

## Collaborating with robot arms, platforms

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## EDITOR'S NOTE

**A**s more robotic features find their way into organizations, the interactions between humans and robots remains a critical focus area. Robot arms and their associated software platforms can help companies optimize processes when they implement robots that collaborate with their human counterparts. How organizations manage this partnership is integral to forging a relationship between humans and machines for optimizing process workflow.

Cobots have opened the door for a more dynamic relationship between human staff and robots in shared environments. As organizations attempt to optimize their operations with the right balance of staff and automation, it raises questions about the ideal scenario for human-robot coexistence and the notion of "replacing" staff with automation.

In this Special Focus Issue, we'll examine how organizations across industries have taken a gambit on robot arms, and how these companies have found a way to create collaborative opportunities between robots and their staff.

**Tim Culverhouse, Editorial Director**

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# Safety systems and teaching options that make working with cobot arms easier

## Yaskawa Motoman HC series features simplify cobot arm deployment and operation

BY DONALD HALSING

Robot arms equipped with the right [safety](#) features can operate in close proximity to people. But not all [collaborative robots](#) are built for constant work alongside humans.

The Association for Advancing Automation (A3) defines four major types of collaborative robots recognized by the ISO. Some primarily move autonomously, abiding by visual [sensors](#) telling the robots to slow down or stop if people get too close. Others are built with collision sensors that stop robot arms when they contact obstacles. And others still are guided by hand, either in operation or during programming.

[Yaskawa America Inc. Motoman](#) Robotics Division (Yaskawa Motoman) produces a wide array of industrial [robot arms](#). Yaskawa Motoman's "Human-Collaborative," or HC series of [cobot](#) arms, are designed for different kinds of interactions between robots and people.

### Cobots designed with people in mind

From the ground up, Yaskawa designs robot arms that are applicable for as many applications as possible. All of Yaskawa's cobots are IP-67 rated, with food-grade



*Yaskawa Motoman's HC series, or "Human Collaborative" cobot arms, include safety features and easy-to-use programming tools that enable flexible deployment options. Source: Yaskawa Motoman*

grease and corrosion-resistant paint as standard features.

"Not all applications will need any one of those individual design elements," said Chris Caldwell, product manager at Yaskawa Motoman. But because each model in the HC line is "safe for any application," he added that "they can easily be deployed anywhere."

Caldwell said Yaskawa's HC10 workstation was designed for a global market - primarily European customers, but with American and Japanese influence. Yaskawa's designers considered what size doorways the workstation would need to fit through and an ergonomic mounting height to match typical human reach.

I/O cabling, air hoses, ethernet, and other utilities run through the robot arms. For the HC10 workstation, the remaining lengths of cable are routed internally. Caldwell said through-arm and internal cable management prevents utilities from getting caught on objects in the surrounding environment and also enables simplified connections.

HC series cobots also feature a "pinchless" design - which prevents injury if someone gets too close to articulating joints - and additional finishing work to smooth out aluminum castings that prevents abrasion from skin contact.



Yaskawa Motoman HC10 workstation at MODEX 2024. Photo: Donald Helsing / PEERLESS MEDIA

### Fenceless operation for greatest flexibility

If a preliminary risk assessment determines it would be safe, companies can deploy fully “fenceless” cobot arms. Caldwell said fully fenceless operation allows free movement of humans and equipment around a robot at all times during operation without any physical safety barriers.

“With the HC10 workstation, you can drop that in place, not put up any other fencing or guarding around it, and allow that robot to operate in that entire area,” Caldwell said.

Yaskawa’s HC20 and HC30 cobot arms can reach up to 1.9 meters, or just over six feet, from their mounting point. “Ultimately the entire reach of that robot is the amount of space and footprint that that cell can take up.”

Under the right circumstances, human and equipment traffic could be allowed to pass freely through the reach of a cobot arm.

But if reach reduction is required for a cobot to operate safely, Caldwell said boundaries can be defined in safety logic circuits. Within functional safety units, software-based limits can be set that restrict areas robots can reach or the speed at which they operate.

Yaskawa’s cobot are built with the same motors, servos, drives and fully cast aluminum construction as its industrial robot arms. But Caldwell said Yaskawa’s customers expect full-time capability for cobot arms to cooperate with humans. To increase throughput, Yaskawa’s cobot arms can run at different speeds depending on proximity to nearby people.

