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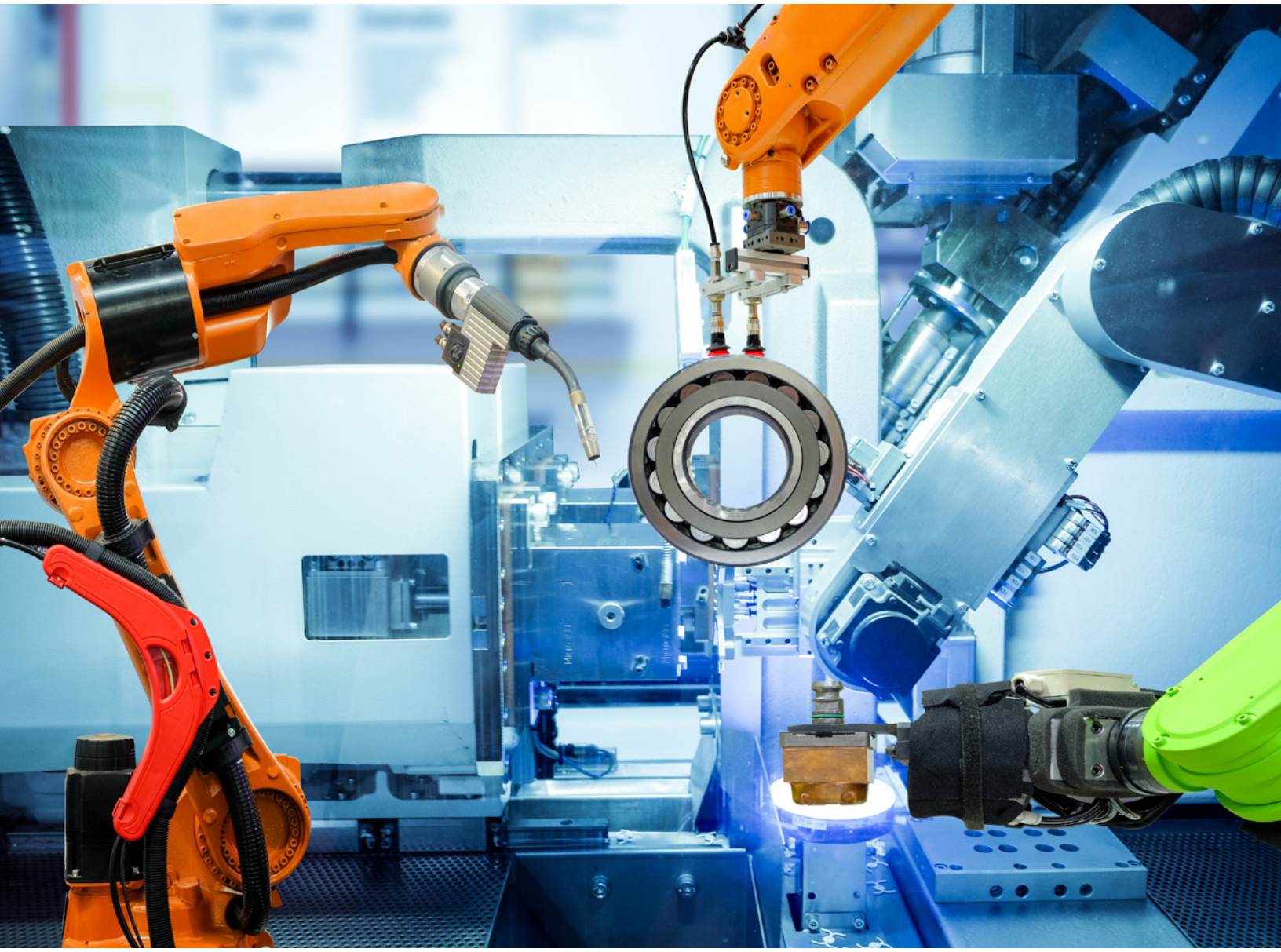

Industrial Automation Providers: A Look at the Top 10

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INDUSTRIAL AUTOMATION PROVIDERS: A LOOK AT THE TOP 10

Robots in manufacturing might seem like old news, but the industry is growing quickly, and many companies are vying to be the top suppliers.

