



THE RISE OF LOW-COST AUTOMATION:

Trends and technologies you need to know about



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Automation Is Surging

So are low-cost solutions for ease of entry

By Alexander Mühlens

I think it's safe to say that industrial automation is a highly dynamic field that's fast advancing across all large-scale manufacturing facilities and supply chains. Today that growth is higher than ever due to a variety of technological developments and solutions — in everything from software and artificial intelligence to cloud computing and robotics.

Thanks to this growth, the cost of entry into automation is fast lowering for new, and small-to mid-sized companies. Here at igus we remain focused on providing component-level linear bearing parts for OEM projects. igus is a global leader in lightweight, corrosion-resistant parts that slide with no needed external or wet lubrication. That will not change.

Where igus is experiencing change is in rising demand among new and smaller companies looking to our company for low-cost automation solutions. They want the same access to automation combined with an influx of smaller, cost-effective, and maintenance-free power-transmission products such as our drylin®, which make it easier for these companies to cross the cost barrier.

They also want affordable and flexible solutions for increasing productivity, coping with labor shortages and enhancing workplace safety. At igus, our low-cost automation solutions help users meet these goals while accelerating return on investment. One flexible solution for reducing safety risks to operators is our Rebel® articulated arm robot, which features up to five degrees of freedom and allows humans to shift from rote tasks that can lead to fatigue and injury to other productive work.

Another example of a low-cost automation solution that is timely during pandemics, flu seasons and beyond: Touchless respiratory mask dispensers for work and other public spaces. Our designers came up with a simple automated dispenser using an igus delta robot with our Robot Control to drive a linear axis. Users can choose between a self-assembly modular kit or preassembly in a transport.

You'll read more about this and other low-cost automation topics and solutions in our Feature and Profile articles. You'll also see more in our FAQs



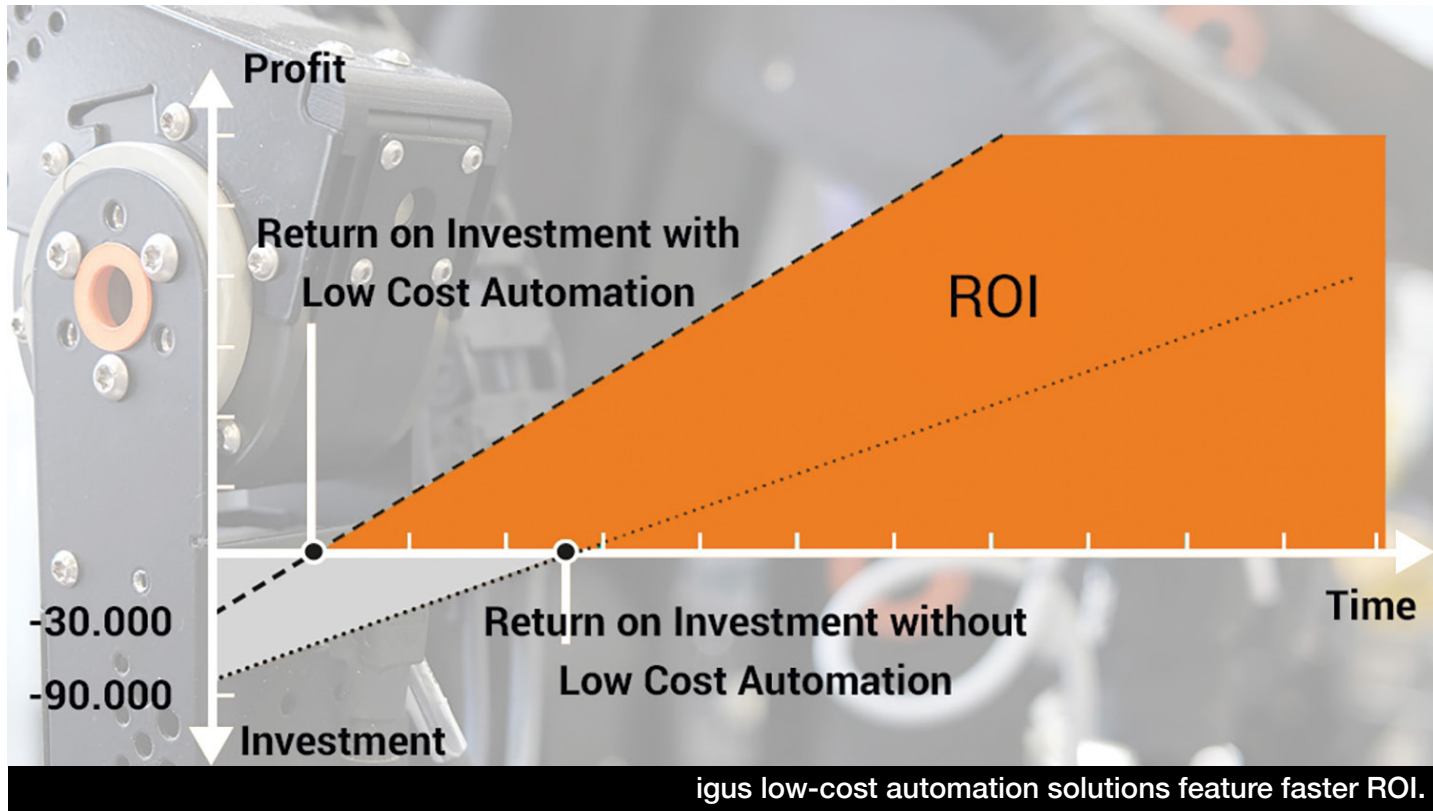
Alexander Mühlens, head of low-cost automation, has been with igus since 2010. He is responsible for the Automation Technology and Robotics business unit. His unit develops automation products — from robots to control technology and software. He also runs the robotics marketplace RBTX.com powered by igus, which specializes in low-cost robot solutions. In addition, Mühlens is a member of the Board of the VDMA Robotics + Automation Association.

