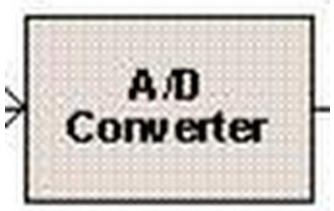
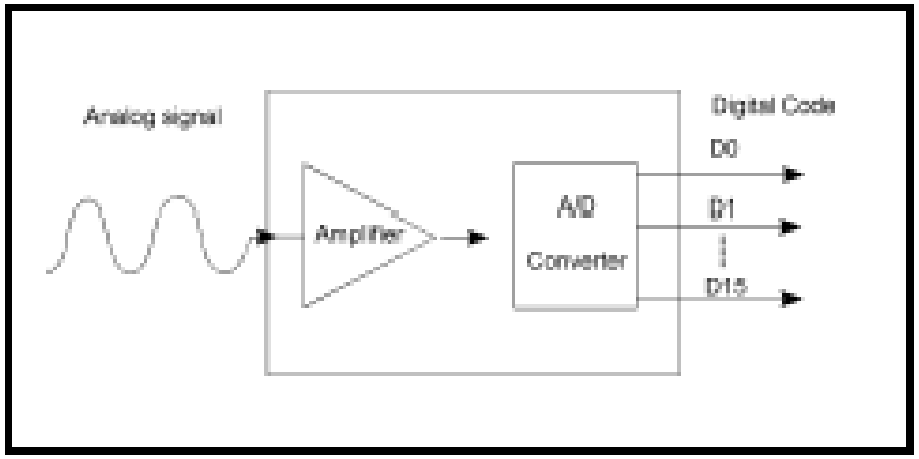
EIPC
NEE-403
Unit-3

DATA ACQUISITION SYSTEM



ANALOG DIGITAL(A/D) CONVERTER

- Analog to digital (A/D) conversion changes analog voltage or current levels into digital information. The conversion is necessary to enable the computer to process or store the signals.



Data Acquisition

- Data acquisition and control hardware generally performs one or more of the following functions:
  - analog input,
  - analog output,
  - digital input,
  - digital output and
  - counter/timer functions.

Analog Inputs (A/D)

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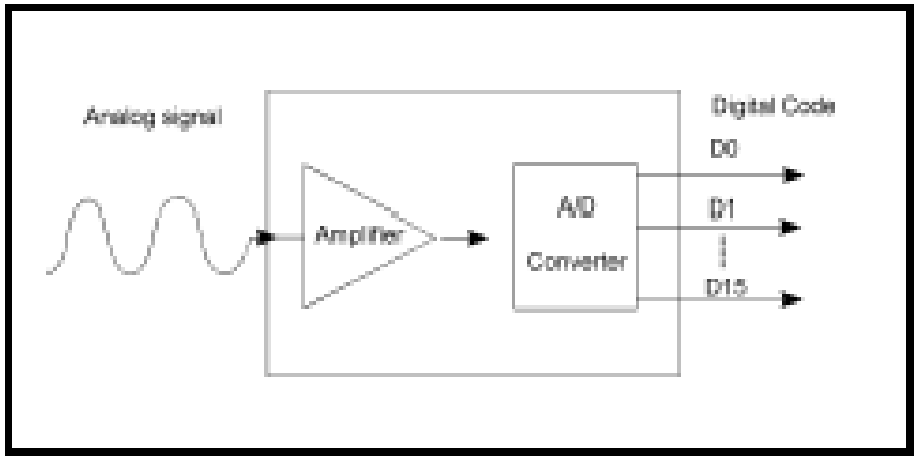


Analog Inputs (A/D)

- The most significant criteria when selecting A/D hardware are:
  - 1. Number of input channels
  - 2. Single-ended or differential input signals
  - 3. Sampling rate (in samples per second)
  - 4. Resolution (usually measured in bits of resolution)
  - 5. Input range (specified in full-scale volts)
  - 6. Noise and nonlinearity

Analog to Digital (A/D) Converter

- Input signal
- Sampling rate
- Throughput

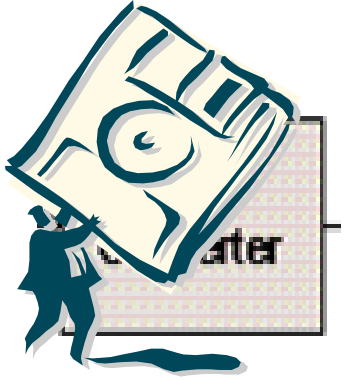
- Resolution
- Range
- Gain

A/D Converter:
Input Signal

- Analog
  - ✓Signal is continuous

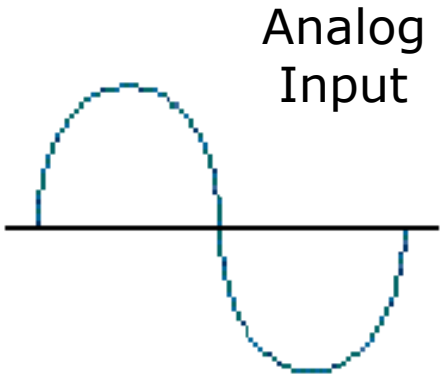
    Example: strain gage. Most of transducers produce analog signals
- Digital
  - ✓Signal is either ON or OFF