### Switching between industrial and collaborative speeds

As defined by A3, safety-monitored stop cobots are designed to stop completely when a human or object enters the work area. But speed and separation type cobots

can slow down and continue operating as humans get closer.

Caldwell said when operating in “industrial mode,” robots can move up to 2 meters per second. For a cobot to run at industrial speed, it relies on additional sensors to detect that humans are not in or near its work area.

“If the robot is able to operate knowing that there is no human present, you can get an increased amount of throughput running at a higher duty cycle,” Caldwell said. “But the design is trying to really blend the needs of operating with a human in mind and operating without.”

For “collaborative” mode, a variety of speeds can be defined up to 1 meter per second for multiple collaborative zones.

Caldwell said when a robot is operating at a distance where it can expect direct interaction, speed is typically limited to 200-400 millimeters per second depending on end-of-arm tooling (EOAT) and size of product being handled. Further zones are commonly set at 400-1000 millimeters per second.

On the end of its cobot arms, Yaskawa installed an indicator light that turns green when the robot is operating in collaborative mode - meaning humans can safely approach it - and turns off when the robot operates in industrial mode.

### Minimizing footprint while maximizing workflow

One challenge [manufacturing](#) and [logistics](#) warehouses must consider is how to accommodate the footprint of robotic workcells.



Yaskawa Motoman HC30PL workcell at MODEX 2024. Photo: Donald Helsing / PEERLESS MEDIA

The goal is to limit how much floor space each robot takes up.

“In brownfield-type sites where there’s already existing work cells set up, you don’t worry about fencing in a human,” Caldwell said. “But there are only certain amounts of access points in and out of any kind of workflow.”

While complete fenceless operation is suitable for many applications, Caldwell said the most common deployment involves work cells with some amount of guarding. “That’s typically the best compromise to limit the amount of footprint that’s dedicated, but also maximize the amount of flow in and out of the cell,” he said.

For example, Yaskawa’s HC30PL depalletizing demonstration setup includes physical barriers on three sides. “That’s still considered fenceless because it doesn’t have a full interlock around it,” Caldwell added.

Limited barriers combined with fenceless zones allow for flow in and out of robotic work

cells of both products and people.

“With some amounts of guarding, you can significantly reduce the overall footprint of the cell that you’d be implementing,” Caldwell said. “That way you can have high-volume traffic or mixed-use traffic.”

Caldwell said mixed traffic scenarios can include robot arms sharing space with humans, other pieces of equipment, or racking.

### Easy-to-use pendants and programs

While some robotic systems require advanced coding knowledge to set up, Yaskawa offers user-friendly interfaces and programming [software](#) for its robot arms.

Sarah Andrzejewski, product manager at Yaskawa Motoman, said Yaskawa’s Smart Pendant is a tablet-style device with an easy-to-use touchscreen interface for industrial robot programming. Designed for shorter duration use, the smart pendant doesn’t require as much training thanks in part to built-in help and how-to guides.

“It’s really meant for people new to robotics, or they’re looking for simpler programming,” Andrzejewski said. “It’s a lot easier to use than the standard pendant.”

Yaskawa’s Smart Pendant is intended for [material handling](#), [pick-and-place](#), [palletizing](#), [machine tending](#), injection molding and inspection applications. It is compatible with the company’s YRC1000 and YRC1000micro controllers.

In addition to programs created by technology partners, Yaskawa offers its own installation packages for the Smart Pendant, including Pallet Builder.

Andrzejewski said Pallet Builder is a free, easy-to-use application for configuring palletizing cells. It’s suitable for single case palletizing with support for up to eight total stations. Through Pallet Builder, users teach robots how to arrange boxes on a pallet, showing them where to put each box to form desired stacking patterns.

Another configuration option is Pallet Solver, an offline PC-based pattern generation and cell definition software with online control-based execution and optimization. Pallet Solver allows users to configure palletizing jobs without using a pendant.

“It’s geared to make palletizing easier,” Andrzejewski said. “It’s best if you have a high mix of products with a high mix of pallet patterns.”

### Intuitive hand guided programming

One more teaching option is hand-guided programming.

While A3's definition technically states hand-guided cobots move in "automatic mode" only when steered by a human operator, Yaskawa uses that interaction to teach robot arms without direct programming.

Caldwell said while some robot arms can be manipulated by hand, users still need to program through a pendant or other interface. "We thought if you're hand guiding and trying to make things easy as you're manipulating the robot around, wouldn't it be great if all you had to do was interact with the robot arm?"