piece by drytech® Product Manager Matt Mowry that highlights a few of our popular low-cost automation and robotics solutions. Please don't hesitate to give Matt a call to learn more.

Your business needs and the partners you work with to address them will guide your decisions about how, and how much, to automate your facility. These are exciting times. It seems that only a few years ago we were lamenting the decline of the manufacturing sector. Now low-cost automation is rapidly turning much of that around due to its speed, precision and overall accessibility — namely, its low cost, ease of implementation and many pre-configured application options.

We are seeing how our increasingly skilled workforce, our people, are working with automation in unprecedented ways to increase morale, productivity and profitability. These indeed are exciting times.

igus, a Design World 2021 Leadership in Engineering award recipient, is a global leader in the manufacture of engineered products made of high-performance plastics. These include plastic plain bearings, flexible cables, energy chains, connectors, robotic components, 3D-printed products and ball bearings.



LOW-COST AUTOMATION AND ROBOTICS, AN OVERVIEW

On the minds of most looking to purchase automated systems is how to justify the cost. The good news is the cost of entry into automation has never been lower and easier than it is today. All you need is the right partners to help identify and customize the best low-cost automation solutions for increasing productivity and return on investment.

Despite the pandemic, changes in the economy and other pressures, automation is on the rise. “Transformation for robotic automation is picking up speed across traditional and new industries,” says Milton Guerry, president of the International Federation of Robotics (IFR). According to the IFR’s 2021 World Robot Report, from 2015 to 2020 industrial robot density nearly doubled worldwide.

Robot density is a metric used by IFR to track the degree of automation adoption around the world. One key to the increase: Low-cost automation that is significantly lowering the cost of entry — leveling the playing field — by making implementation and components simpler, smaller and affordable.

Whether users are looking for off-the-shelf or do-it-yourself solutions, today's low-cost build-or-buy automation toolbox comes with many customized options. These range from individual robotic components to finished products, engineered to "do more with less" while keeping automation system designs as lean as possible — without reinventing the wheel.

Low-cost automation applications are broad in scope and include pick and place; sorting; labeling measurement; inspection automation; and repetitive material handling.

Low-cost automation

In defining "low-cost automation," it's helpful to start with automation itself. The International Society of Automation (ISA) defines automation as "the creation and application of technology to monitor and control the production and delivery of products and services. Automation crosses all functions within industry, from installation, integration, and maintenance to design, procurement, and management."

