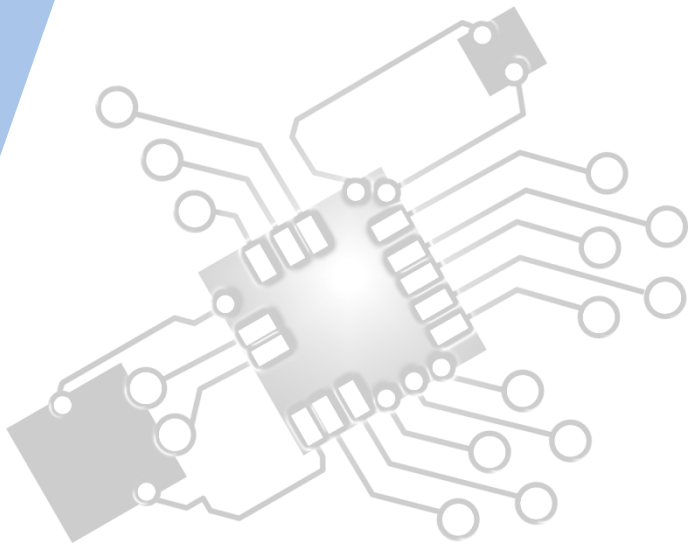
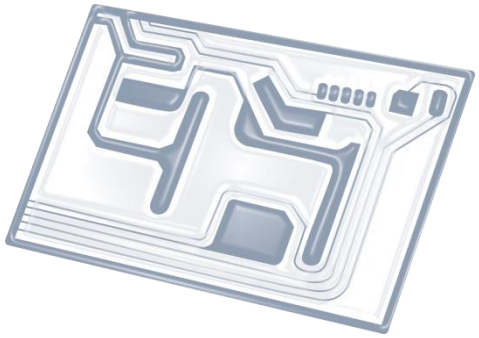
Control Systems

IB Computer Science



Content developed by
Dartford Grammar School
Computer Science Department

HL Topics 1-7, D1-4



1: System design

2: Computer Organisation

3: Networks

4: Computational thinking

5: Abstract data structures

6: Resource management

7: Control

D: OOP

HL only 7 Overview

Centralized control systems

7.1.1 Discuss a range of control systems

7.1.2 Outline the uses of microprocessors and sensor input in control systems

7.1.3 Evaluate different input devices for the collection of data in specified situations

7.1.4 Explain the relationship between a sensor, the processor and an output transducer

7.1.5 Describe the role of feedback in a control system

7.1.6 Discuss the social impacts and ethical considerations associated with the use of embedded systems

Distributed systems

7.1.7 Compare a centrally controlled system with a distributed system

7.1.8 Outline the role of autonomous agents acting within a larger system

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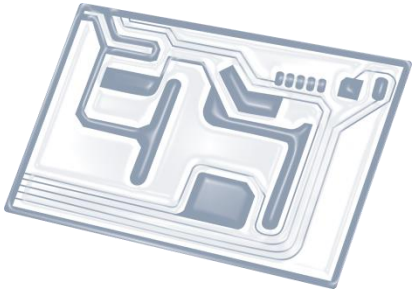
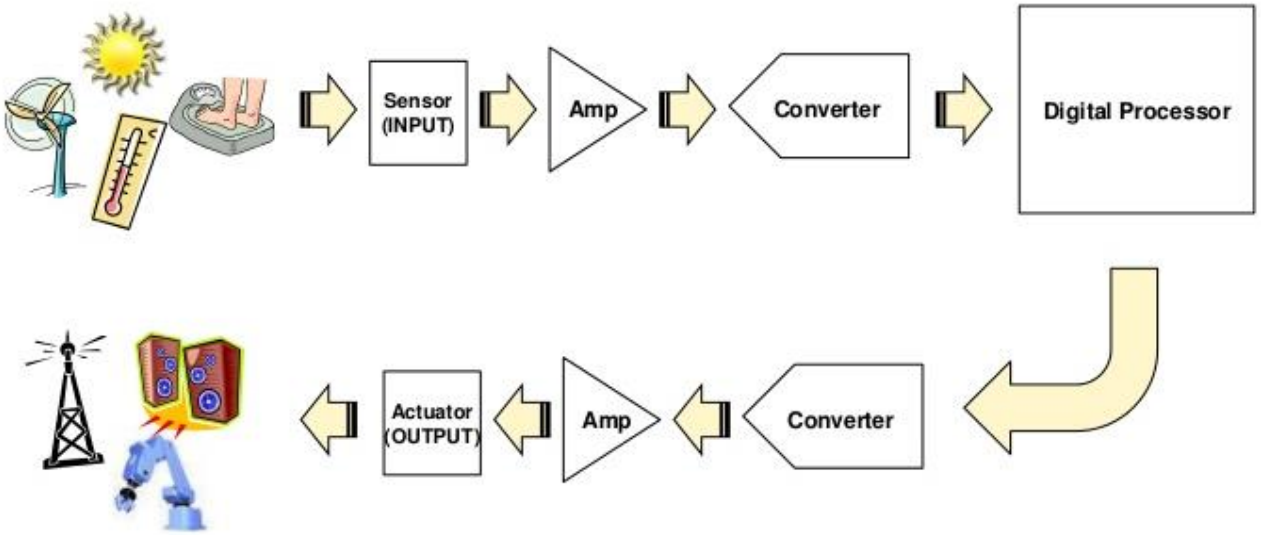