Three buttons on the flange of Yaskawa's cobots allow hand-guided programming. One is held down while moving the robot through a series of points. Another is pressed to teach the robot where a specific point is. The third button's function is customizable, but Caldwell said it is usually mapped to open and close [gripper](#) attachments.

"You can really create most of

your robot job - all of the motion and most of the activities - without interacting at all with your teach pendant," Caldwell said.

### Power and force limiting safety features

Caldwell said Yaskawa considers A3's cobot definitions when designing robots and control systems to create the safest robots possible. Power and force limiting (PFL) cobots are designed for constant human collaboration and equipped with intelligent collision sensors.

PFL is a form of functional safety that allows robots to react to external forces by stopping movement. It also includes limiting the amount of force robots use to begin with. PFL events can include unintentional contact with a human or the robot detecting that an object it tried to lift was heavier than it was supposed to be.

In a robot's functional safety unit, the amount of force a robot

would detect to trigger a PFL event can be defined. Yaskawa built in a pull-back function that follows a PFL event detection, which tells the robot to reverse a set distance so it is no longer pushing against the object it encountered.

Beyond pulling back, an "avoidance" function allows humans working alongside robots to gently push the robot out of the way if they are not ready for it to enter the area. Yaskawa enables its cobots to be programmed to enter a "time out" mode, waiting for a specified amount of time, and return to the work area at a defined speed.

"When you have a human and a robot interacting in the same space, humans are not always great at meeting the exact same cycle times," Caldwell said.

Yaskawa also includes reset buttons on robot wrists that light up if a cobot stops specifically for a PFL event.

While Yaskawa's default safety sensors are currently all touch-based, Caldwell said the logic circuitry allows for the addition of additional types, including vision sensors, area scanners, and light curtains.

Caldwell said Yaskawa will be bringing its Motoman Next AI-enabled robot platform to market over the next year. The new generation of Motoman Next models will feature integrated [cameras](#) that, although not safety-rated, allow Yaskawa's cobots to expand their environmental awareness. •



Yaskawa Motoman's Pallet Builder interface is a free, easy-to-use software for the company's Smart Pendant. Source: Yaskawa Motoman

Donald Halsing is Associate Editor of Robotics247.com.

# Schneider Electric debuts two new Lexium cobots

New cobots allow Schneider Electric to provide customers complete, customized automation offerings that simplify sourcing, commissioning

BY ROBOTICS 24/7 STAFF



*Schneider Electric released two new Lexium model cobots at MODEX 2024. Source: Schneider Electric*

**Schneider Electric** announced the release of two new Lexium cobots at MODEX 2024. The company announced the Lexium RL 3 and RL 12, as well as the Lexium RL 18 model, scheduled to come later in 2024.

From single-axis machines to high-performance multi-axis machines, the comprehensive Lexium cobot line enables high-speed motion and control of up to 130 axes from one processor for precise positioning to help solve manufacturer production, flexibility and sustainability challenges.

### Schneider Electric offerings encompass robotics suite

Schneider Electric goes beyond robots to provide fully integrated automation systems - digitally designed from concept to operation and maintenance. The company integrates robots into machine control systems through its EcoStruxure architecture, which enables collaborative data flow from shop-floor to top-floor, by connecting smart products, robots, controls, software and services.

Controlled by Modicon motion controllers, the system unifies programmable logic controller (PLC) motion and robotics control functionality on a single hardware platform and integrates into EcoStruxure Machine Expert software.

“As US manufacturing increases, the demand for smart machines is growing and customers are requiring robots with digital twin capabilities that validate machine performance to help them quickly increase production consistently, efficiently, and sustainably,” said Christine Bush, Robotics Center of Excellence leader at Schneider Electric. “We are partnering with our customers to understand their challenges and pain points, then responding with complete, customized automation solutions - from power

products and HMIs to PLCs and robotics - to simplify the process and meet their needs.”

Compatibility with EcoStruxure Machine Expert Twin, a digital twin software suite that creates digital models of real machines, allows for virtual test strategies and commissioning, as well as shortened factory acceptance testing. Digitizing these processes can reduce time-to-market by up to 50% and commissioning time by up to 60%, according to the company.