Automation benefits virtually all of industry, including manufacturing, transportation, utilities, defense and facility operations, the ISA adds. It is integral to a broad spectrum of traditional industrial applications and advanced technologies. Automation often is used with robotics, particularly in the manufacturing and engineering space looking to eliminate downtime and human error, which in turn leads to fewer worker accidents and improved workplace safety. Automation also allows for workers to focus on other important tasks.

The phrase "low-cost automation" stands for increased productivity driven by simple and affordable automation in the form of robotics components. Low-cost automation in production and processes is made possible in large part by the growing demand for low-cost, high-performance polymers used in plain bearings, flexible cables and robotic components.

Whether users are looking for off-the-shelf or do-it-yourself solutions, today's low-cost build-or-buy automation toolbox comes with many customized options. These range from individual robotic components to finished products, engineered to "do more with less" while keeping automation system designs as lean as possible — without reinventing the wheel. Low-cost automation also offers bundled hardware packages with pre-installed software for integrated workflows. Users increasingly are turning to one-stop shops for these solutions.

Robot systems and components

For new businesses, small and medium-sized companies and others looking for a competitive advantage, low-cost-automation using robot systems and components has become a game-changer. The rapid growth

of robotic production in fact relies on these components.

Depending on the scope of the application, whole processes or parts of them can be automated with the help of cost-efficient robotic solutions. These include gantry robots; delta pick-and-place robots; robotic arms and parts; multi-axis robotics carriers; linear actuators; and 7th-axis robot slides for cobots; individual components for single or multiple applications; and control systems with intuitive software.

One of any robot's limitations is the physical space in which it moves. The gantry robot, similar to a cartesian robot, is a mainstay of modern automation due to its low cost, high speed and precision, and ability to get big jobs done in small work envelopes. This line of robots enables movement along linear paths within a 3D workspace. Gantries are comprised of two base X axes, a Y axis and an optional Z axis. In advanced models, ball bearings are replaced with self-lubricating plastic liners that slide rather than roll, ensuring a smooth and quiet run.

Gantries are beneficial to engineers looking to automate their warehouses, improve current systems or solve design challenges. Advanced gantries are ideal for applications with two sets of easily configurable parameters: Low speeds with high loads or high speeds with low loads. The gantry's many applications include pick-and-place; packaging; palletizing; sorting; labeling; measurement; inspection automation; and material handling.

In one example, 14 container gantry cranes at the HHLA Container Terminal Altenwerder (CTA) were equipped with energy chains to supply the gantry trolleys with energy and signals. Proprietary chain flex cables have been working for a dozen-plus years, trouble-free and at high loads. Today the solution for CTA, a pioneer in the

use of energy chains and highly flexible cables, is recognized worldwide.

Another popular robot line is the delta robot, or parallel kinematic robot, a simple solution for fast assembly tasks whose initial investment is far less than many units used in manufacturing industries. For this reason, they are ideal for a variety of users, including those new to automation. The lightweight three-arm delta is connected by a common joint above and below the arms to allow for high-speed pick-and-place applications in industries such as food, pharmaceutical and electronics.

They are based on three toothed-belt actuators, with self-lubricating sliding plastic liners, spherical bearings and other lightweight components that don't require external lubricants or maintenance. They come in large and small sizes, both of which enable users to achieve high speed no matter the work area size. Stepper motors and encoders ensure quick handling by the delta robot.

In this pandemic era, one timely application for delta robots is in the design of contactless, low-cost automation face mask dispensers that make mask accessibility safer and easier. A delta robot is used with a robot control that helps drive a linear axis. Delta kinematics are optimal for fast dispensing of up

to 60 picks per minute. Users choose between a self-assembly modular kit or preassembly in a transport.

Whether you're in the market for gantry, delta or other automation options such as articulated arm and SCARA robots, you'll want to familiarize yourself with them before you buy. (See "FAQ: What are the major types of industrial robots?" for more.)

Emerging technologies and the workforce

With low-cost automation on the rise, there's a strong case for robots like linear gantries and deltas empowered by lubricating products and other components. They address the pain points like cost, quality and throughput that keep users up at night. In process and production robots are proving their repeatability and flexibility, and performing at astounding speed — all while optimizing throughput and maximizing ROI.

