INDUSTRIAL ROBOTS

A robot is a type of automated machine that can execute specific tasks with little or no human intervention and with speed and precision

Types of Industrial Robot :

1. Cartesian Robot
2. Polar Robot
3. Cylindrical Robot
4. Scara Robot
5. Delta Robot

Cartesian Robot : A Cartesian robot is composed of three prismatic joints. Thus, the tool is limited to linear motion at each axis but can still generate circular movements throu gh kinematic models that allow circular interpolation.

Key Features:

1. Linear motion in x, y, and z axes
2. High accuracy and repeatability
3. Compact, rectangular design
4. Easy integration with peripherals
5. Cost-effective

Advantages	Disadvantages
1. High precision and accuracy	1. Limited flexibility
2. Efficient material handling and assembly	2. High upfront costs
3. Easy programming and integration	3. Integration complexity
4. Space-saving design requirements	4. Maintenance
5. Reduced labor costs capacity	5. Limited payload

Applications:

1. Material handling (loading/unloading)

2. Assembly and inspection

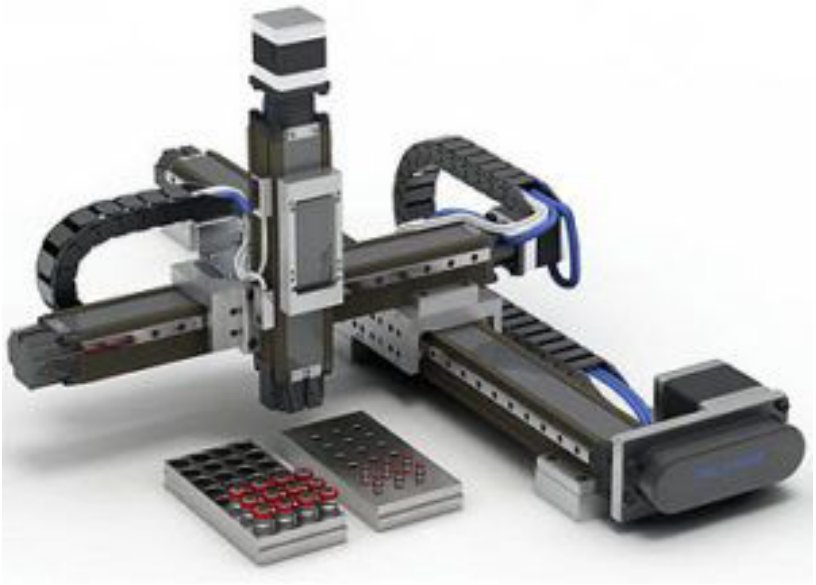
3. Packaging and palletizing

4. Machining and grinding

5. Welding and cutting

6. Automotive, aerospace, and medical industries

Cartesian Industrial Robots offer high precision and efficiency for various



industrial applications.

Polar Robot : Polar robots, also known as spherical robots, use the three-

dimensional polar coordinate system r, θ, and φ coordinate. Instead having a work envelope in the shape of a rectangular prism, polar robots have a spherical range. Their range of motion has a radius equal to the length of the link connecting the EOAT and the nearest rotator cuff joint. This configuration allows polar robots to have the farthest reach for a given arm length compared to other robot types. The range of a polar robot can be further extended using a second link connected by a prismatic joint. Because of their wide reach, polar robots are commonly used in machine loading applications.

Key Characteristics:

1. Polar coordinate system (r, θ, φ)
2. 3-4 degrees of freedom (DOF)
3. Rotational and linear motion
4. Compact, spherical design
5. High accuracy and repeatability

Advantages	Disadvantages
1. High precision and accuracy	1. Limited flexibility
2. Efficient material handling	2. High upfront costs
3. Easy integration with peripherals	3. Integration complexity

4. Space-saving design

4. Maintenance requirements

Applications :

1. Welding and cutting

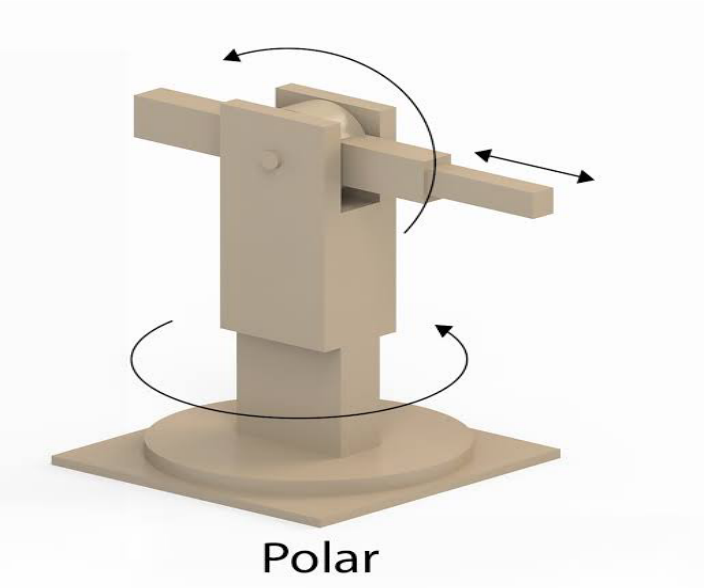
2. Material handling (loading/unloading)

3. Assembly and inspection

4. Machining and grinding

5. Painting and coating

6. Aerospace, automotive, and medical industries



Cylindrical Robot: As the name suggests, a cylindrical robot has a cylindrical range of motion. This type consists of one revolute joint and two

prismatic joints. The revolute joint is located at the arm's base, allowing the rotation of the links about the robot's axis. The two prismatic joints are used for adjusting the radius and height of the robot's cylindrical work envelope. In compact designs, the prismatic joint used for adjusting the arm's radius is eliminated.