By Eugene Demaitre, Senior Editor, Robotics Business Review

From the first numerically controlled machines in the late 1930s, through UNIMATE at a General Motors plant in 1961, to the robot arms with built-in motors and more programmable controls of the 1980s, robots have long had a place in factories. In the past several years, technological improvements and innovative use cases have boosted interest in robotics, even among small and midsize enterprises.

Today's industrial robots are more accurate, diverse, and versatile than ever. Articulated, cartesian, and parallel robots serve different needs, and software support is becoming just as important as distinctions in hardware. Machine learning also promises to help robotics in manufacturing.

Automotive and aerospace manufacturers are still the biggest consumers of robotics. They have been joined by electronics, machining, pharmaceuticals and cosmetics makers, and food processors.

In this RBR Insider report, we look at 10 top providers of robots to manufacturers. As with any list, it's somewhat subjective, since there are so many competitors to choose from. However, *Robotics Business Review*'s research and selections for the 2018 RBR50 list, our many conversations with developers and end users at events such as RoboBusiness, site visits, and reader feedback have led us to this year's roundup.

BULLISH ON FACTORY AUTOMATION

Estimates vary, but market research firms agree on the favorable prospects for robot suppliers, despite the threat of trade restrictions and recession.

For instance, Grand View Research Inc. predicts that the global industrial robotics market will expand at a compound annual growth rate (CAGR) of 7% from 2017 to 2020, reaching $41.23 billion by 2020. The San Francisco-based company has noted that the automotive sector will continue to be the strongest in demand.

Similarly, Research and Markets says the industrial robotics market will grow from $16.84 billion in 2017 to $48 billion in 2025. The Dublin, Ireland-based firm

attributes some of this to interest in collaborative robots, or cobots, which are designed to be safer to operate around people.

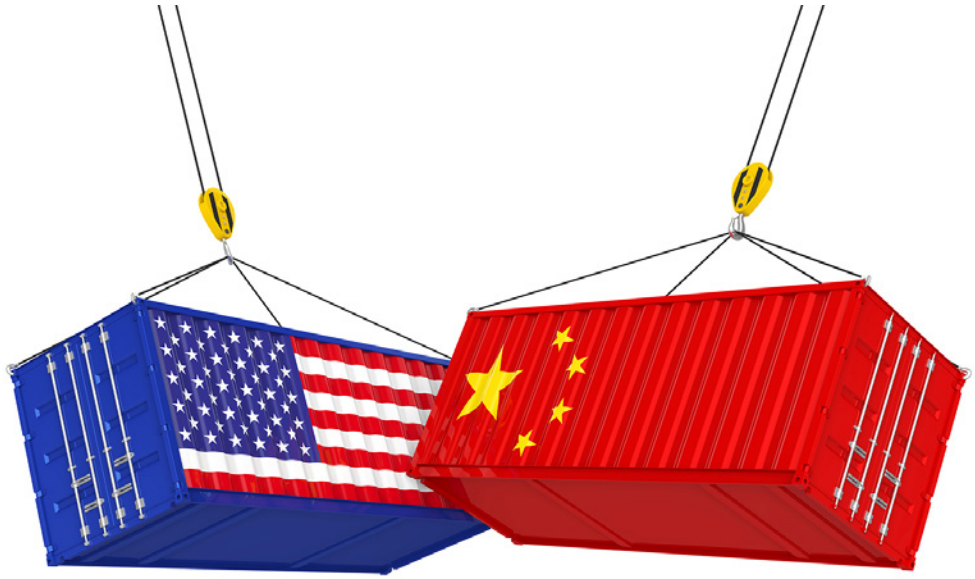
On the higher end, the global market will grow from $37.8 billion in 2016 to $70.1 billion in 2023 at a CAGR of 9.4%, says Allied Market Research in Pune, India.

MarketsandMarkets forecasts a CAGR of 9.6%, with the market reaching $71.72 billion by 2023. Articulated robots and automation for the metals and machinery sector will lead demand, said the Pune-based firm.