In manufacturing, the "Fourth Industrial Revolution (Industry 4.0)" has seen traditional processes being revolutionized by emerging technologies, including robotics, according to the Association for Advancing Automation (A3). "Manufacturers have realized that, when it comes to quality and efficiency, the best way to compete is to automate their factories with robots — whether they are programmed to carry out autonomous tasks or support manual processes."

A3 adds that when it comes to manual labor, today's users increasingly recognize that the benefits of low-cost automation cannot come at the expense of workforce stability and employee retention. The pandemic and other pressures have worsened the labor gap, but have increased automation and software systems and, with that, healthy profit margins. This allows for higher wages and benefits to employees.

In addition, gantry, delta and other robots handling repetitive tasks needn't be seen as "robots in, humans out." According to A3 and other experts, people will upskill or reskill to handle other processes or work alongside collaborative robots.

As low-cost automation continues to mature it will increasingly attract and retain high-quality employees, including those who have gone through apprenticeships, and primary and secondary school programs. Because automation is not a cure-all, trained workers will remain critical to optimizing decision-making, productivity and profitability.

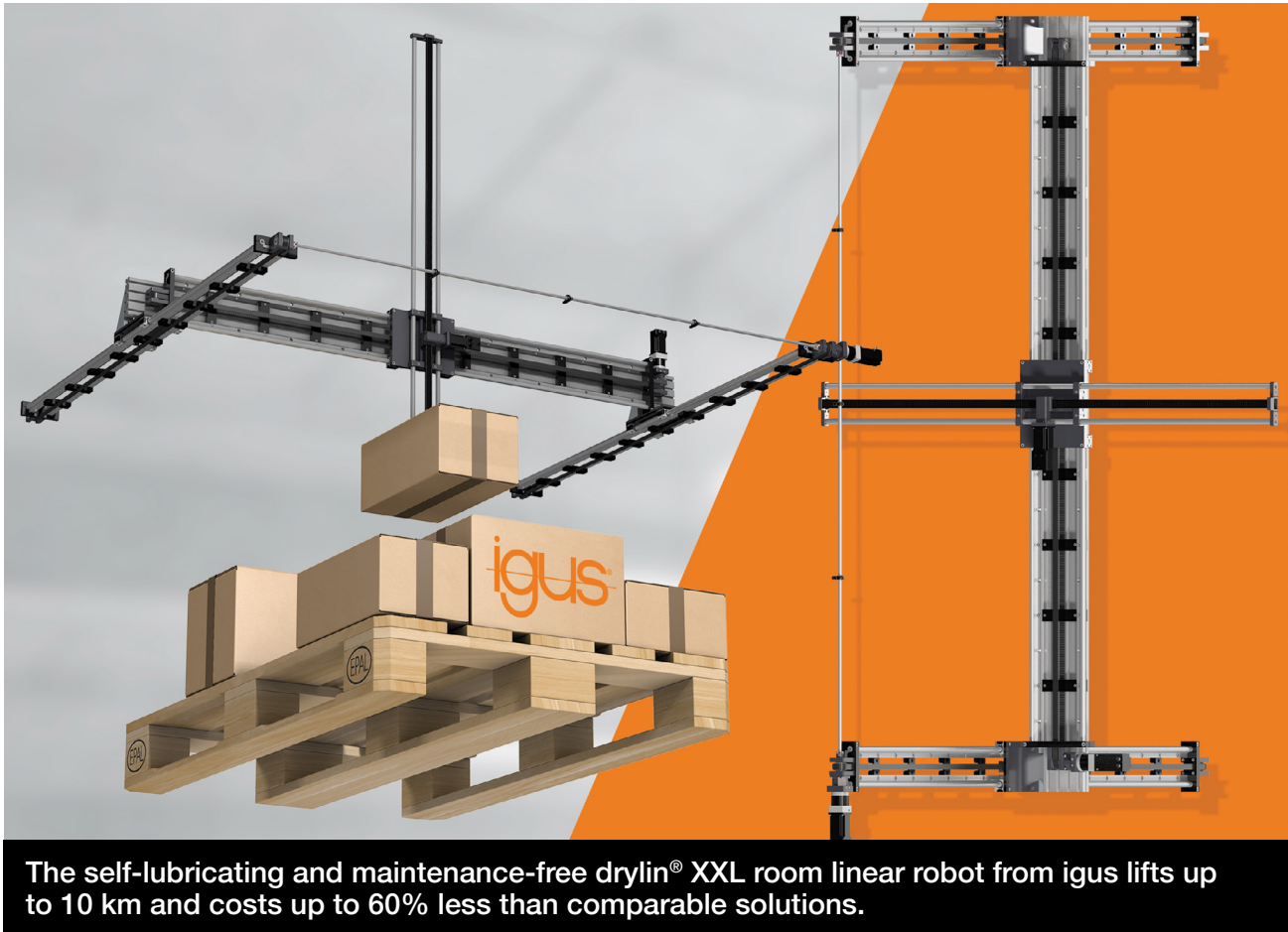
igus provides a variety of low-cost automation robots and robotic components and other tools for all of users' preconfigured, do-it-yourself and other needs. igus also believes users should be able to test before investing: We encourage you to test your application before you buy.