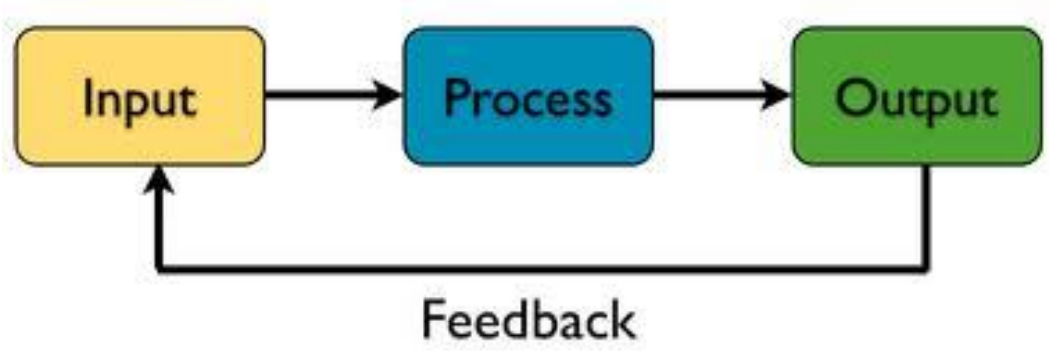
Topic 7.1.4

Explain the **relationship** between a **sensor**, the **processor** and an **output transducer**

