

1.4 Robot Classification

Degree of Freedom (D.O.F) - Each joint on the robot introduces a degree of freedom. Each dof can be a slider, rotary, or other type of actuator. Robots typically have 5 or 6 degrees of freedom. 3 of the degrees of freedom allow positioning in 3D space, while the other 2 or 3 are used for orientation of the end effector. 6 degrees of freedom are enough to allow the robot to reach all positions and orientations in 3D space. 5 D.O.F requires a restriction to 2D space, or else it limits orientations. 5 D.O.F robots are commonly used for handling tools such as arc welders.

Work Volume/Workspace - The robot tends to have a fixed and limited geometry. The work envelope is the boundary of positions in space that the robot can reach. For a Cartesian robot (like an overhead crane) the workspace might be a square, for more sophisticated robots the workspace might be a shape that looks like a 'clump of intersecting bubbles'.

The Pneumatic Robot.

The pick and place machine is the simplest of the robots. Pneumatic powered, it has no servo motors driving the axes, but an air cylinder instead.

As such, each stroke is to an end stop, that is generally adjustable for a few millimeters, via a micrometer type screw.



A popular application is to pick and place small components into an assembly, maybe from a vibratory bowl feeder to an assembly fixture.

Pick and Place units are fast, accurate and very cost effective.

The Scara Robots.

Scara means Selective, Compliant, Robot arm. This robot is especially designed for assembly automation and uses 4-axes of motion, each axis driven by a servo motor. The two joints have a motor each and the base has a rotate axis.

The fourth axis is the vertical axis that generally inserts a component. This arrangement makes a very "stiff" arrangement that is ideally suited for accurate insertion. The Scara is the least expensive of the servo powered robots and are usually small and can be very fast. The photo at left is of an Epson robot. Take a look at this page for more details- **The Scara Robots.**



MMR8691 ROBOT



The 6-Axes Industrial Robot Arm.

Maybe the most recognized industrial robot. It is available in a wide range of sizes and payloads, They can be small enough to mount on a table or, like the ABB IR 140 shown here are floor mounted.

Applications are universal in the field of industrial robotics. The robot arm can be found in all types of uses, from assembly to welding to painting and material handling.

The Painting Robot.



When used in a painting application, the robot does not need a large payload capability but does need good