### Lexium cobot enhancements

Lexium cobots are part of a full line of robotics and automation options developed to meet manufacturer needs across industries, including [warehouse/logistics](#), life sciences, consumer packaged goods and more. According to Schneider Electric, some potential benefits of the Lexium cobot line and other motion offerings from the company include:

- **Fast deployment:** Built on open automation standards and protocols, cobots offer flexibility, scalability and third-party equipment integration. They can be applied to existing or new production lines in a variety of different industries.

- **Streamlined integration:** Enhanced computing power, open software and networking technologies facilitate quicker assembly, installation and robotic maintenance. A centralized architecture with a unified programming platform using open standards promotes interoperability among automation systems, machines and robots.
- **Consistent output:** Designed to handle repetitive tasks without errors or distractions, cobots can maintain overall equipment effectiveness (OEE) while manufacturing higher volumes of quality goods over shorter periods 24/7 without fatigue. This produces a consistent output with little variability over a given production batch.
- **Workplace health and safety:** Cobots perform well in harsh environments and can handle riskier operator tasks involving heavy weights to reduce accidents and injuries.

Amidst the rapid growth of US manufacturing, companies are increasingly seeking digital, efficient and sustainable options to meet expanding output demands. •

## Anyware Robotics unveils unloading add-on for Pixmo robots

Pixmo and new add-on will double unloading throughput up to 1,000 boxes per hour

BY ROBOTICS 24/7 STAFF



*Anyware Robotics' Pixmo robot arm with add-on feature will expand throughput capabilities.*  
Source: Anyware Robotics

**Anyware Robotics** recently announced a major add-on for its Pixmo robotic offering for truck and container unloading. The patent-pending add-on includes a vertical lift with a conveyor belt that is attached to Pixmo between the robot and the boxes to be unloaded.

The integrated Pixmo software quickly processes the various heights of the boxes in the container and then controls the conveyor of the add-on to move up and down to these positions to “meet” the robot arm as it unloads. The add-on, according to [Anyware Robotics](#), enhances unloading efficiency, weight capability and reliability at marginal additional cost.

### **Pixmo arm expands unloading throughput**

Every year an estimated 28 million containers enter the US with contents - usually boxes - that need to be unloaded. Anyware said its mobile robots autonomously unload boxes in containers and trucks more safely, cost-effectively, reliably and quickly than humans can, without the related injuries.

With the new add-on, the Pixmo robot arm no longer has to “rotate and place” to a conveyor. Now, the arm can “pull” to a conveyor, minimizing the distance the robot arm needs to travel to unload each box. Anyware said the change in motion doubles the throughput of Pixmo to up

to 1,000 boxes per hour, and the support of the conveyor increases the weight capacity of the solution to 65 pounds.

The new Pixmo robot, as well as a prototype of the new add-on, were on display at Anyware’s booth at MODEX 2024.

“We are excited to showcase our Pixmo robotic solution and the innovative patent-pending add-on for unloading at MODEX,” said Thomas Tang, CEO and co-founder of Anyware Robotics. “The versatile Pixmo can easily connect to, power, and enable add-ons for different applications. This is all part of our plan to help it deliver increasing capabilities for different warehouse applications in the future.”

### **Pixmo can fit in many logistics operations**

Pixmo robots can be used for unloading at transload facilities, cross docks, [3PL](#) providers, [distribution centers](#) and e-commerce fulfillment warehouses. The robots can be installed within days and provide enhanced operational efficiencies and predictability.

Pixmo combines an autonomous mobile robot ([AMR](#)) base, a cobot arm with six degrees of freedom, vacuum-powered end effector designed for case handling and [AI](#)-powered perception and motion planning systems. It does not require costly software integrations or infrastructure changes to be deployed into the warehouse environment.

With its mobile base that has the footprint of a warehouse pallet, the Pixmo robot can move in any direction to create the best handling pose for the robot arm, both inside and outside the container. Pixmo is built on an advanced AI software stack that combines perception algorithms, learning-based motion planning and a data generation pipeline for AI training.

The commercial version of Pixmo is scheduled to be available in the summer of 2024. It will be available via direct purchase or robotics-as-a-service ([RaaS](#)) models, enabling companies that use Pixmo to scale as their business grows. The add-on is scheduled to be available in Q3 of 2024. •

# Agility Robotics expands Amazon relationship with Digit testing

Humanoid robot to assist Amazon warehouse workers with repetitive tote tasks

BY ROBOTICS 24/7 STAFF



*Agility Robotics' Digit in an Amazon facility. Source: Business Wire*

**A** week after Amazon provided a peek at the robots it is currently testing, [Agility Robotics](#) Inc. confirmed that Amazon's research and development center near Seattle will begin testing its Digit bipedal robot.

