

# Automation and mechatronics



**Automation and Mechatronics** are becoming increasingly important disciplines in today's digital society. Consumers and society have benefited tremendously from new products which have been designed by applying mechatronics principles and **accomplished** by means of automation processes.

Complicated systems, such as modern factories, airplanes and ships, generally use all these combined techniques. The benefits include: labour savings, savings in electricity costs, savings in material costs, and improvements in quality, accuracy, and precision.

In general, automation and mechatronics technicians work to create, integrate and control machines, plants and automated systems so they have a robust knowledge in the mechanical, electrical and automation areas and can operate in the design, programming, assembling, and control of automated machines.

## ■ Feedback control

The advanced results that have revolutionised manufacturing, aircraft, communications and other industries, is the **feedback control**, which is a system which involves taking measurements on the output using a **sensor** and making calculated adjustments on the input in order to keep the measured variable within a **set range**.

## ■ Types of control system

Fundamentally, there are two types of control systems:

- in **open loop control** systems, the output of the system does not have any effect on its input and there is no feedback to alter the machine's operation. A washing machine, for example, is an open loop control system as the operation of a washing machine does not depend on the cleanliness of the clothes, but rather on the preset time;
- in **closed loop control** or **feedback control** systems, the system has the capacity for **self-correction**. By means of sensors, it continuously senses and measures data from the output and compares it to the fixed standard of the input, which is the reference value. In this way the system takes whatever **pre-programmed** action is necessary to maintain the measured quantity within the limits of acceptable standards. A simple example of a closed loop control system is a home thermostat. This uses a temperature sensor to detect the current air temperature, so when the air reaches a certain temperature the thermostat turns the heater off and when the temperature is below the set point, it turns the heater on.



**to accomplish:** *raggiungere*  
**feedback:** *riscontro*  
**set range:** *gamma impostata*

## 1 Find the English terms for the following Italian words.

- |                         |                         |
|-------------------------|-------------------------|
| 1. Procedimento .....   | 5. Misurazione .....    |
| 2. Programmazione ..... | 6. Preselezionato ..... |
| 3. Progettazione .....  | 7. Impianto .....       |
| 4. Assemblaggio .....   | 8. Rilevare .....       |

## 2 Read the text and fill in the blanks with the words given below.

alerted • required • objective • customers • signals • malfunctions • detecting • hazards • sensors • made

### Decision-making Capacity in Feedback Control Systems

Programmable machines in automated systems often possess a decision-making capacity which is contained in the control program and includes the following features:

- *Error detection and recovery.* This concerns decisions that must be **1.** ..... by the system in response to **2.** ..... and errors: the system itself sets up corrective actions without human intervention.
- *Safety monitoring.* It is important for **3.** ..... malfunctions which involve safety **4.** ..... Errors are identified by **5.** .....

and the system takes the most appropriate actions: operations may be stopped or the maintenance personnel

**6.** .....

- *Interaction with humans.* This capacity is largely **7.** ..... nowadays. An automatic bank teller, for example, must receive instructions from **8.** ..... and act accordingly.
- *Process optimisation.* Minimising cost is an important **9.** ..... in manufacturing: the automated system might use adaptive control to receive appropriate sensor **10.** ..... and other inputs and make decisions to drive the process towards the optimal state.

## 3 Write the questions for these answers.

- .....?  
Open loop and closed loop control systems.
- .....?  
It implies that the output of the system does not have any effect on its input and there is no feedback to alter the machine's operation.
- .....?  
A feedback control system implies that a system has the capacity for self-correction.
- .....?

It is a system that senses and measures data from the output and compares it to the fixed standard of the input, which is the reference value.

- .....?  
An example of a closed loop control system is a home thermostat.
- .....?  
Unlike closed-loop systems, open-loop systems do not use feedback control and thus they cannot correct or compensate variations in the output process.