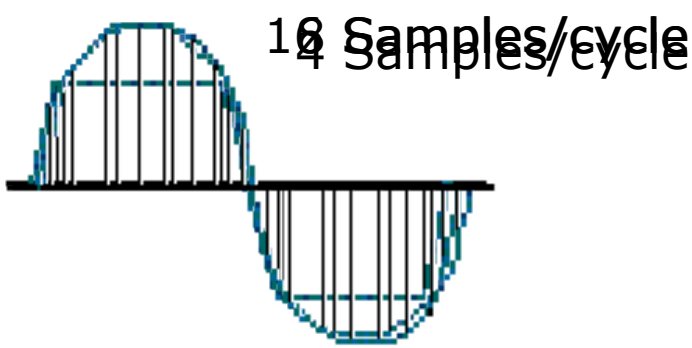
    Example: light switch.



A/D Converter:
Sampling Rate

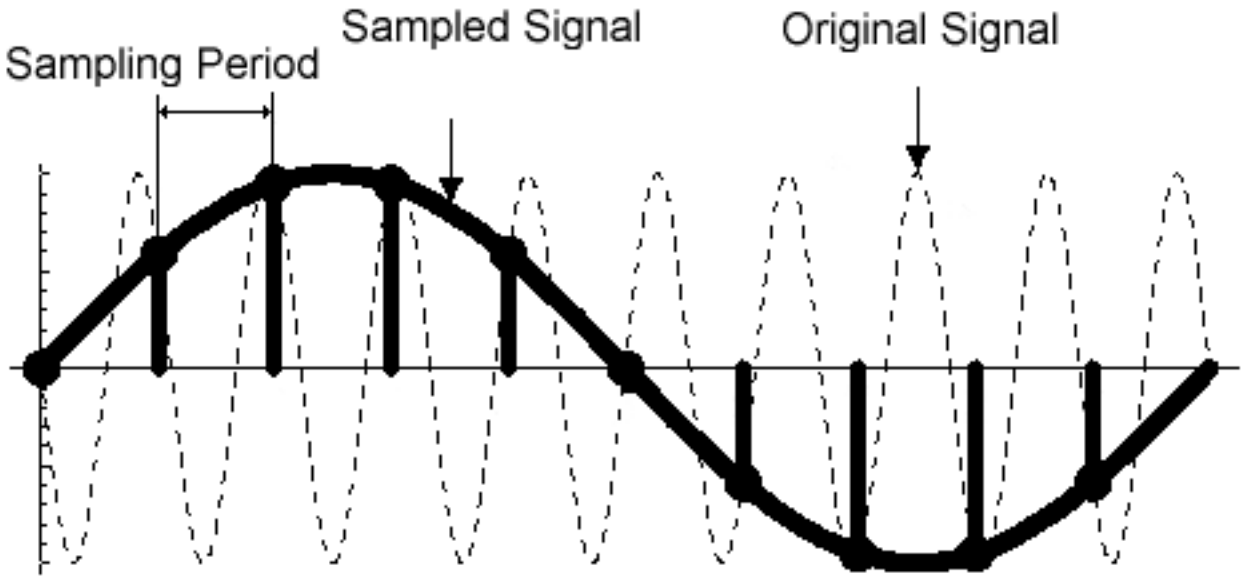
- Determines how often conversions take place.
- The higher the sampling rate, the better.





A/D Converter:
Sampling Rate

- Aliasing.
  - ✓Acquired signal gets distorted if sampling rate is too small.



A/D Converter: Throughput

Effective rate of each individual channel is inversely proportional to the number of channels sampled.

Example:

- 100 KHz maximum.
- 16 channels.