These wide-ranging estimates are the result of different time frames, inclusiveness of definitions, and research methodologies.

GLOBAL SUPPLY AND DEMAND

In terms of international supply and demand, East Asia continues to be the leader, notes the International Federation of Robotics (IFR). South Korea and Japan continue to produce and use robots at a higher robot density (number of robots per 10,000 human workers) than the rest of the world.



China is a major user of industrial automation and is investing in developing its homegrown R&D and production capabilities. India also hopes to grow its share of the global robotics market.

After that, the U.S. leads in North America, followed by Mexico. In Europe, Germany has the highest robot density, with Italy the next largest, thanks to automotive production.

TOP 10 INDUSTRIAL AUTOMATION PROVIDERS

Without further ado, here in alphabetical order are RBR's picks for the current top 10 industrial automation providers.

ABB ROBOTICS

ABB Robotics has an installed base of more than 400,000 robots in 53 countries. It made the first painting robot and the first microprocessor-controlled robot.

Zurich-based ABB Group serves the energy industry, among others, and is the parent of ABB Robotics. ABB's robots are used in welding, materials handling, small parts assembly, picking, packing and palletizing, and machine tending.

Like most of the companies in this roundup, ABB is a complete solutions provider, selling hardware, software, accessories, and services. Not only does ABB make the IRB line of industrial robot arms for different payloads and reach distances, but it also makes parallel, SCARA, and collaborative robots.

In addition to the two-armed YuMi collaborative robot, ABB recently introduced the IRB 14050 single-arm cobot. Last fall, ABB and rival Kawasaki Heavy Industries Ltd. said they would cooperate on promoting cobots and

Credit: ABB

ABB's SafeMove2 collaborative software and advanced vision systems enable robots to insert a car door into its hinges while the car body and door continue moving through the factory.

safety standards.

In June, ABB released its OmniCore family of robot controllers. The controllers take up less space than their predecessors, and they come with the RoboWare 7 operating system and work with the newly designed FlexPendant.

As an example of the Industrial Internet of Things (IIoT), ABB said that it has delivered 40,000 robots with embedded connectivity, ready for the five parts of its Connected Services suite.

In an emerging sales approach, ABB is offering its solutions as a portfolio for the "factory of the future," as it announced at Automatica 2018 in Munich. The company is doing well in terms of orders.

Beyond automotive manufacturing, ABB serves the plastics, metal fabrication, foundry, energy, consumer electronics, and food and beverage industries.

BOSCH GROUP

Germany-based Robert Bosch GmbH includes about 450 subsidiaries in 60 companies. It is the third-largest home-appliance manufacturer in the world and includes divisions focused on IIoT and mobility solutions.

What ABB calls the "factory of the future," Bosch refers to as "Industry 4.0," a term frequently used in Europe for advanced manufacturing automation.

Bosch also focuses on packaging, additive manufacturing (or 3D printing), pharmaceuticals, and food processing.

Like other industrial automation providers, Bosch Group is big enough and brave enough to experiment in other forms of robotics. For instance, it supported Mayfield Robotics, which produced the Kuri service robot before ceasing operations. It also developed a foosball or table soccer system using artificial intelligence.

Bosch has also backed a robotic lawn mower, a "weed-punching" agricultural robot, and autonomous trucks.

Industry experts have said that platoons of autonomous trucks could hit the roads before self-driving passenger cars, which Bosch is also watching and

Credit: Bosch

Among other verticals, Bosch offers automation for packaging.

supporting with training and research.

Parallel work is occurring on ground-based delivery robots. Bosch has provided equipment to Teleretail AG, which is working on long-distance logistics robots.

EPSON ROBOTS

Japan-based Seiko Epson Corp. is best known for computer printers and related imaging and information technology equipment.

Epson Robots claims that it's the No. 1 SCARA robot maker in the world. The company has an installed base of more than 65,000 robots worldwide. It also sells six-axis robot arms, Cartesian robots, controllers, software, and accessories.

