloscope




Vertical axis (Voltage)
Scale set in volts/division (volts/div)

Horizontal axis (Time)
Scale set in seconds/division (sec/div)

Oscilloscope (Scope) Display

## Making Voltage and Time Measurements with an Oscilloscope-Peak and Peak-to-Peak Voltage

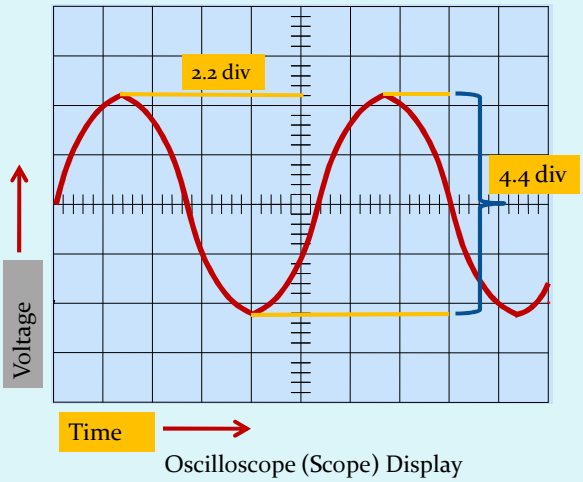
Example:
Time axis 1 mS/div
Voltage axis 2 V/div

Find peak voltage

$V_p$ = 2.2 div(2 V/div)
$V_p$ =4.4 V peak

Find peak-to-peak Value

$V_{pp}$ = 4.4 div(2 V/div)
$V_{pp}$ =8.8 V peak-to-peak




Oscilloscope (Scope) Display

## Making Voltage and Time Measurements with an Oscilloscope-Period and Frequency

Example:
Time axis 1 mS/div
Voltage axis 2 V/div

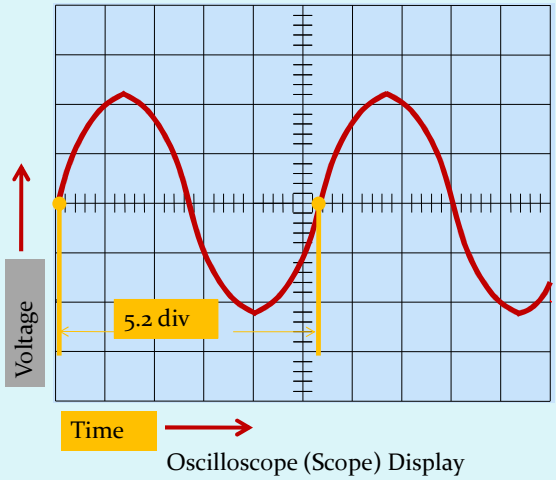
Find period of signal

T = 5.2 div(1 mS/div)
T = 5.2 mS

Find frequency of signal

$$f = \frac{1}{T}$$

$$f = \frac{1}{5.2 \times 10^{-3}\,s} \approx 192\,Hz$$




Oscilloscope (Scope) Display

## Making Voltage and Time Measurements with an Oscilloscope-Phase Shift

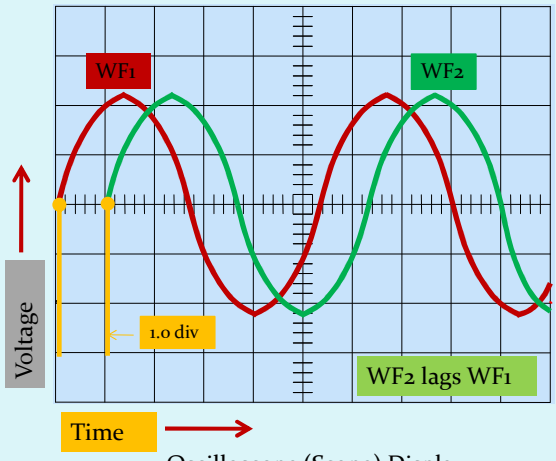
Example:
Time axis 1 mS/div
Voltage axis 2 V/div

Find phase shift
between WF1 and WF2
(WF1 reference)

$t_p$ = 1.0 div(1 mS/div)
$t_p$ = 1.0 mS

$$\phi = \left(\frac{t_p}{T}\right)(360)$$

$$\phi = \left(\frac{1.0\,mS}{5.2\,mS}\right)(360) = 69.2°$$




Oscilloscope (Scope) Display

# Measuring Waveform Values Using an Oscilloscope

End Lesson 11 EET 150

Coming Next: Oscilloscope Controls