To learn more, visit www.igus.com/automation or call an igus expert at 800-521-2747.



www.igus.com/automation

New Gantry Robot: Up to 60% more cost-effective, easier to use



The self-lubricating and maintenance-free drylin® XXL room linear robot from igus lifts up to 10 km and costs up to 60% less than comparable solutions.

igus is committed to helping new companies enter the world of automation through low-cost solutions. Toward that end, the company has expanded its range of low-cost automation solutions with the addition of the XXL Large DIY 3-axis linear gantry robot.

This newest member of the igus gantry — similar to cartesian — product line features an action radius of 2,000 x 2,000 x 1,500 mm, and it is ideal for palletizing applications of up to 10 kg. Another feature: The pricing for the robot and control system. It is structured to help new, small and mid-sized users enter the world of low-cost automation and robotics.

The system is easy to set up and program using the do-it-yourself principle — no help needed from a system integrator. And, the 3-axis linear gantry robot is maintenance-free.

Lowering the barrier to cost-effective automation

The DIY kit allows companies to easily install a pick-and-place 3-axis linear gantry for tasks ranging from palletizing and sorting, to labelling and quality inspection. Palletizing robots created in collaboration with

external service providers cost from \$95,000 to \$135,000.

The people at igus believe that's a hefty price tag for many small companies. At igus, the use of high-performance plastics and lightweight materials such as aluminum results in a high-quality, low-cost solution. Because the drylin® XXL Large DIY palletizing gantry robot comes at a fraction of the price of comparable systems, it is a low-risk investment that typically pays off in a few weeks.

Assembling the DIY kit without prior knowledge

Users are introduced to the igus robot through its 3-axis linear gantry as a DIY kit. It consists of two-toothed belt axes and a toothed rack cantilever axis with stepper motors and an

action range of 2,000 x 2,000 x 1,500 mm. A maximum length of up to 6,000 x 6,000 x 1,500 mm are also possible. In addition, the package includes a control system, cables and free igus Robot Control (iRC) software. The software includes a matrix function for palletizing exercises.

Users can assemble the components into a ready-to-use system in just a few hours — without prior knowledge or lengthy training. If additional components such as camera systems or grippers are needed, users can easily find them through the igus robotics marketplace.

Augmenting the work of employees

A gantry robot can be used on conveyor belts that transport products from injection-molding machines. The robot picks parts with a maximum weight of 10 kilograms from the conveyor belt, transports them at a speed of up to 500mm/s, and positions them on a pallet with a repeatability of 0.8 millimeters.

This automation relieves employees of physically demanding and time-intensive palletizing work, freeing them up for more important tasks. Linear axes consist of corrosion-free aluminum, and the carriages move via plain bearings made of igus high-performance iglide plastics. The self-lubricating properties of igus bearings enable a low-friction, dry operation without external lubricants.

drylin[®] XYZ Gantries from igus[®]:

- **Workspace: Up to 6,000mm**
- **Positioning accuracy: Approx. +/-0.8mm**
- **Max load: 24.5N (5.5lbs) horizontally mounted**
- **Max speed: 0.5m/s**
- **Higher load and speed options available**
- **Different motors and Ingress Protection Ratings available.**

Enabling foolproof robot programming

The iRC software from igus enables simple and intuitive robot programming and control, allowing for easy entry into automation. The free software allows users to program different robot kinematics.