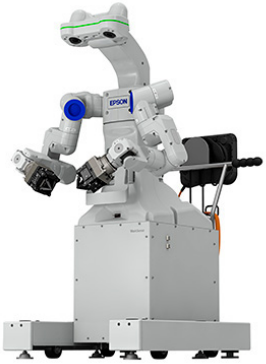
Epson provides automation for small parts assembly and packaging in aerospace, biotechnology, consumer products, medical, and telecommunications markets, among others.

Products from Epson Robots include its Flexion™ N-series six-axis robot, which it describes as "the world's first patented folding arm."

The company's Synthis T3 all-in-one SCARA robot comes with a built-in controller to reduce the use of space and simplify setup.

The T6 SCARA robot, shown at Automatica 2018, is intended to make it easier for smaller organizations to adopt robotics.

Epson's WorkSense W-01 dual-arm robot is designed to be about human size, use integrated vision, and conduct tasks requiring two hands.



Credit: Epson

Epson's WorkSense W-01 robot is designed to be compact and cost-effective.

FANUC ROBOTICS

Last year, Japan-based FANUC Corp. announced that it had produced 500,000 robots. The Japan-based company also makes CNC (computer numerical control) products, the RoboMachine/RoboDrill machining center, and IIoT systems.

FANUC Robotics supplies just about every industry, including automotive, textiles, and food processing.

Along with ABB, KUKA, and Yaskawa, FANUC has been one of the "big four" industrial automation providers for several years. Shops with products from multiple vendors can easily distinguish their robots by their respective colors — orange for ABB, yellow or green for FANUC, orange for KUKA, and blue for Yaskawa.

Political differences between the U.S. and China have reportedly hurt

Credit: FANUC

FANUC's latest SCARA robot is designed for compactness and high productivity.

FANUC's orders, particularly among smartphone manufacturers, but the company is still doing well.

Although none of the big four robotics makers are based in the U.S., FANUC is investing $51 million in an expansion in Auburn Hills, Mich.

The company recently added the SR-6*i*A to its SCARA line for high-speed applications.

FANUC's Zero Downtime, or ZDT, can help production managers monitor, troubleshoot, and optimize their industrial robots in real time. It collects performance data and notifies managers of any problems via tablet or smartphone.

Like other traditional industrial robotics makers, FANUC is looking ahead to the small and midsize enterprise (SME) market with collaborative robots on top of its existing product lines.

The company recently unveiled the CR-15*i*A and M-10*i*D/10L robot arms designed for light payloads and narrow workspaces.

KUKA AG

Two years ago, China's Midea Group bought Germany-based KUKA AG for $5 billion, sparking controversy but granting KUKA access to the growing Chinese market. This includes the Swisslog unit and a new robot park in China. KUKA has an installed base of 80,000 robots.

KUKA Robotics makes a wide variety of robots for multiple industrial applications, including press linking, machine tools, palletizing, and welding.

Midea is the world's largest maker of home appliances. Midea and KUKA

Credit: KUKA AG

KUKA's LBR iisy is a collaborative robot that can share programming in a swarm.

have also explored household robots and assistive technologies.

As an example of multinational synergy, Chinese OEM Guangzhou Automobile Group Co. (GAC) recently ordered 430 KUKA Quantec and Fortec robots, plus its KUKA Connect cloud-based platform, for the production of electric vehicles.

KUKA has the record for the world's strongest robot, with its KR 1000 able to lift 1,000 kg (2,204 lb.).

In the first half of 2018, KUKA reported $1.8 billion worth of orders, primarily from automotive, industrial, and consumer goods and logistics segments in Europe and China.

KUKA's new e-commerce site is intended to make it easier for customers to buy robots, software, or components.

The company has also pursued strategic relationships with partners and competitors. It signed a memorandum of understanding with Hyundai Heavy Industries in May for joint marketing and support in South Korea.

In cooperation with MHP and Munich Re, KUKA is offering "SmartFactory as a Service" to help shorten the time to market for new projects by up to 30%.

The LBR iiwa from KUKA was one of the first robots designed to be used without a safety cage. The company has continued its cobot legacy with the lightweight LBR iisy, which can operate in small-batch, high-throughput environments.

MITSUBISHI ROBOTICS

Mitsubishi Robotics produces the MELFA industrial robots for manufacturing cells. It sells vertical, horizontal, ceiling-mounted, and "micro working" robots, as well as sensors, safety equipment, and application and engineering software.