Key Features:

1. Rotational and linear motion
2. High accuracy and repeatability
3. Compact, cylindrical design
4. Easy integration with peripherals
5. Cost-effective

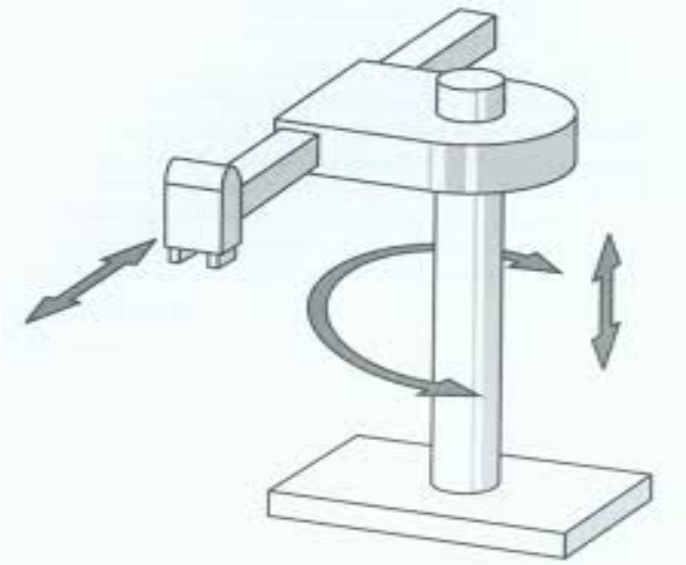
Advantages	Disadvantages
1. Efficient material handling	1. Limited flexibility
2. High precision and accuracy	2. High initial cost
3. Easy programming and integration	3. Maintenance Requirement
4. Space-saving design	4. Limited Playload
5. Reduced labor costs	5. Integration Complexity

Applications:

1. Material handling (loading/unloading)

2. Assembly and inspection

3. Machining and grinding



4. Welding

Selective compliant articulating robot arm (SCARA): A SCARA is a type of robot with an arm that is compliant or flexible in the horizontal or XY-plane but rigid in the vertical direction or Z-axis. Its translational movement on a single plane describes its "Sele ctive Compliance" characteristic. A SCARA has two links, two revolute joints, and a single prismatic joint. The links and the base are connected by the revolute joints, which are oriented along the

same axis.

Key Features:

1. Compact, rigid design
2. 4-axis movement (x, y, z, and theta)
3. High-speed and high-accuracy motion
4. Selective compliance (flexibility in certain axes)
5. Easy programming and integration

Advantages	Disadvantages
1. High precision and accuracy	1. Limited flexibility
2. Fast cycle times	2. High initial cost
3. Compact footprint	3. Maintenance requirement
4. Easy maintenance	4. Integration Complexity
5. Cost-effective	
6. Flexible and adaptable	

Applications:

1. Assembly and inspection
2. Material handling (loading/unloading)

3. Packaging and palletizing

4. Machining and grinding

5. Welding and cutting

6. Automotive, aerospace, and medical industries

Delta Robot: A delta robot consists of at least three links connected to an EOAT and a common base. The EOAT is connected to the links by three undriven universal joints. On the other hand, the base is connected by either three prismatic or revolute-driven joints. The driven joints work together to allow the EOAT to have four degrees of freedom. For designs using prismatic joints, a fourth link or shaft is usually connected to the EOAT to enable rotation. The EOAT of a delta robot can move along all Cartesian axes and rotate around the vertical axis, resulting in a dome-shaped work envelope. The simultaneous action of the three driven joints makes delta robots suitable for high-speed pick-and-place applications.

Key Features:

1. Parallel kinematics design
2. 3-4 degrees of freedom (DOF)
3. High-speed motion (up to 300 picks/min)
4. High precision and repeatability
5. Compact, lightweight design

Advantages	Disadvantages
1. High speed and productivity	1. Limited flexibility
2. High precision and accuracy	2. High initial cost
3. Compact footprint	3. Integration Complexity
4. Low maintenance	4. Maintenance requirement
5. Cost-effective	5. Limited Playload capacity
6. Flexible and adaptable	

Applications:

1. Pick-and-place

2. Assembly and inspection

3. Packaging and palletizing

4. Food processing and handling

5. Pharmaceutical and medical device manufacturing

6. Electronics and semiconductor manufacturing