For many companies without in-house IT specialists, programming robots can be fraught with challenges. That's why igus developed iRC, a no-cost software application that visually resembles commonly used office software and allows intuitive programming of movements. What makes it special is the resulting low-code programming that can be used 1:1 on the robot.

The core of the software is a 3D digital twin of the 3-axis linear gantry, which can be used to define movements with just a few clicks. Prospective users can use the 3D model to check whether desired movements are feasible before making a purchase.

With the igus gantry configurator, you can customize the specifications, requirements and size of any type of gantry, whether it's a XY actuator (single rail), XY gantry or XYZ gantry. Contact igus to determine your requirements and which gantry is suitable for your application.

To learn more, visit www.igus.com/gantry or call an igus expert at 800-521-2747.



www.igus.com/automation

What Are the Major Types of Industrial Robots?

Answers you need before you buy

By Matt Mowry | drytech® product manager

When considering low-cost automation solutions, you'll want to know the differences between the top industrial robots on the market. We'll take a look at four of them included in the igus catalog: Gantry, delta, articulated arm and SCARA robots. Their main differentiators are size, speed and workspace. The design of each type is customized for various applications such as handling, palletizing and packaging.



Matt Mowry, drytech® product manager, started at igus in January of 2000 in outside technical sales. In 2005, he became North American product manager for the drylin® Linear Bearings and Low-Cost Automation business unit at igus and spent four months at igus headquarters in Cologne, Germany. Mowry holds a bachelor's degree in communications from Washington State University.

GANTRY

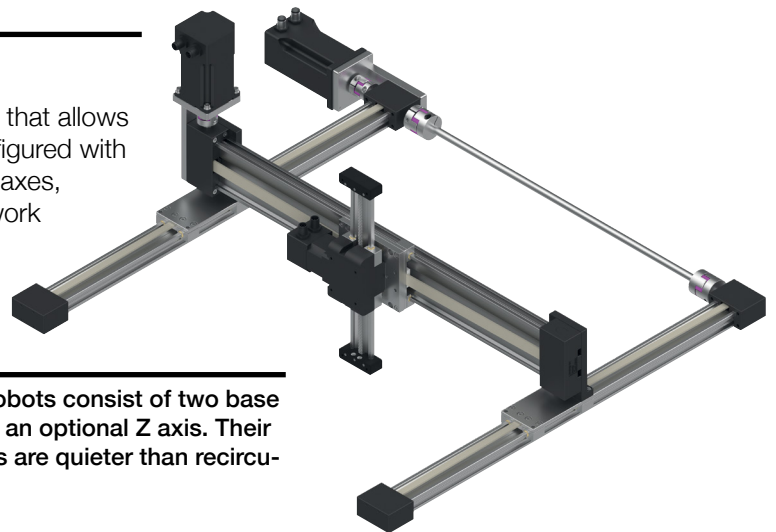
The gantry robot, similar to a cartesian robot, is a modular system that allows movement along linear paths within a 3D space. Gantries are configured with two base X axes, a supported Y axis that spans across the two X axes, and an optional cantilevered Z axis. It has a rectangular or cubic work envelope. It requires a mounting frame.

Advantages

- Self-lubricating and maintenance-free
- Resistant to dirt, dust and corrosion
- Clean and quiet

Applications

- Food packaging
- Material handling
- Automotive assembly



igus drylin® gantry robots consist of two base X axes, a Y axis and an optional Z axis. Their self-lubricating liners are quieter than recirculating ball bearings.

DELTA

Also called parallel or spider robots, deltas consist of three arms and a single base. The base is mounted above the work area while the arms move at high speeds with the help of motors on each axis. Delta robots have a dome shaped work envelope. The delta's payload capacity is lower than that of other robot types.

Advantages

- Linear actuators with self-lubricating sliding plastic liners
- No external lubricants needed
- Exceptionally high speed

Applications

- Parts inspection
- Material handling
- Friction welding



igus delta robots with drylin® linear actuators feature self-lubricating sliding plastic liners. No external lubricants required, and switching out liners is easy.