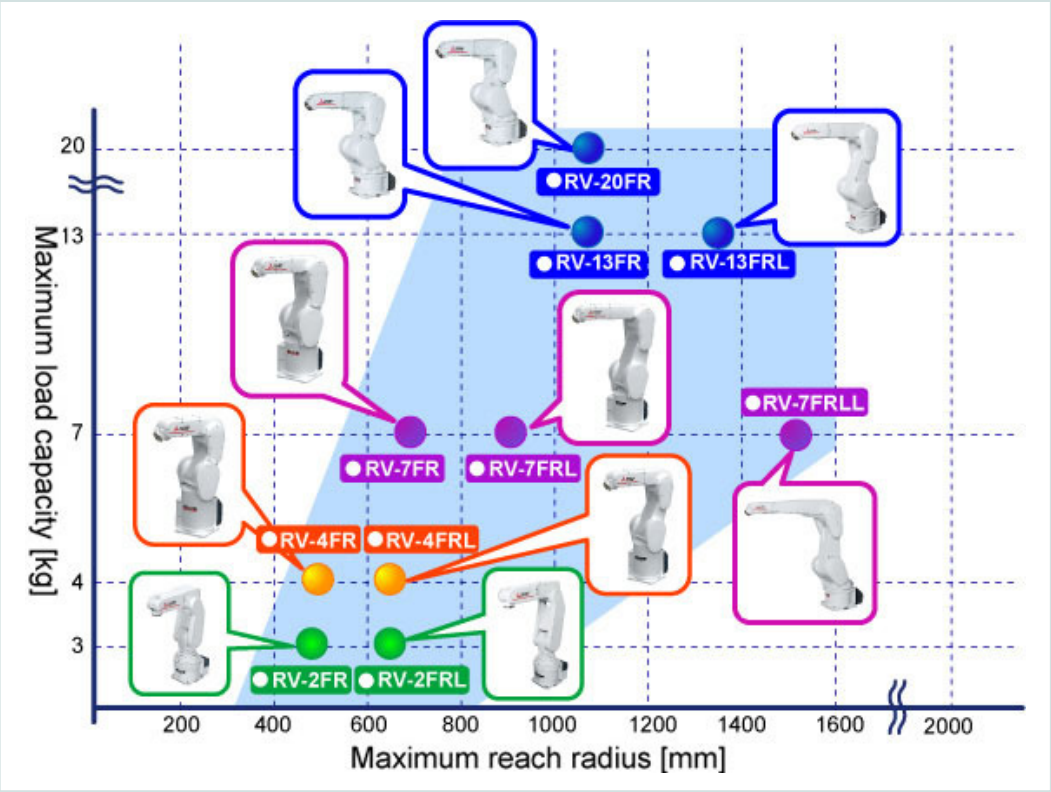
The unit of Tokyo-based Mitsubishi Electric Corp. serves material handling, pick-and-place, assembly, dispensing, and packing applications.

Mitsubishi Electric was the top-earning industrial robotics company in 2016 at $12.59 billion, according to Statista in Hamburg, Germany.

The company has said that its integrated manufacturing systems can provide information to help businesses make informed decisions in real time.

By partnering with other hardware and software vendors, plus systems integrators, Mitsubishi claims that its "eF@ctory" concept can improve efficiencies, reduce costs, and increase productivity.

The Pak/iQ portfolio combines smart machines with machine learning to lower the costs of packaging machinery, according to Mitsubishi.



Credit: Mitsubishi Electric

A product map of Mitsubishi's RV-FR series robots by reach and load capacity.

Speaking of combinations, there have been several attempts to combine cobot arms with mobile platforms. A recent example is a Mitsubishi arm atop an automated guided vehicle (AGV) from Mirage for pick-and-place and manufacturing tasks.

OMRON ADEPT TECHNOLOGIES INC.

Omron Adept Technologies provides vision-guided robotic systems and services for the appliances, automotive, electronics, food processing, pharmaceuticals, and telecommunications markets.

In 2015, Kyoto, Japan-based Omron bought Adept Technology, which was then the largest manufacturer of industrial robots in the U.S.