"Digit's size and shape are well-suited for buildings that are

designed for humans, and we believe that there is a big opportunity to scale a mobile manipulator solution," explained Emily Vetterick, director of engineering at Amazon. "Collaborative robotics solutions like Digit support workplace safety and help Amazon deliver to customers faster, while creating new opportunities and



picking up and moving empty totes once inventory has been completely picked out of them.

“Amazon is a company that is committed to making the work experience of their employees safer, easier, and less repetitive,” asserted Damion Shelton, co-founder and CEO of Agility Robotics.

“When we announced our most recent version of Digit earlier this year, this is exactly the type of repetitive material handling deployment we had in mind – one that enables humans to be more human,” he said.

Warehouse automation still faces skepticism. According to research from ProGlove, 45.6% of 1,000 warehouse and logistics professionals surveyed in the U.S. and Europe see automation as necessary over the next five years. Just over a third are currently deploying the technology, but 27% are considering implementations, it said. •

career paths for our employees.”

Agility Robotics noted that the testing reflects a broadening of its relationship with the [e-commerce](#) giant, since it is already part of the Amazon Industrial Innovation Fund.

### **Agility designs digit for human spaces**

Corvallis, Ore.-based Agility Robotics claimed that Digit is “the first multi-purpose, human-centric robot that is made for work.” Its stated mission is to build robots that augment and safely collaborate with the human workforce.

The company, which has offices in Pittsburgh and Palo Alto, Calif., said it designed its humanoid robot to safely do useful work for “multi-purpose utility.” Agility has initially targeted applications including bulk material handling in warehouses and distribution centers.

“Digit can move, grasp and handle items in spaces and corners of a warehouse in novel ways,” said the company. “Its size and shape

are well-suited for buildings that are designed for humans.”

Agility added that customers in the Agility Partner Program can expect delivery of the first Digits in 2024, with general market availability in 2025.

In addition, Agility recently announced that it is opening RoboFab, a 70,000-sq.-ft. manufacturing facility in Salem, Ore. The company said it expects to be able to produce hundreds of robots in the first year and eventually scale to more than 10,000 robots per year.

Digit will also work in the new factory in a similar capacity to Agility’s customer sites - moving, loading and unloading totes.

### **Amazon to use robot for tote recycling**

Amazon said it will initially use Digit to help employees with tote recycling, a highly repetitive process of



# Another brick in the wall: Building walls with AI-powered robotic arm platforms

DexR truck loading system helped FedEx unlock the dock

BY TIM CULVERHOUSE



*The Dexterity DexR is an AI-enabled robot with two robot arms that precisely build walls in a truck. Source: Dexterity*

## “All in all, it’s just another brick in the wall.”

Pink Floyd’s classic from 1979 dives into plenty of other topics than robotics in 2024, but the underlying tie-in of bricks in a wall does spill over 45 years later.

When [FedEx](#) first partnered with California-based [Dexterity](#) to develop a mobile truck loading robot in 2021, there was room for growth, improvement and evolution. Truck unloading is a tedious, physically-demanding

and cumbersome task. Hence, the need for automation was apparent. But how do you go about automating a process with a high degree of variability?

It doesn’t happen overnight.

### Multiple revolutions and degrees

As Dexterity engineers worked with their FedEx counterparts, there was plenty of room to evolve the robot. Mainly, the robot had to reach all four corners of the truck without leaving its base.

Were multiple robot arms the trick? What about a bigger base? But what about how dock staff would interact with the robot? Many questions required many answers and time to revise the robot to meet FedEx’s demands for reach, cube utilization and throughput.

Seven revolutions later, DexR was unveiled in September 2023.

“Unlike a lot of robot manufacturers, we are not building the robots. We’re using off-the-shelf technology,” said Michael Perry,



*The DexR uses grippers to weigh and pick up the box for placement on a wall in the back of a truck.  
Source: Dexterity*

VP of marketing and development at Dexterity. “So seven generations of robots sounds like a lot of work, but that was really just a year of mixing and matching things that come off the shelf.”

During that learning process, Dexterity and FedEx staff [collaborated](#) to identify the major challenges associated with material handling at a massive scope. As the robot “evolved” into what became the DexR, it generated a learning curve for both organizations. From the Dexterity standpoint, the focus became handling variability with predictability and durability from its robot.

