EE 254

Electronic Instrumentation

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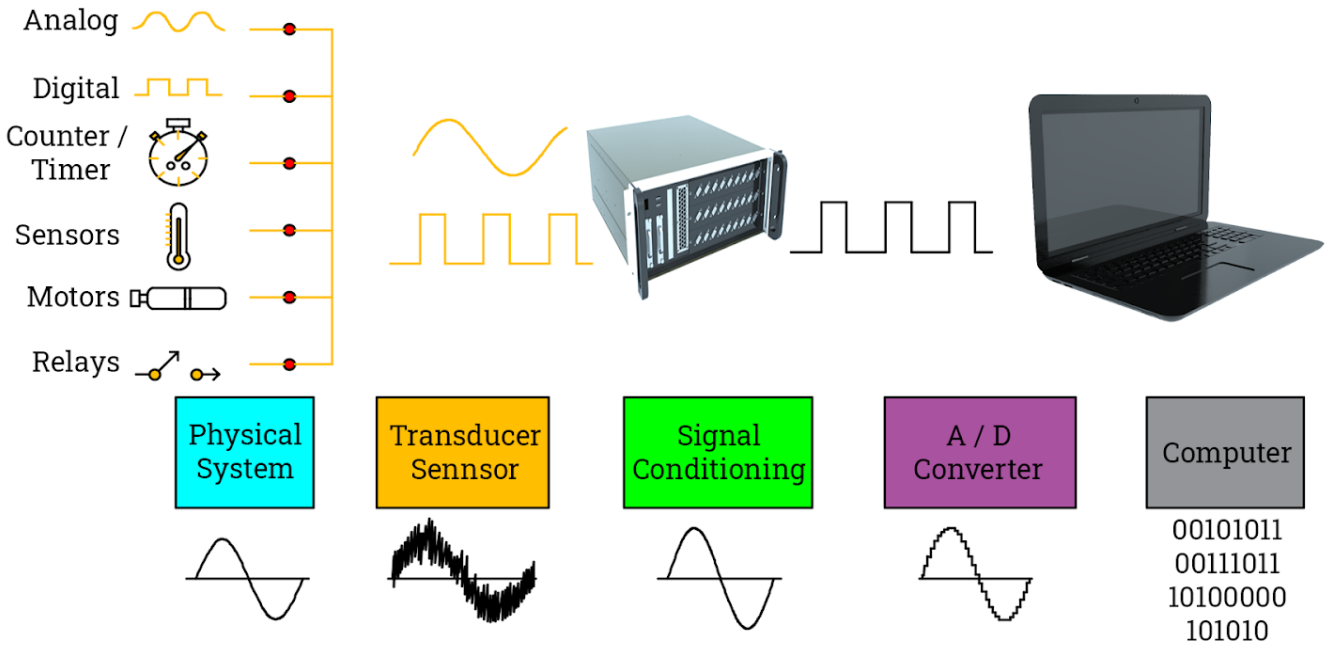
Lecture Note #14

Computer Interfacing and Data Acquisition (DAQ) Systems

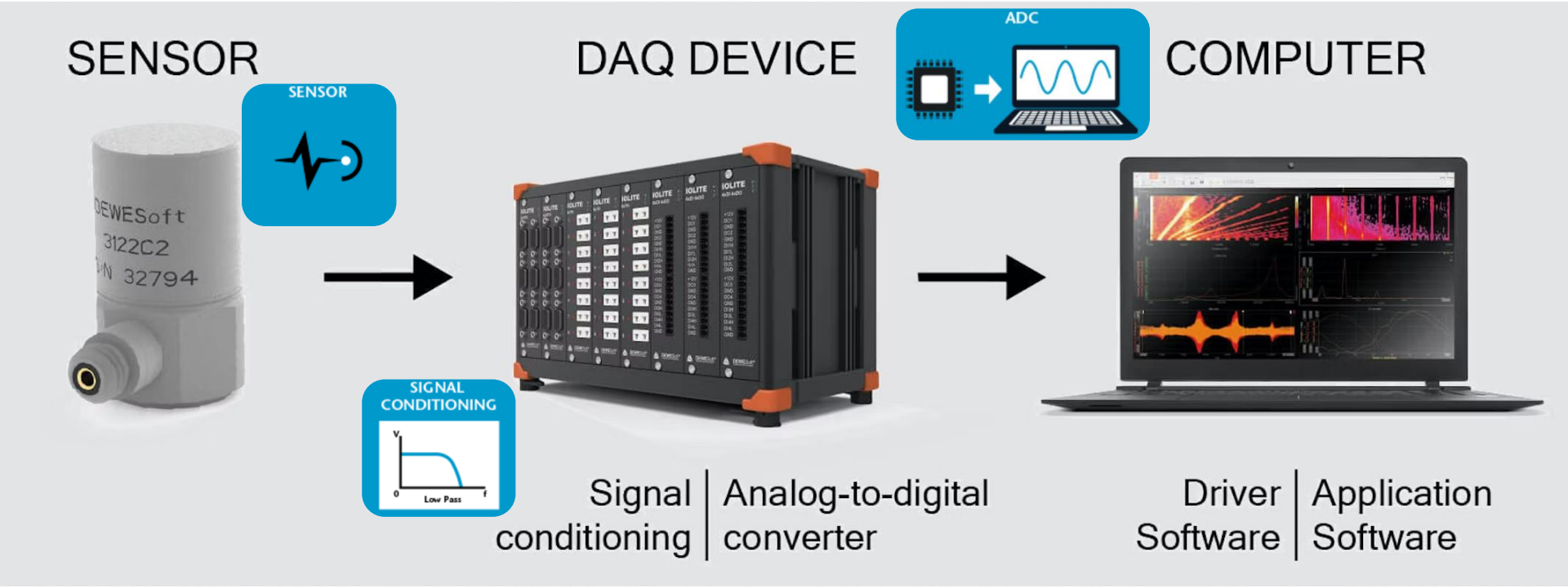
What is Data Acquisition?