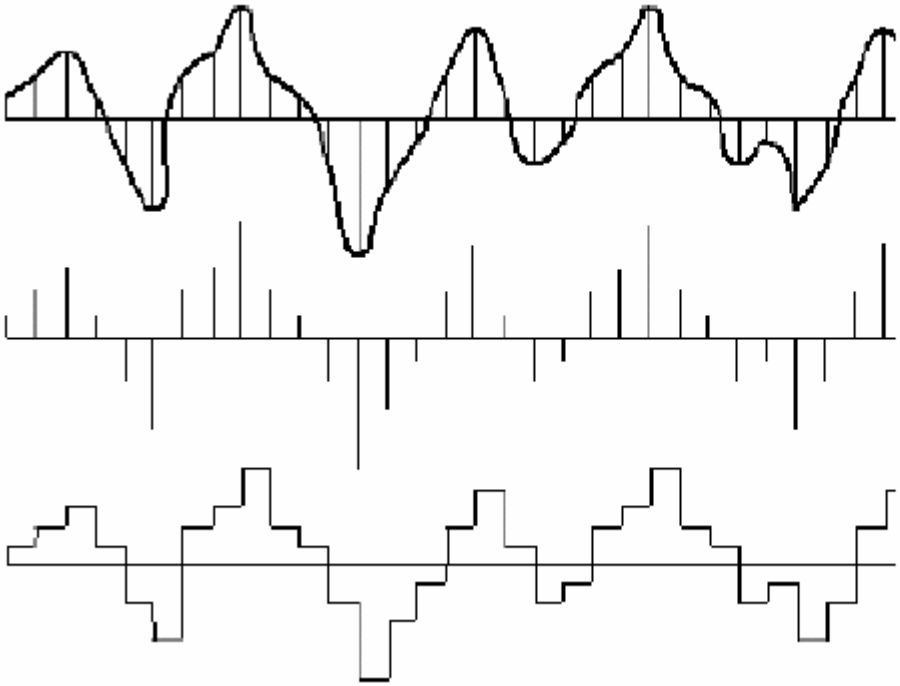


Basic I-P-O model

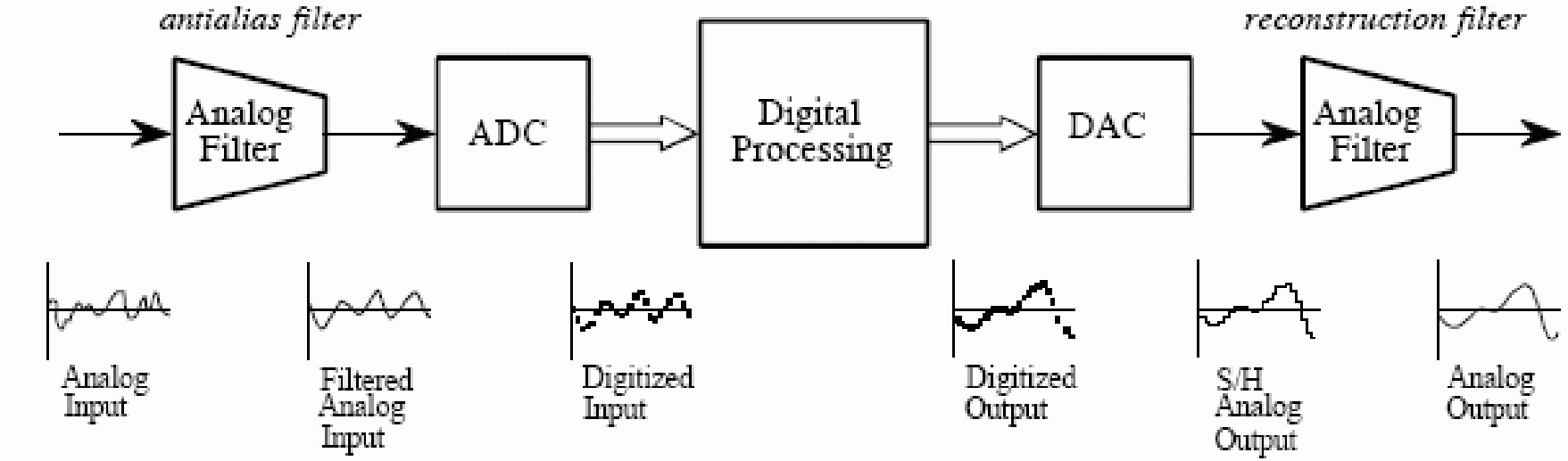
- Simplistically, **sensors** take analogue input and convert them to digital data.
- Digital data can then be processed by a **microprocessor**, producing digital output.
- **Output transducers** can then turn the digital data into analogue signals to power 'real world' devices.



Analogue signals are converted to digital

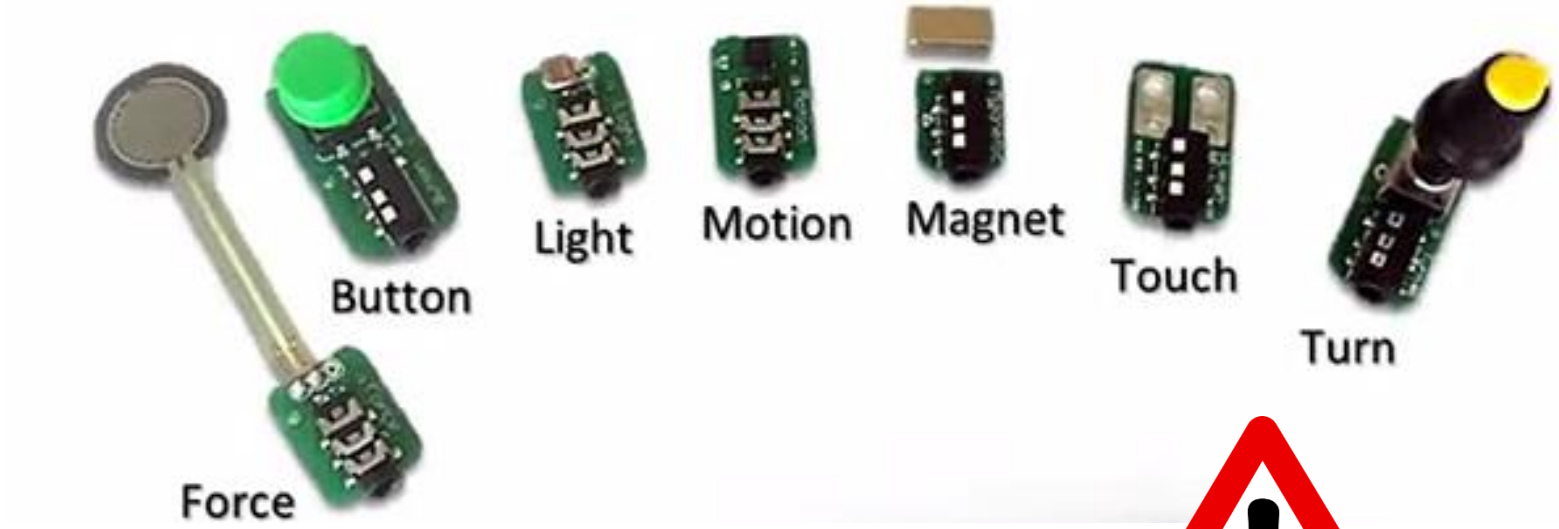


ADC (Analogue to Digital Converter) and vice versa



Sensors record analogue signals which are then converted to digital signals for processing in the microprocessor.
The processor's digital output can then be converted to analogue signals again (if needed).