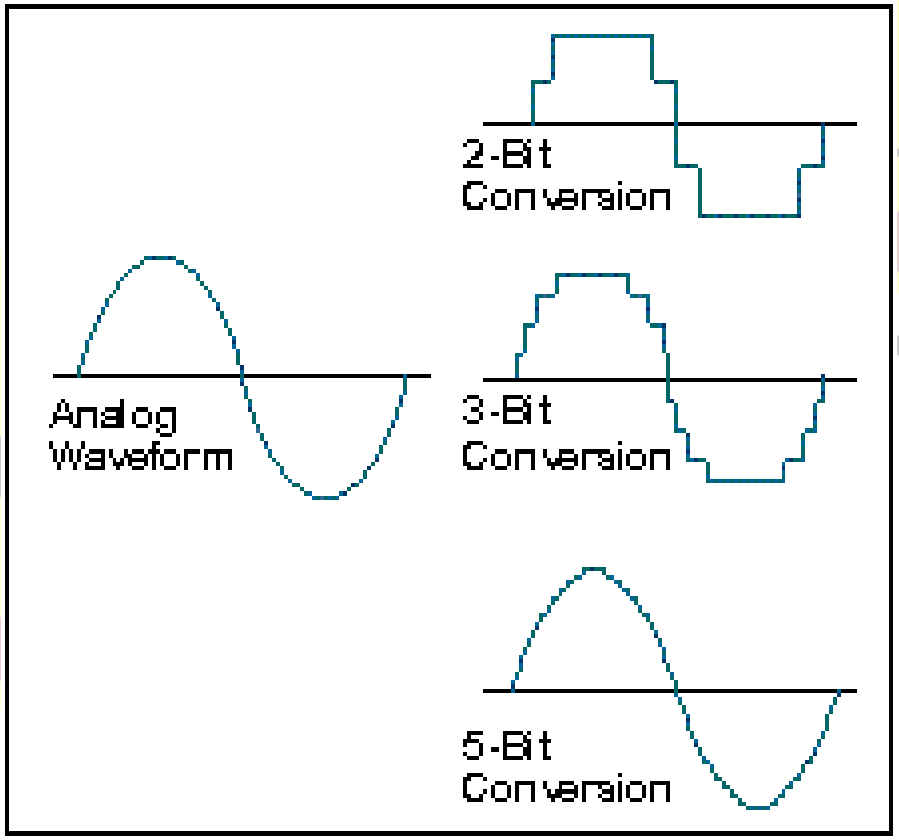
100 KHz/16 = 6.25 KHz per channel.

A/D Converter: Range

- Minimum and maximum voltage levels that the A/D converter can quantize

- Ranges are selectable (either hardware or software) to accurately measure the signal

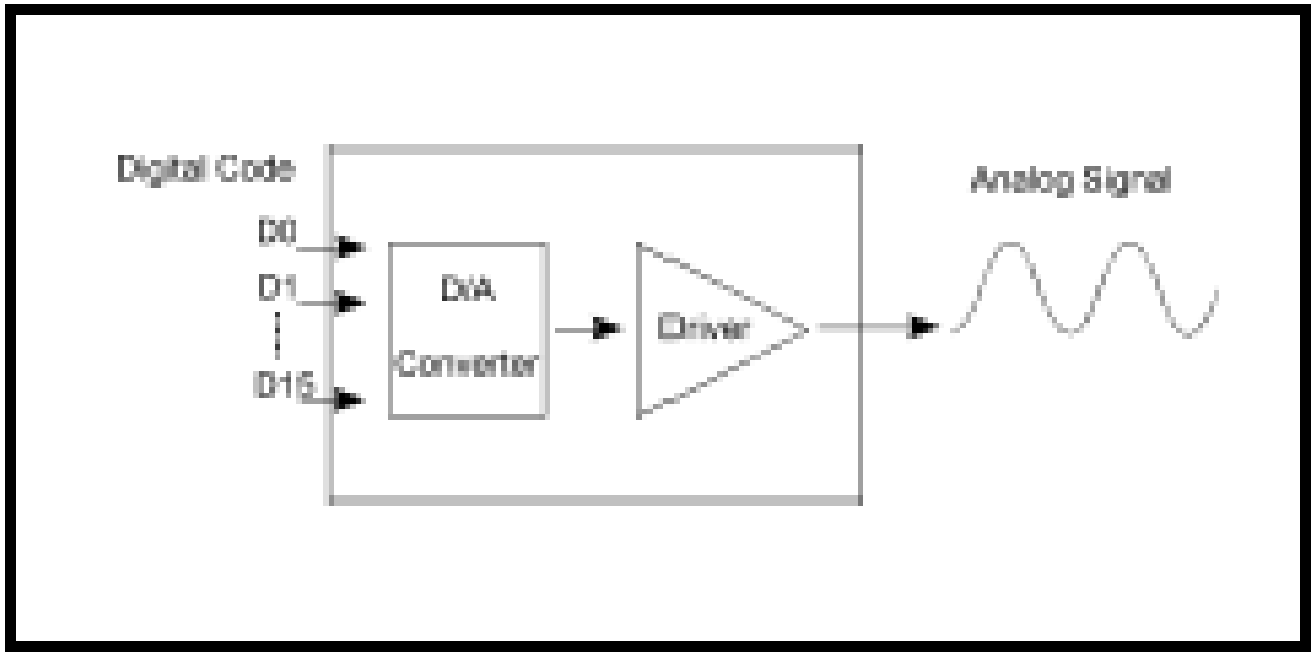
A/D Converter:
Resolution



Analog Outputs (D/A)

- The opposite of analog to digital conversion is digital to analog (D/A) conversion. This operation converts digital information into analog voltage or current. D/A devices allow the computer to control real-world events.
- Analog output signals may directly control process equipment. The process can give feedback in the form of analog input signals. This is referred to as a closed loop control system with PID control.
- Analog outputs can also be used to generate waveforms. In this case, the device behaves as a function generator.

Analog Outputs (D/A)



Designing a DAS: Factors to Consider

- Is it a fixed or a mobile application?
- Type of input/output signal: digital or analog?
- Frequency of input signal ?
- Resolution, range, and gain?
- Continuous operation?
- Compatibility between hardware and software. Are the drivers available?
- Overall price.

Thank You