Data acquisition is the process of digitizing data from the world around us so it can be displayed, analyzed, and stored in a computer.

A simple example is the process of measuring the temperature in a room as a digital value using a sensor such as a thermocouple.

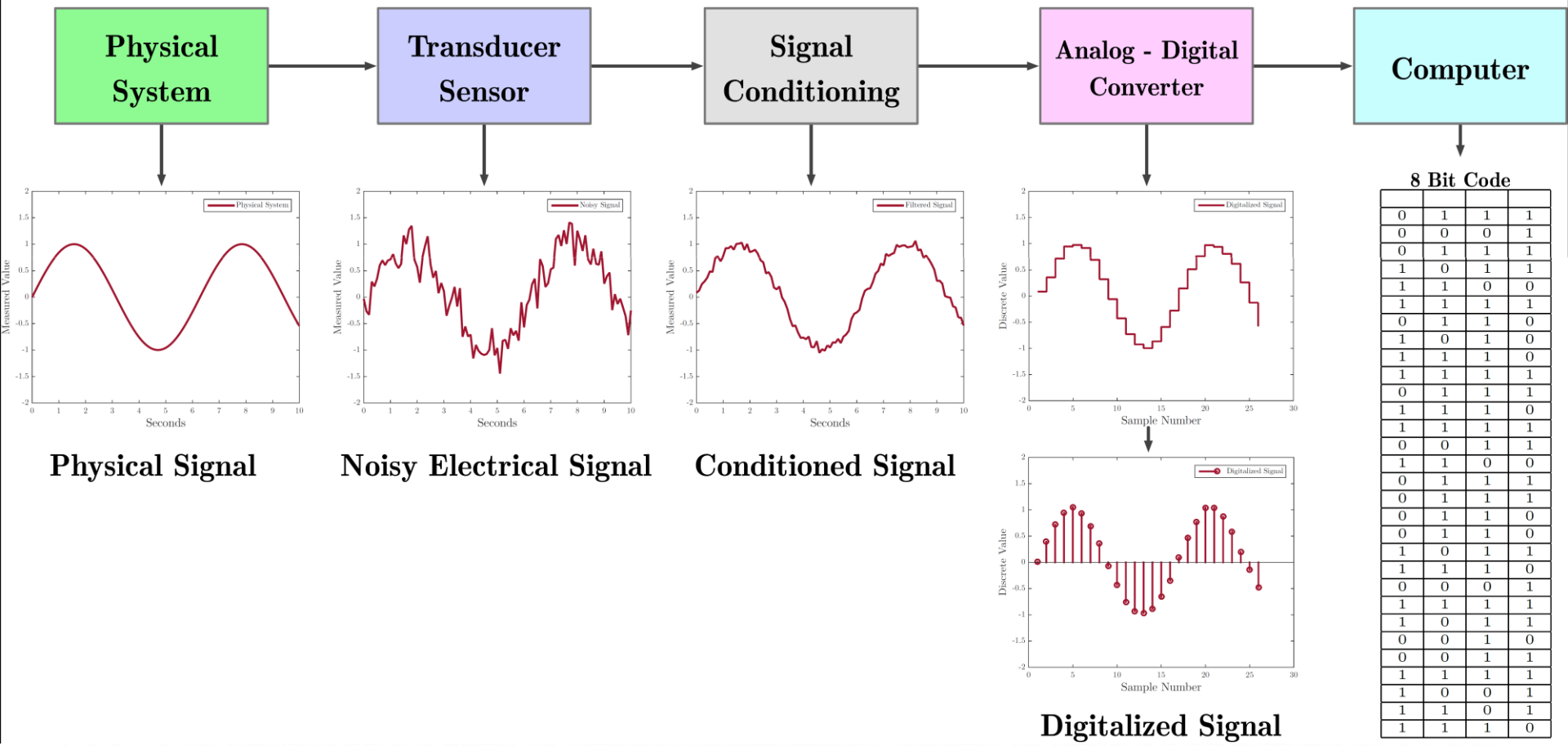
Data Acquisition System



Modern digital data acquisition systems consist of four essential components:

- Sensors (Transducers)
- Signal Conditioning
- Analog-to-Digital Converter
- Computer with DAQ software for data logging and analysis

Process of Data Acquisition System



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What Does a Data Acquisition System Measure?

Data acquisition systems are principally in the business of measuring physical phenomena such as:

