

# Analog and Digital Signals

## Analog Signals

- Continuous value reporting
- Infinite range of values
- More precise than digital, but more difficult to work with

## Digital Signals

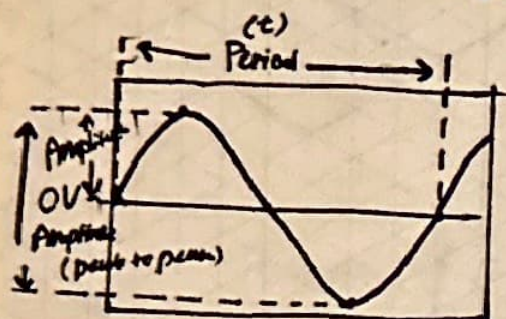
- Discrete value reporting
- Finite range of values
- Less precise than analog, but easier to work with

## Examples of Analog Signals

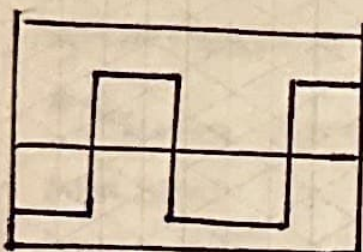
An analog signal can be any time-varying signal. Minimum and maximum values can either be negative or positive.

They can be periodic (repeating) or non-periodic.

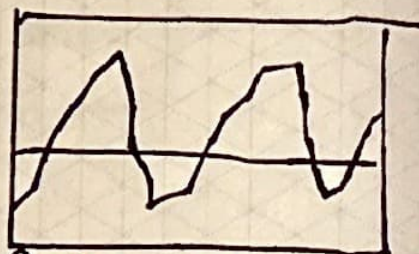
Sine waves and square waves are two common analog signals.



Sine wave



Square wave



Random - periodic

## Logic Levels

A logic level is a voltage level that represents a defined digital state.

Logic HIGH: The higher of two voltages, typically 5V

Logic Low: The lower of two voltages, typically 0V

5.0V	Logic High
2.0V	UNDEFINED LOGIC LEVEL
0.8V	Logic Low
0.0V	

LOGIC LEVEL	VOLTAGE	TRUE/FALSE	ON/OFF	0/1
HIGH	5V	TRUE	ON	1
LOW	0V	FALSE	OFF	0

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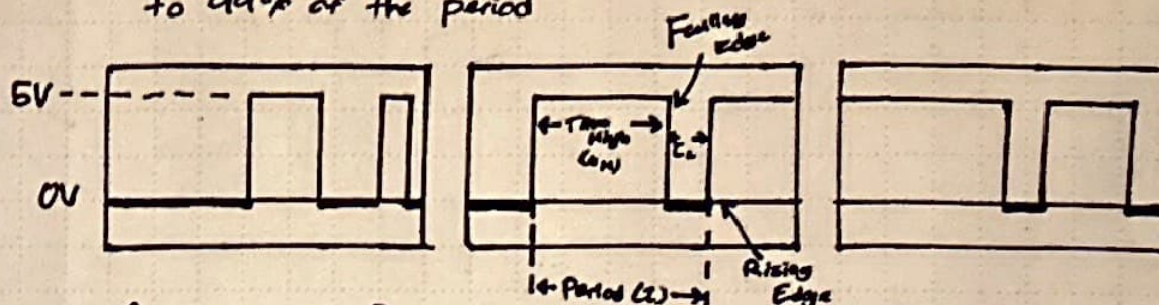
## Example of Digital Signals

Digital signals are commonly referred to as square waves or clock signals

Their minimum value must be 0V and their maximum value must be 5V

They can be periodic (repeating) or non-periodic.

The time the signal is high ( $t_H$ ) can vary anywhere from 1% of the periodic to 99% of the period



Amplitude: 5V Period ( $T$ ): Time (seconds) it takes for a signal to repeat Frequency ( $F$ ): Number of cycles ( $t_H$ ) of the signal per second.

Time High ( $t_H$ ): Time (seconds) during a signal is high Time Low ( $t_L$ ): Time (seconds) during a signal is low

Duty Cycle (DC): Ratio (%) of  $t_H$  to the period ( $T$ )

## Oscilloscope

The oscilloscope is a piece of electronic test equipment used to capture and measure time-varying analog and digital signals

### Oscilloscopes

Part of an electronics workspace (physical)

Simulation feature (virtual)

Virtual Instrumentation Software (virtual)

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