

What Types of Industrial Robots Are There?

A Guide to the 6 Primary Types

The first industrial robot in Japan was created over half a century ago. In 1968, Kawasaki Heavy Industries signed a technical licensing agreement with an American venture company Unimation and began domestic production in Japan. Japan's first domestically manufactured industrial robot, the "Kawasaki-Unimate 2000", was completed in 1969.

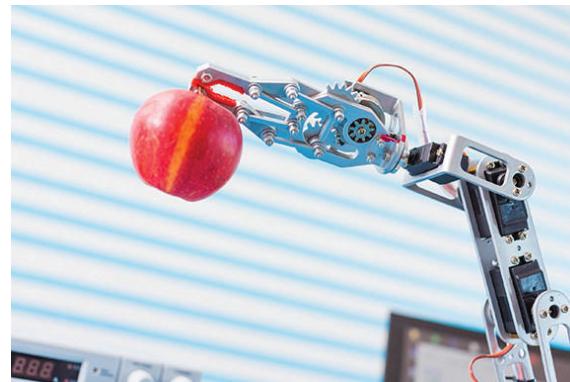
Since then, the development of industrial robots in Japan has accelerated, with a primary focus on the automotive industry. Kawasaki has become one of the major industrial robot manufacturers, gaining a large global market share and establishing the foundation for Japan to become the present-day "Robot Kingdom". In a way, industrial robots were born in the U.S. and raised in Japan.

Industrial robots are roughly categorized into 6 different types

Industrial robots are utilized not only in the automotive industry, but also in a variety of other fields including the electronics and food industries. Robots are used in factories for many applications, including welding, painting, assembling, material handling and palletizing. In order to adapt to each type of application, industrial robots come in many different varieties, with different attributes and features that make them ideal.

Although they are so widely utilized in various fields and there seem to be an unlimited amount of variations, there are 6 major types of industrial robots.

The difference is in the type of joint and mechanical structure



There are various ways to categorize industrial robots, including operation, industry or size. Here, we will focus on the type of joint and the mechanical structure

Axes are to robots as joints are to humans

For robots, rotary and linear joints are both counted as a joint. The number of joints is described using the number of "axes" or "degrees of freedom" (DOF). The number of joints a robot has is a major way to identify the type.

There are many similarities between the joints of robots and humans, but there are also differences. Motors are used in the joints of robots to help them move in a rotary fashion like human wrists and elbows do, but robots also have linear joints that extend forward, backward, upward and downward.

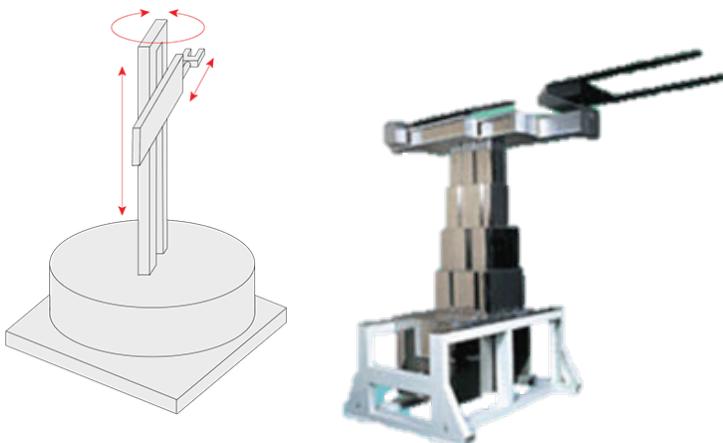
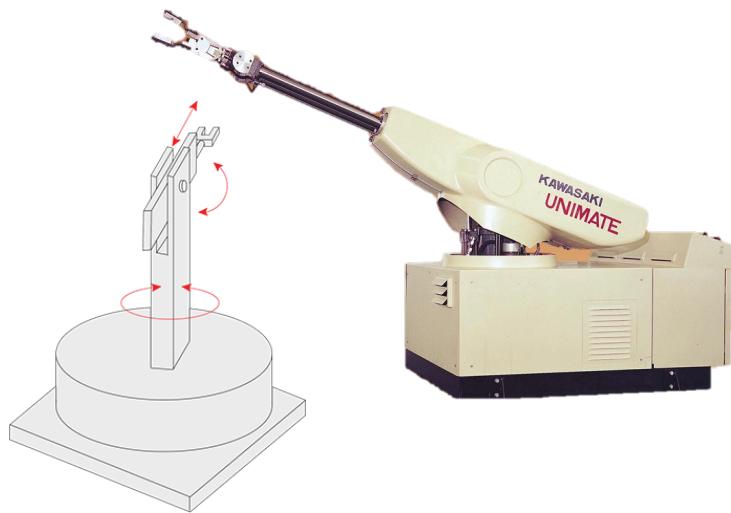
Operation tools, known as end effectors or end-of-arm tools, are attached to the end of robot arms and used like hands to grip objects. Robots move their end effectors to perform various kinds of work, but more than three joints are required to move the tooling.