- Temperature
- Voltage
- Current
- Strain and Pressure
- Shock and Vibration
- Distance and Displacement
- RPM, Angle, and Discrete Events
- Weight

Several other measures:

light and images, sound, mass, position, speed, etc.

The Purposes of Data Acquisition

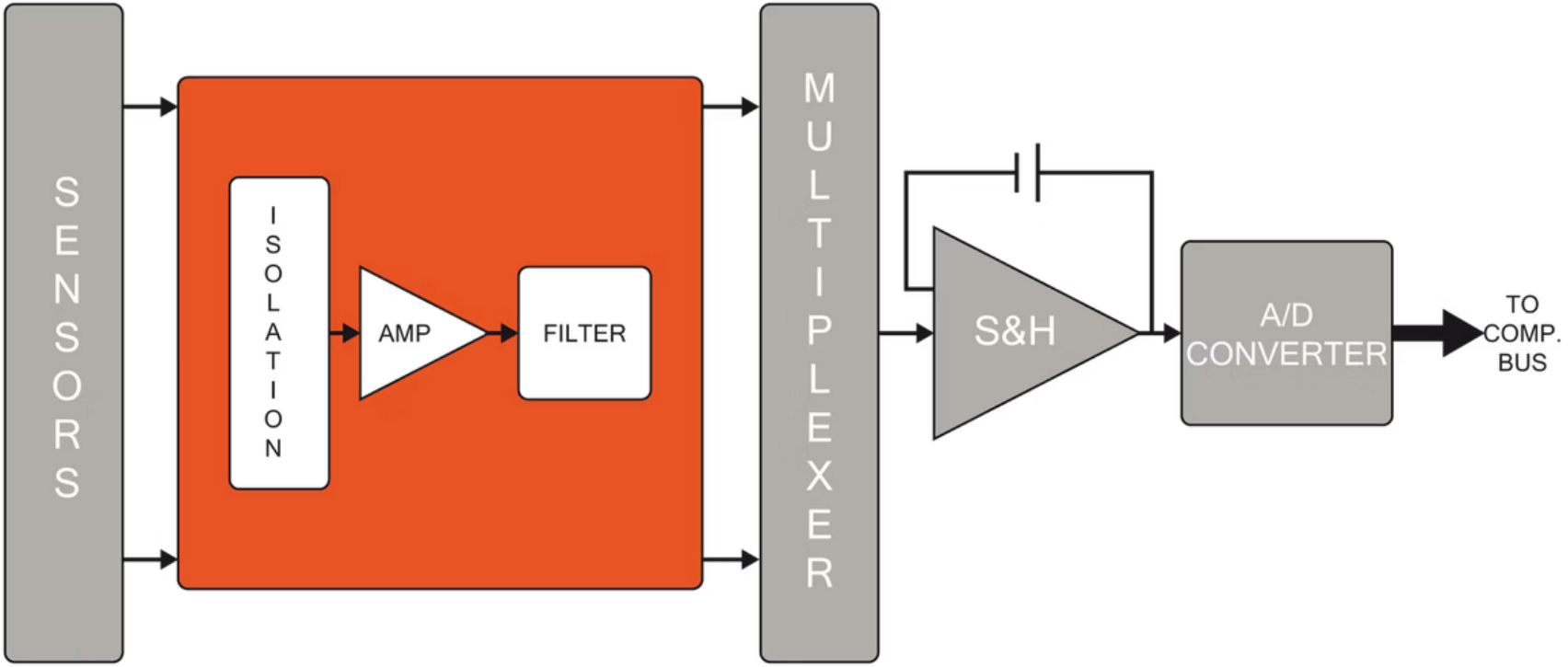
- The primary purpose: to acquire and store the data.
- But intended to provide real-time and post-recording visualization and analysis of the data.
- Some analytical and report generation.
  1. Data recording
  2. Data storing
  3. Real-time data visualization
  4. Post-recording data review
  5. Data analysis using various mathematical and statistical calculations
  6. Report generation