ARTICULATED ARM

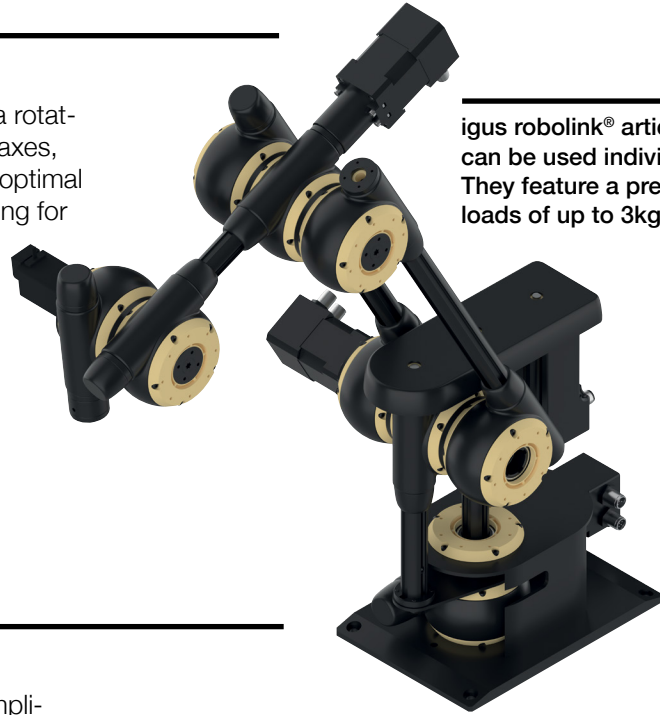
Articulated robots, or robotic arms, are fixed to a base with a rotating joint. The arms can be designed with two to 10 or more axes, with each added axis enabling more motion. Their design is optimal for complex movements. They can pitch, roll and yaw, allowing for directional control. They feature a large work envelope.

Advantages

- Precision movement
- Adaptable to process changes
- High speed

Applications

- Palletization
- Pick-and-place and gripping
- Arc welding



igus robolink® articulated arm robots can be used individually and flexibly. They feature a precision of 1mm and loads of up to 3kg in most industries.

SCARA

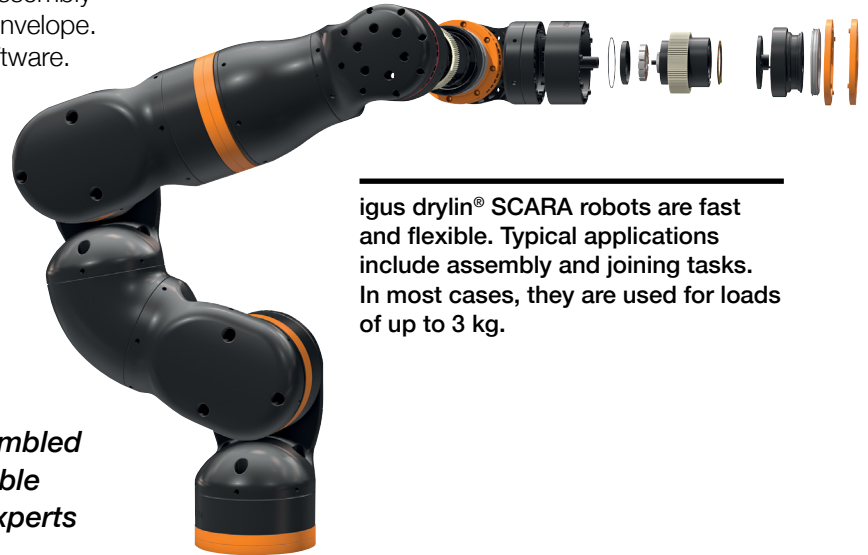
Newer to the low-cost automation range is the selective compliance assembly robot arm, or selective compliance articulated robot arm. The SCARA robot features three axes — X, Y and Z — for rotating and lateral movements. They are suited for simple assembly and robotics tasks. They have a cylindrical-shaped work envelope. At igus, they are fully integrated into our Robot Control software.

Advantages

- Compact size
- Adaptable axis configuration
- High speed and accuracy

Applications

- Higher speed with optional cleanroom specification
- Material handling
- Assembly and joining



igus drylin® SCARA robots are fast and flexible. Typical applications include assembly and joining tasks. In most cases, they are used for loads of up to 3 kg.

Whether you're interested in turnkey or fully assembled solutions, or looking to build your own customizable project, please call me or one of our other igus experts at 800-521-2747.



www.igus.com/automation