ROBOT TYPES

POLAR COORDINATE ROBOT

The original industrial robot

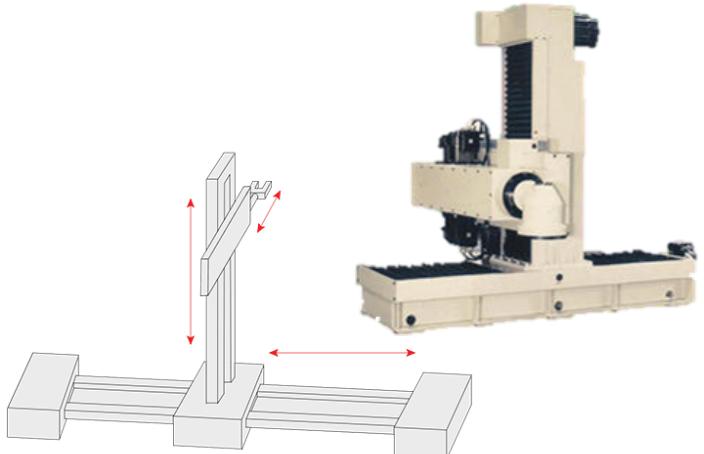
This is a robot that features a centrally pivoting shaft, like a revolving gun turret and an extendable rotating arm. With a hand designed to reach a wide surrounding area, this robot was extensively used in the early days of industrial robot development. (The Kawasaki-Unimate 2000 belongs in this category.)



CYLINDRICAL COORDINATE ROBOT

The robot with 50-year history

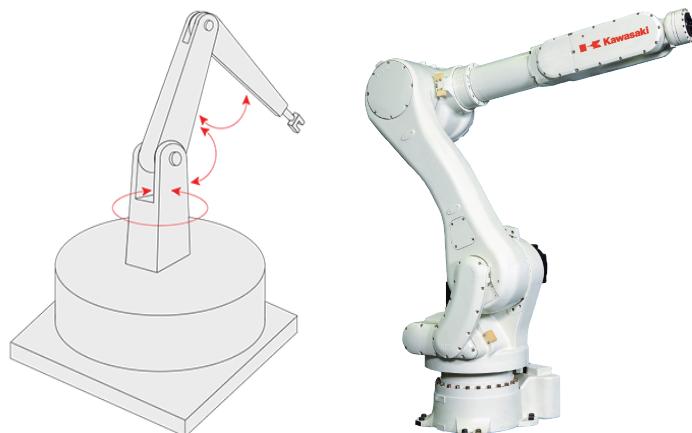
This robot is similar to the polar coordinate type in its pivoting shaft and extendable arm, but the difference lies in arm movement. The arm moves vertically by sliding, not by rotating. Its features are almost identical to its polar coordinate counterpart and many early industrial robots belong in this category. Today, this type of robots is still in use for the transport of items such as LCD panels.



CARTESIAN COORDINATE ROBOT

Simple control

This robot's movements are similar to those of an arcade claw machine; the robot slides on its three perpendicular axes, and doesn't rotate. Cartesian coordinate robots have a large footprint, but offer high accuracy and ease of use. This robot type is most frequently used to transport heavy items.



ARTICULATED ROBOT

Highly flexible movement

This is the most common type of industrial robot found today. Articulated robots have a similar mechanical structure to that of a human arm; it features a high degree of freedom, but controlling and programming these types of robots can be complicated. This type of robots is used for various purposes, including palletizing or welding for automobiles.

SELECTIVE COMPLIANCE ASSEMBLY

ROBOT ARM (SCARA)

The assembler

SCARA robots specialize in lateral movements. Rotary shafts are vertically positioned, so any end effector attached to the arm can only move horizontally. This type of robot works by moving the arm at high speed to a point on flat surface, and then raising and lowering the effector, thus making them useful for operations on level surfaces. You will find SCARA robots like the Kawasaki dual-arm duAro robot in a variety of applications, including handling semiconductor wafers and assembling circuit boards.



PARALLEL LINK ROBOT (DELTA)

When speed is key

While the previously mentioned articulated robot has serial joint linkages, the parallel link robot has parallel joint linkages. In general, these robots have three arms to control the positioning of the effector and they are usually used in situations such as sorting and selecting food products running along on conveyor belts. The work range is rather limited, but because each joint has direct control over the effector, delta robots have the ability to achieve high speeds.

The most important factor? The right fit for your application.

While all of the above mentioned robots fall into the industrial robot category, each robot is characteristically different from the others in various ways, including work range, mechanics, precision and speed. Depending on the type of joint and the robot's overall mechanical structure, each robot type is suited for certain tasks. When automating your specific process, it's important to understand the different options available, so you can select the best type of industrial robot for your application.

If you'd like to discuss what robot type would be best for your specific application, give us a call at **(248) 446-4100**, or send an email info@kri-us.com.