Omron Adept's offerings include AGVs, multi-axis robots, and parallel and SCARA robots. Its mobile robots can fulfill both manufacturing and supply chain needs. Omron also sells

Credit: Omron Adept Technologies

Omron Adept's mobile robots include vision-based guidance.

integrated controllers, sensors, cameras, relays, and drives.

The company recently released the NX1 series machine controller to link device data with the Industrial Internet of Things.

At the 2018 Consumer Electronics Show, Omron's FORPHEUS robot took on human challengers in table tennis to demonstrate the agility and adaptability of its parallel robots.

Continuing the theme of partnerships and collaboration, Omron is working with Taiwan's Techman Robot Inc. to develop next-generation cobot arms.

STÄUBLI

Switzerland-based Stäubli focuses on electrical connectors, textile machinery, and robotics. The company has operations in 29 countries and agents in 50 countries.

Stäubli Robotics makes six-axis, FAST picker, SCARA, and collaborative robots, as well as controllers and Windows-based development software. It offers end users the CAD files for its robotic arms.

Credit: Stäubli

The Stäubli TX340 SH six-axis robot has a maximum payload of 190 kg (418 lb.) and a reach of 3,680 mm (12 ft.).

At Automatica 2018 in Munich, Stäubli launched its TS2 SCARA series, which was completely redesigned. It is designed to be hygienic for sensitive environments such as healthcare, food processing, and semiconductor manufacturing environments.

Stäubli has partnered with Schneider Electric (see below) to integrate the TS series of four-axis robots into Schneider's EcoStruxure Machine IoT architecture. The goal is to make programming robot movements easier for end users and to remove a proprietary robot control from the hardware installation process.

UNIVERSAL LOGIC INC.

Unlike most of the companies on this list, Universal Logic (formerly Universal Robotics) is primarily a software company. Nashville, Tenn.-based Universal Logic uses artificial intelligence to enable industrial robots to see, react, and learn at human-like speeds.

Universal Logic's Neocortex AI is hardware-agnostic and can allow automation users to handle high item variability, part changeovers, and deformable objects without changing fixtures. According to the company, typical payback takes less than 18 months.

Credit: Universal Logic

The G2R cells can be used to quickly and accurately fill product orders.

The latest version of the modular software, Neocortex DIY, allows engineers to configure robot cells for variable picking in both manufacturing and consumer-product supply chains. From palletizing to custom applications, Universal Logic's offerings can help in pharmaceuticals, food and beverage suppliers, and bin picking.

Universal Logic also ships the G2R (Goods to Robot) complete prefabricated work cells. These are designed to drop into existing cells previously designed for humans without requiring the entire production line to be reconfigured.

These cells can work with robots from ABB, Cognex, IDS, and Yaskawa. At MODEX this year, Universal Logic demonstrated G2R installations that could handle up to 90,000 SKUs (stock-keeping units) at a rate of 600 to 1,600 items per hour.