Applications

Data acquisition instrumentation is also heavily used in monitoring applications. Such examples are:

- Monitor the condition of complex machinery such as generators, motors, fans, etc.
- Monitor structural properties of buildings such as bridges, stadiums, etc.
- Monitor energy consumption and energy efficiency in the production process.
- And many other monitoring scenarios.

The Measurement Process



Sensors or Transducers

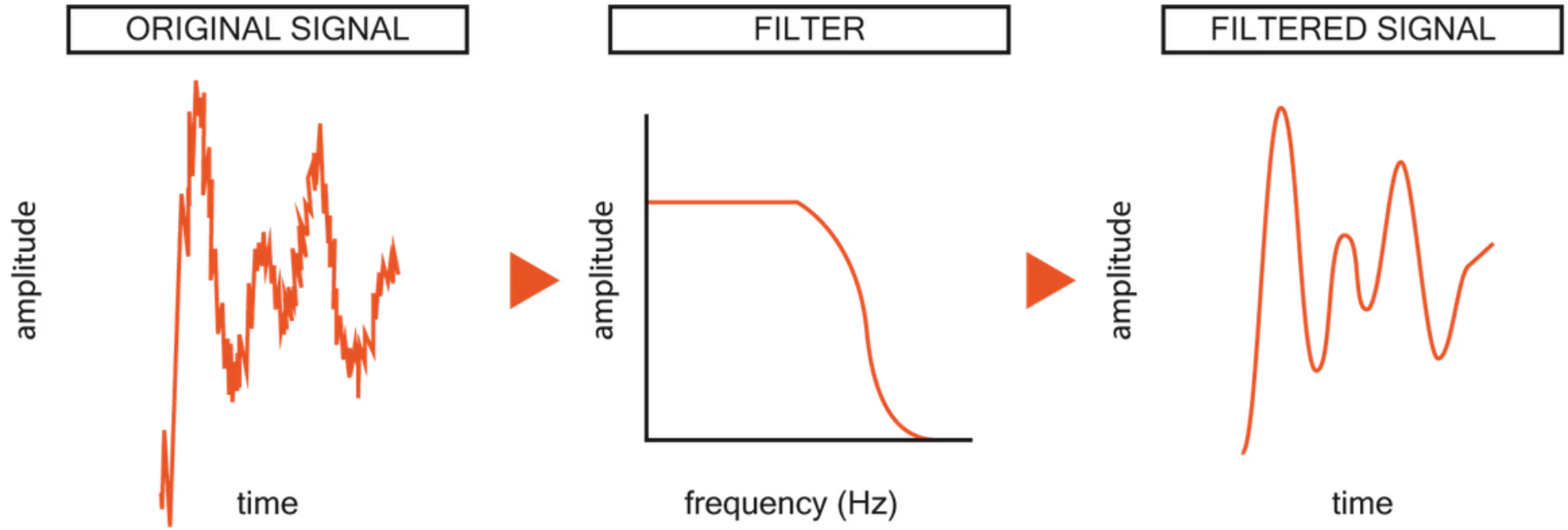
The classical thermometer is used to measure temperature for centuries

Temperature sensors

Signal Conditioning

Signal Source	Sensor (transducer)	Signal Conditioning	Analog-to-digital converter	Driver Software	Application Software
				00101001 01001011 10001011 10110101 10001011 01001011 00101001 01001011	12.256 lbf 43.643 lbf 67.873 lbf 84.299 lbf 62.916 lbf 33.009 lbf
Physical phenomena	Noisy electrical signal	Conditioned signal	Digitalized and sampled data	Raw binary information	Processed data

Filtering


ORIGINAL SIGNAL
FILTER
FILTERED SIGNAL
amplitude
time
amplitude
frequency (Hz)
amplitude
time

Analog-to-Digital Converters (ADCs)