Oscilloscope

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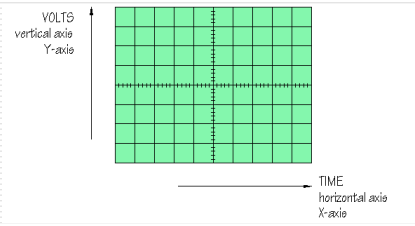
What is an oscilloscope?

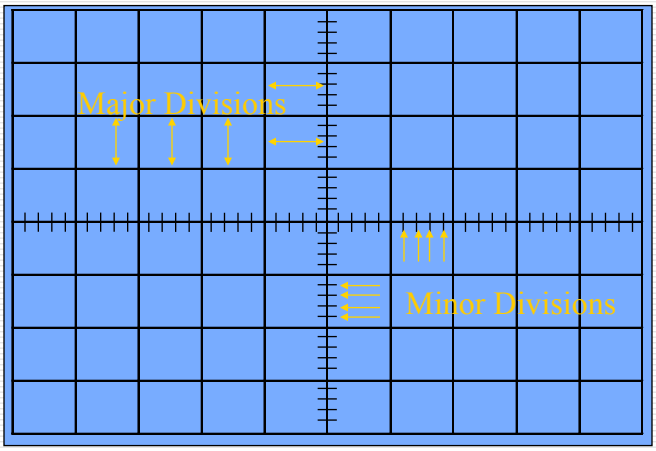
- A visually scaling voltmeter.
- Used to measure and then display voltage readings over a period of time.
- Graphed on a graticule with X and Y axis's.

Graticule



- The vertical scale is the Y axis which displays measured voltage.
- Horizontal scale is the X axis which displays measured time.

Gridlines



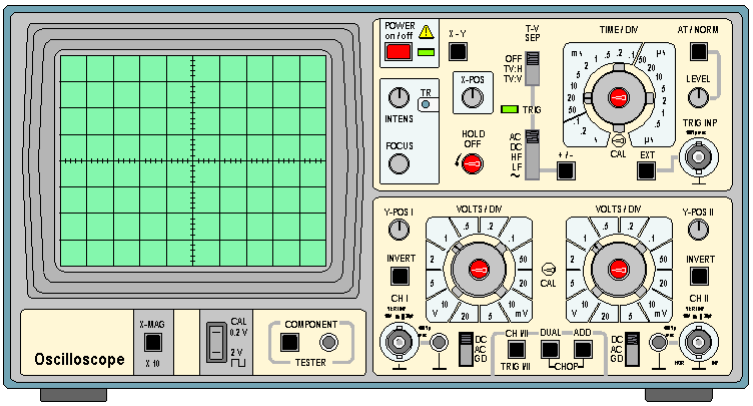
"Y" axis

- Displays the voltage measured from a circuit.
- Graduations are in volts or fractions of a volt.
- Each horizontal grid line is a major division of the measurement
- Voltages/Division 5.0v-.005v

"X" axis

- Displays the time which has passed.
- Graduations are in seconds or fractions of a second.
- Each vertical grid line is a major division of the measurement
- Time/Division .2sec-.2usec

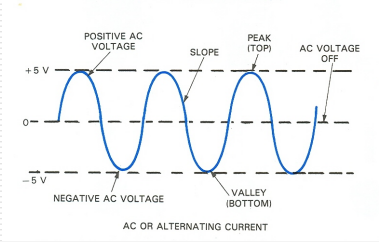
Control layout



Waves and waveforms

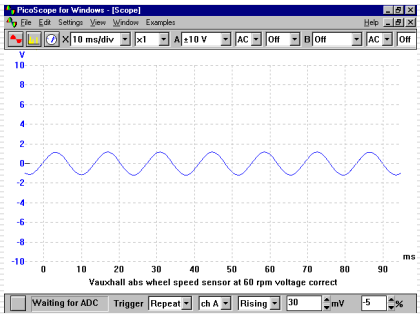
- A wave is a disturbance traveling through a medium. (electrical flow)
- A waveform is the graphic representation of the wave plotted over time.

Wave



- A signal with a gradual increase or decrease which may repeat over time.
- Components:
  - Positive slope
  - Negative slope
  - Peak
  - Valley
  - Cycle
  - Period

Components of a waveform



- Frequency: number of times a signal cycles within a second.
- Period: amount of time required to complete one cycle.
- Amplitude: reference point to peak. DC from zero to peak. AC peak to trough.

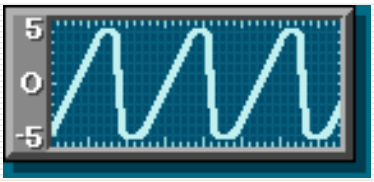
Period

- The amount of time required to complete one cycle.
- Measure from two similar sections of consecutive waves.

Amplitude

- The vertical measurement from a reference point to a peak.
- DC from zero to peak.
- AC peak to trough.