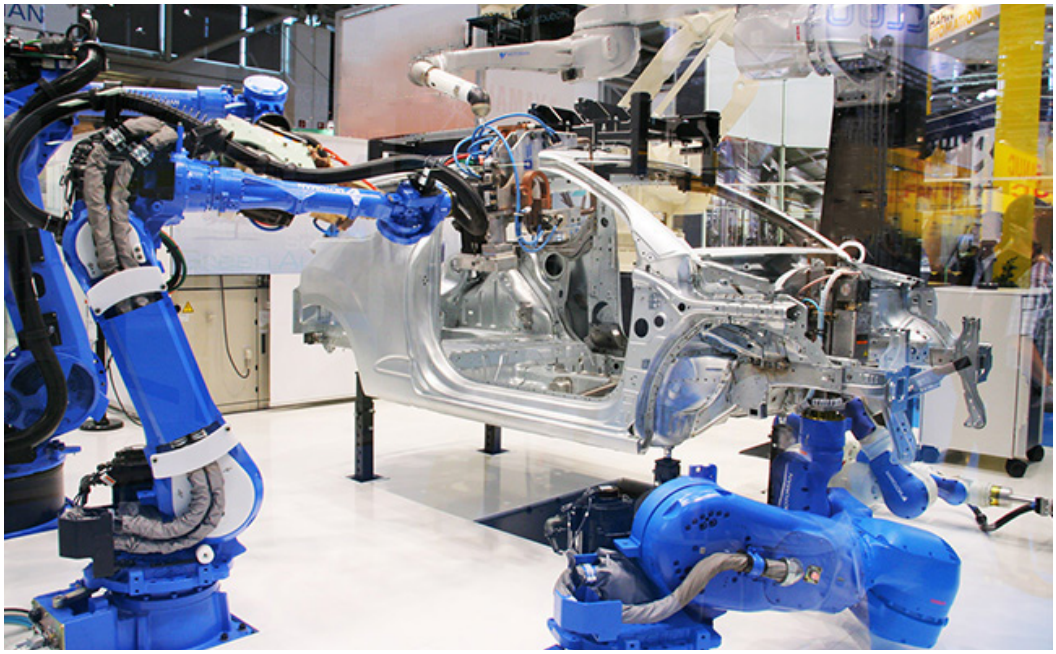
YASKAWA MOTOMAN

Japan-based Yaskawa Electric Corp.'s Yaskawa America Inc. unit includes the Motoman Robotics Division after a 2010 merger. It is the last of the "big four" industrial automation suppliers and the last of this year's top 10.

Yaskawa Motoman is based in Miamisburg, Ohio., and more than 400,000 of its robots are installed per year. Its high-speed industrial robots are used for assembling, dispensing, machine tending, painting, pick and place, welding, and other operations.

Applications include automotive, semiconductors, biomedical, packaging, and electronics manufacturing.

Yaskawa offers more than 140 industrial robot models, including the SDA20D



Credit: Yaskawa Motoman

Yaskawa produces robot arms for a wide variety of industrial applications.

dual-arm robot for complex assembly and materials handling appplications. It also offers the MH 900, which has a payload capacity of 900 kg (1,984 lb.).

Last autumn, Yaskawa joined the cobot bandwagon by releasing the HC10, which includes the company's new high-performance YRC1000 controller.

As part of its efforts to enter the growing Chinese robotics market, Yaskawa recently offered its servomotors and machine controllers to robot makers in China. This is similar to Intel Corp.'s "Intel Inside" strategy for licensing its hardware.

THE BEST OF THE REST

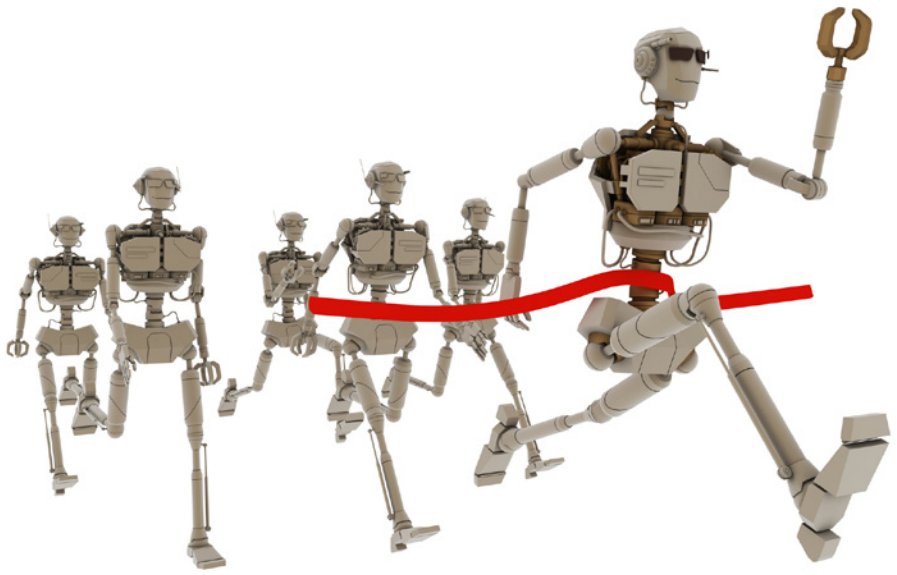
Since manufacturing remains a mainstay of industrial automation, it's no surprise that there are many vendors in this relatively mature space.