Examples of analogue input sensors



Friendly warning:
Sometimes Transducers can be classified as input devices too…

SIDENOTE: Transducers as input

Definition:

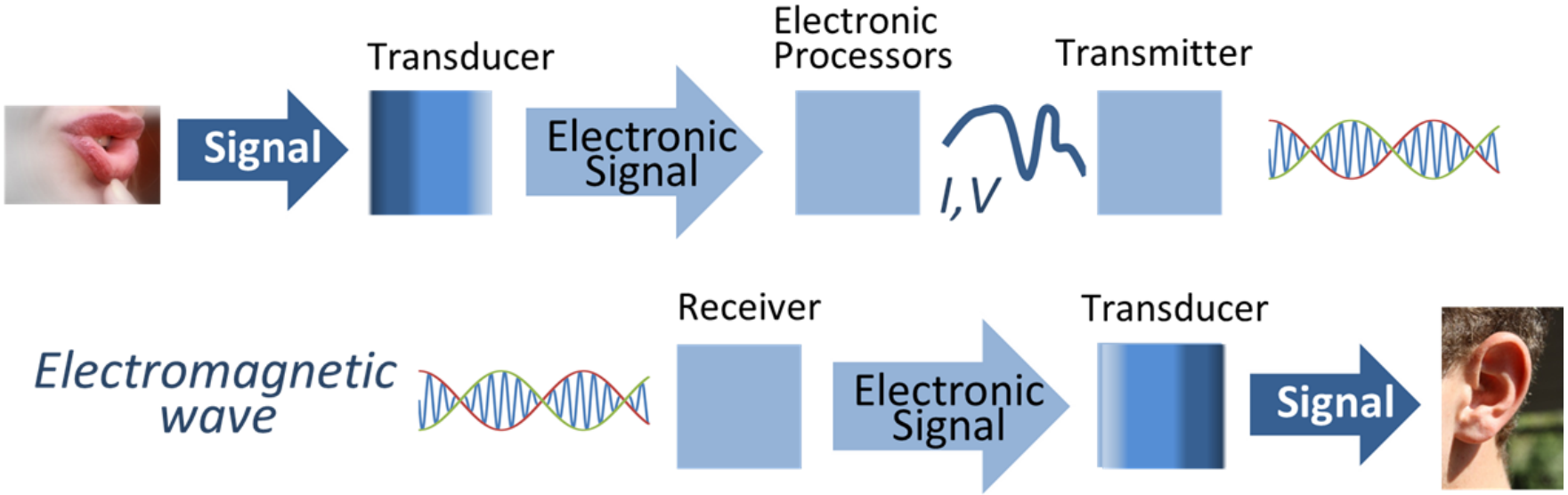
A transducer is a device, which converts one type of physical property, quantity or condition into another easily usable form

Advantages of transducers

If the output signal from the transducer is in electrical form then it is convenient to handle and has many advantages.

- Ease of amplification
- Ease of integration and differentiation
- Ease of convertibility from analog to digital and vise versa
- Remote controllability and easy data transmission capability
- Compatibility with microprocessors and computers

Transducers are used every time a signal has to be converted from one form to another

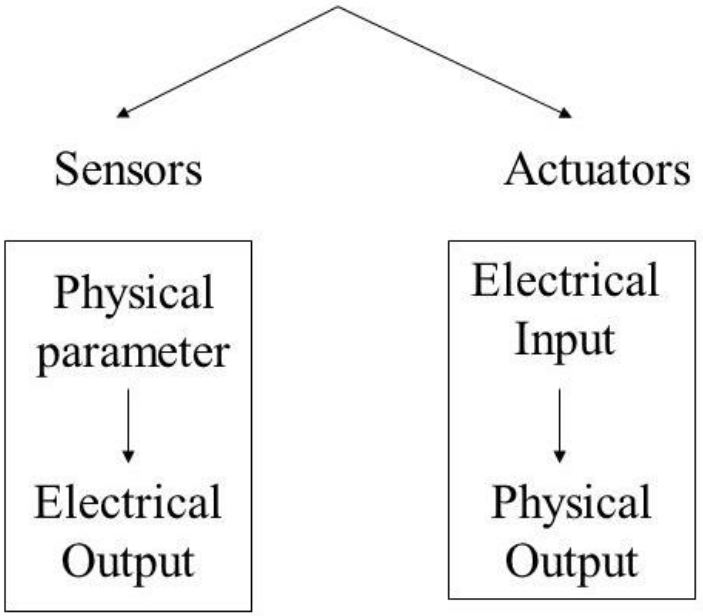


Rule of thumb:

Input = sensor (via transducer)

Output = actuator (via transducer)

A device which converts one form of energy to another



e.g. Piezoelectric:

Force -> voltage

Voltage-> Force

=> Ultrasound!