Frequency

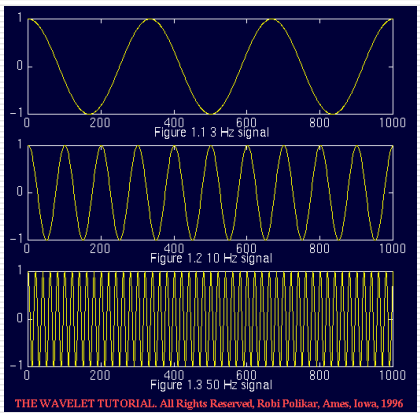


- How many times a signal cycles within one second.
- Measured in Hertz (Hz).
- Measured with:
  - DVOM Hz setting
  - Analog oscilloscope
  - Digital oscilloscope

Frequency

- To determine frequency:
  - Convert the period from a multiplier based number to a second base number.
    - 15ms = .015s
  - Divide 1 by the second based period.
    - 1/.015s = 66.66 hz
- Frequency uses multipliers also:
  - Khz
  - Mhz
  - picoHz

Hertz



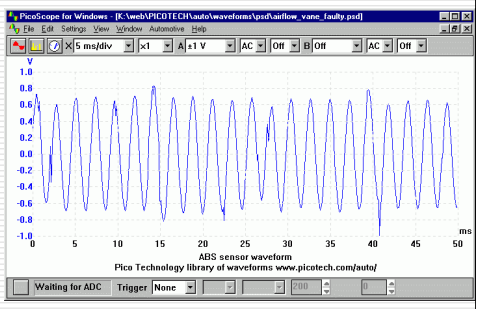
- To determine Hz:
  - Count number of times signal cycles.
  - Measure period of a cycle and divide into 1
  - Use DVOM Hz setting and measure.

Types of waves

- Sine wave
- Square wave
- Triangle wave
- Sawtooth wave
- Injector
-

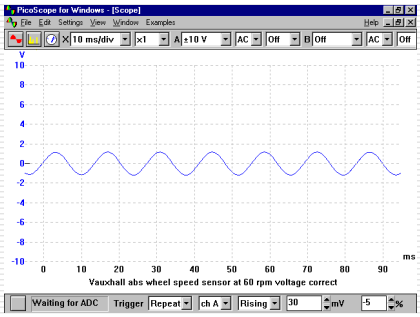
A/C sine wave.

- This waveform is when the rise and fall of the wave is identical from peak to peak.
- Created by variable reluctance sensors.
- These sensors produce their own voltage.

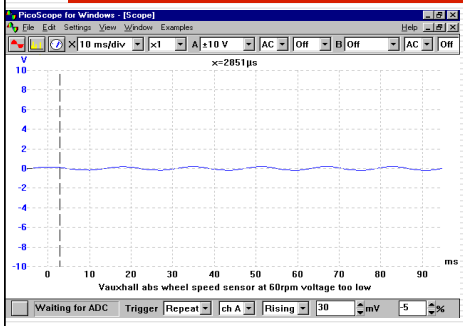


Normal wave form

- Normal waveform of abs sensor.



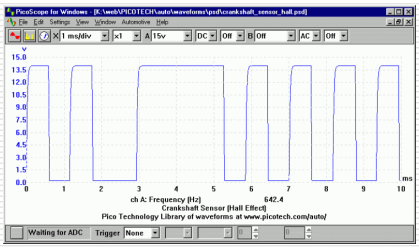
Abnormal waveform



- Caused by excessive resistance in circuits or by air gap between exciter wheel and sensor.

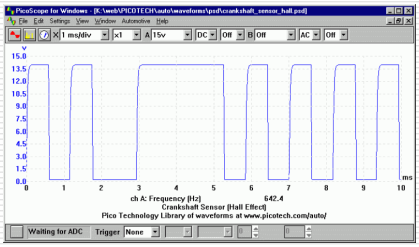
D/C signal Square wave

- Simple on/off signal.
- Measured in duty cycle.
- Used to dim lights, drive solenoids, and network communication.



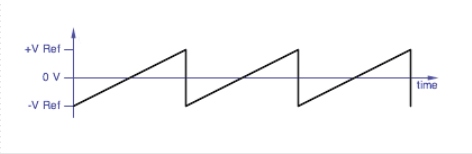
Duty cycle

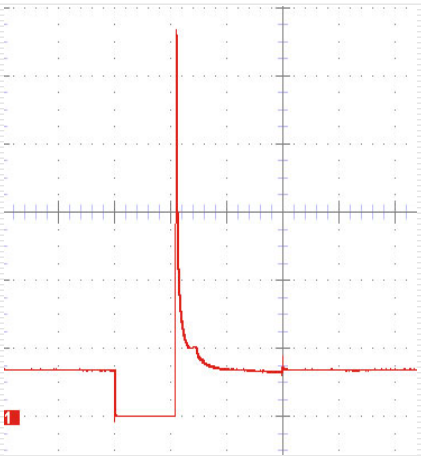
- Only on square wave and D/C signals.
- Ratio of pulse width to signal's period.
- Measured in percentages.



Saw Tooth

- The pattern slowly ramps upward with a positive slope. The signal then reaches a fall-off point and it quickly falls to its starting point



Injector Wave Form

- Volts = 20 volts
- Time = 10ms
- Discuss the waveform.
- When does the injector turn on?
- What is the max. voltage?