Italy's Comau S.p.A. is a subsidiary of Fiat Chrysler Automobiles. In addition to traditional robots for manufacturing, the company is also working on an exoskeleton to help workers.

Japan-based Denso Robotics is a pioneer in small robotic arms for assembly and inspection. Also based in Japan, Nachi-Fujikoshi Corp. makes industrial robots for cleanrooms, materials handling, palletizing, and welding. It also makes service robots.

In November, Emerson Electric Co. offered Rockwell Automation Inc. $29 million but was rejected. Ferguson, Mo.-based Emerson Electric focuses on software and hardware for the chemicals, oil, and food industries.

Milwaukee-based Rockwell Automation supplies software, sensors, and training to manufacturers of cars, electronics, and appliances. In June, it



announced a $1 billion investment in PTC Inc. to combine the companies' expertise in industrial automation and IoT and augmented reality.

Foxconn Technology Group, also known as Hon Hai Precision Industry Co., is the world's largest electronics manufacturer. Taipei, Taiwan-based Foxconn is a producer and user of robots and is building plants in Mount Pleasant, Wisc., and Zhuhai, China.

Honeywell International Inc. in Morris Plains, N.J., makes sensors and robots for the energy, food, and pharmaceuticals verticals.

Kawasaki Robotics is a 50-year-old unit of Kawasaki Heavy Industries Ltd. in Japan. It makes industrial robots for payloads of all sizes, dual-arm SCARA robots, and models for pick-and-place and welding operations.

Kawasaki also makes controllers, vision systems, and robot transport units. It is also testing an autonomous underwater vehicle (AUV) for pipeline inspection and is working with ABB on a common interface for cobots (see above).

Siasun Robot & Automation Co. makes industrial robot arms, AGVs, and humanoid service robots. It's also one of the leading robotics producers based in China.

France-based Schneider Electric SE makes linear, delta, and SCARA robots for manufacturing, as well as offering integration services and home energy-efficiency systems.

In addition to its EcoStruxure IoT deal with Stäubli (see above), in May, Schneider Electric agreed to buy India-based Larsen & Toubro for $2.1 billion.

Germany-based Siemens AG supports the energy, healthcare, infrastructure, and manufacturing markets. It plans to invest $1.14 billion over the next five years on digitization initiatives in Brazil.

Credit: Universal Robots

Universal Robots' UR5 collaborative robot arm.

COBOTS JOIN THE COMPETITION

As we've seen, many industrial automation providers, which initially dismissed collaborative robot arms as niche products, have begun selling cobots of their own. Companies that make only cobots have an edge in specialized experience, as well as a challenge in getting market awareness. Fortunately for them, smaller businesses are beginning to understand the potential benefits.

Universal Robots A/S in Odense, Denmark, is the clear leader in the cobot space. It has developed a growing ecosystem through the UR+ online marketplace and the free Universal Robots Academy for staff and customer training.

Earlier this summer, Universal Robots released its e-Series cobots, which include more sensors for greater safety and easier application development for end users.

Boston-based Rethink Robotics Inc.'s Baxter and Sawyer have been widely used as research platforms. The two- and one-armed models are also finding use in industrial settings, and Rethink has been adding distribution partners to its global network.

Waltham, Mass.-based Veo Robotics uses AI and computer vision to make work cells that wouldn't normally be considered collaborative spaces safer for humans and robots to operate in together at speed.

Several companies have emerged to provide end effectors for these cobots, especially for picking tasks.

Somerville, Mass.-based RightHand Robotics Inc.'s RightPick combines

software and hardware to quickly and reliably sort apparel, electronics, groceries, and pharmaceuticals.

Robotiq is a Quebec-based provider of finger grippers, sensors, and modular connectors for all the major cobots.

Morrisville, N.C.-based Schunk GmbH sells a wide variety of grippers and clamping products.

Massachusetts-based Soft Robotics Inc. offers innovative soft grippers that are useful for e-commerce order fulfillment, food processing, and other use cases that require handling of varied, fragile objects.