

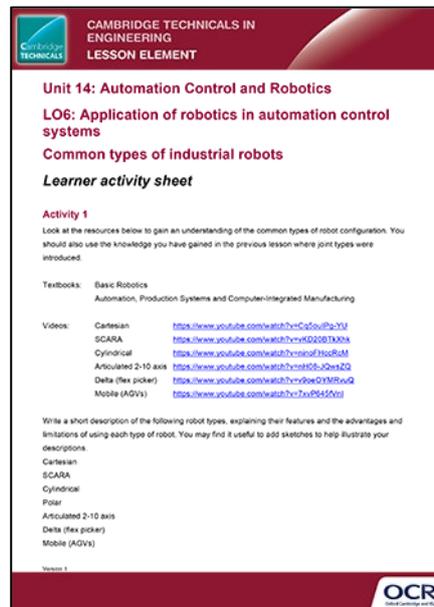
Unit 14: Automation Control and Robotics

LO6: Application of robotics in automation control systems

Common types of industrial robots

Instructions and answers for teachers

These instructions should accompany the OCR resource ‘Common types of industrial robots’ activity which supports Cambridge Technicals in Engineering Level 3.



**CAMBRIDGE TECHNICALS IN
ENGINEERING
LESSON ELEMENT**

Unit 14: Automation Control and Robotics
LO6: Application of robotics in automation control systems
Common types of industrial robots
Learner activity sheet

Activity 1
 Look at the resources below to gain an understanding of the common types of robot configuration. You should also use the knowledge you have gained in the previous lesson where joint types were introduced.

Textbooks: Basic Robotics
 Automation, Production Systems and Computer-Integrated Manufacturing

Videos: Cartesian <https://www.youtube.com/watch?v=Cc5ouPz-3YI>
 SCARA <https://www.youtube.com/watch?v=U5Q2081X00k>
 Cylindrical <https://www.youtube.com/watch?v=ro1of1Hoc8M>
 Articulated 2-10 axis <https://www.youtube.com/watch?v=ro1of1Hoc8M>
 Delta (flex picker) <https://www.youtube.com/watch?v=ro1of1Hoc8M>
 Mobile (AGVs) <https://www.youtube.com/watch?v=ro1of1Hoc8M>

Write a short description of the following robot types, explaining their features and the advantages and limitations of using each type of robot. You may find it useful to add sketches to help illustrate your descriptions.

Cartesian
 SCARA
 Cylindrical
 Polar
 Articulated 2-10 axis
 Delta (flex picker)
 Mobile (AGVs)

Version 1 

The Activity:



This activity offers an opportunity for English skills development.



This activity offers an opportunity for maths skills development.

Suggested timings:

Activity 1

Teachers should introduce learners to a range of resources such as the ones below:

Textbooks: Basic Robotics
Automation, Production Systems and Computer-Integrated Manufacturing

Videos: Cartesian <https://www.youtube.com/watch?v=Cg5oulPq-YU>
SCARA <https://www.youtube.com/watch?v=vKD20BTkXhk>
Cylindrical <https://www.youtube.com/watch?v=ninoFHccRcM>
Articulated 2-10 axis <https://www.youtube.com/watch?v=nH08-JQwsZQ>
Delta (flex picker) <https://www.youtube.com/watch?v=v9oeOYMRvuQ>
Mobile (AGVs) <https://www.youtube.com/watch?v=7xvP645fVnl>

Learners should use these resources to write a short description of the following robot types, explaining their features and the advantages and limitations of using each type of robot. They should be encouraged to add sketches to help illustrate their work.

Cartesian

SCARA

Cylindrical

Polar

Articulated 2-10 axis

Delta (flex picker)

Mobile (AGVs)

Additionally, learners should answer the following questions:

- 1) What are the benefits of a Cartesian work envelope?
Answers: Easy to determine position using x, y, z co-ordinates. Large x, y work envelope at relatively little cost.
- 2) What is the difference between a SCARA and a horizontally jointed cylindrical robot?
Answers: A cylindrical robot only rotates on its central main axis restricting its reach, whereas a SCARA robot has two rotating axis for greater freedom of movement. SCARA robots have built in compliance to allow for component misalignment which aids assembly tasks.
- 3) What shape is the work envelope of an articulated arm robot?
Answer: Complex! The series nature of connecting rotating arms give great flexibility of movement, but also a complex work envelope.

- 4) Which geometry is most commonly used in robots and why?
Six axis articulated arm robots predominate today as they give a good balance of geometry articulation, reach, and cost.

Activity 2

Teachers should introduce a number of manufacturing scenarios where robots could be implemented.

Teachers should organise the learners into small groups. The groups should discuss and identify the type of robot that might be used for each scenario. In some cases there may be more than one appropriate robot choice, so learners should have clear reasons for their choices.

Groups should present their choice for one of the scenarios to the class.

- 1) Spot welding of sheet steel body panels to form a car body.
Answers: Most likely to use an articulated arm robot. Car body panels are complex 3 dimensional shapes that require a wide range of arm articulation. Additionally reasonable reach into the car body is required.
- 2) Transfer of small prismatic shaped boxed items from a conveyor to a packing box.
Answers: Complex arm articulation is not required. Depending upon production volume, high speed may be required. A low cost would be a Cartesian robot. Flex-picker or cylindrical may also be applicable.
- 3) Painting of a plastic vacuum cleaner casing.
Answers: Most likely to use an articulated arm robot. Modern styled consumer products usually have complex curved plastic mouldings. Even paint coverage would require complex articulation to place the spray gun perpendicular to the surface being sprayed.
- 4) Assembly of sealed roller ball bearings into a gearbox casing.
Answers: Probably a SCARA robot to allow for slight misalignment. You could also use an articulated arm robot with a compliant assembly tool.

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