“We were starting to understand what exactly were some unique challenges that FedEx was facing in terms of truck loading,” said Mukesh Ranjan, VP of product at Dexterity. “The way this evolution has come about is that your truck loading for FedEx is a really hard problem.

If you think about the traffic that flows through the FedEx network of packages - the volume, the velocity, the complexity of the mix and so on - that is especially challenging.”

One of the major elements developed by Dexterity to combat these challenges is the dual arm on the DexR. At first, the robot started with a single arm and 60 degrees of freedom. Through revisions, evolutions and revolutions, DexR ultimately deployed with two robot arms on one base and 80 degrees of freedom. The resulting mobility checked off some major boxes.

“You can’t get the requisite throughput and at the same time, get the load quality with a single arm,” Ranjan said. “It’s a highly complex problem about throughput, cube score and also minimizing interventions at the same time. You’re making sure the walls that you’re creating are stable. You need as much

throughput budget as you have, and then you use that budget to optimize for other metrics. That was sort of the evolution in the product. And then we learned a lot about what kind of reach we need and do we need to build multiple walls.”

### **Brick by brick through the AI lens**

When the grippers of the robot arm receive a box at the end of the conveyor belt, it marks the end of one journey - one from the warehouse to the truck - before it starts its next one. However, when DexR picks up a box (which Dexterity calls a brick), the AI-enabled platform begins computing the optimal space where it can place the brick in a wall as it loads the truck.

“A lot of customers have different ways of measuring stability,” Ranjan said. “They have very specific conditions around how you do brick layering, like if you do brick layering there’s more even distribution of weight. Some customers prefer towering because that optimizes for cube density. A lot of these metrics need to be highly optimized when you’re building these walls inside the trailer and building the whole load. When you start with AI and [machine learning](#) in this scenario, you have to first teach the AI machine learning.”

Ranjan and the rest of the Dexterity staff did just that.

What better way to teach an AI system brick layering than by playing a game?

Tetris, anyone?

“We built a full truck loading game and allowed players to play, like our customers, our AI/ML

engineers and our operators,” Ranjan added. “That also gave us a lot of information related to learning. And then we also collected a massive amount of package data, like package characteristics, like damages of packages, types of packages and more. Eventually, all that information went into training the models that we built.”

As DexR picks up a box and gathers pertinent data, including weight, shape, package material, package condition and more, the AI software assesses billions of wall shape possibilities to pack the trailer in the optimal way. And, it does this thinking in a fraction of a second.

Thanks to the dual arm design and mobile platform, DexR is able to build multiple walls at the same time and maneuver with precision forward and backward through trailers. With each box and truck build, the robot’s machine learning gathers more information, allowing Dexterity’s platform to digest and interpret the data for future builds.

“When you think about how AI and machine learning works in this thing, there’s a lot of focus on action generation,” Ranjan said. “What are the possible sets of actions, given the number of boxes that you can foresee coming, given the state of the wall that is in front of you or state of the load that is in front of you? And then, what is the most optimal set of actions that are feasible in the constraints that you’re working with?”

“We eventually landed on reinforcement learning based



models, which allow it to be very general, in terms of different kinds of load quality,” Ranjan added. “A generalizability of that model was super important for us, because at the end of it, we don’t want to be building very specific local models, which work for one scenario and don’t work for the other scenario. You have to have generalized models where you can scale throughout the massive network of some of our customers.”

### **Out of the box (truck)**

Along with the confines of the truck for loading boxes, DexR can also be used in other scenarios at the loading dock or in the warehouse. As Ranjan described, “Think about Dex at the highest level, and think of it as an iPhone or an Android system. And then the applications are the applications that you deploy on it.”

“DexR is able to work in multiple locations,” Perry added. “So you’re not having to buy one robot system for every single door that you’re loading, and have the ability to use one piece of technology in multiple locations. Now, the way to expand that

even further is not only going to multiple locations, but multiple applications. One piece of robotic hardware that’s able to do a lot more than just the one thing that you bought it for.”

The system’s maneuverability allows customers to deploy DexR across multiple locations in the warehouse and let the robot’s motion planning come to life. The robot is equipped with several sensors and cameras to navigate safely through environments, and steer clear of obstacles and humans. The robot arms’ motion planning capabilities optimize the arm movement and trajectory as it picks and places boxes in a truck, or elsewhere.

The collaborative effort between DexR and loading dock staff has helped organizations like FedEx improve their truck loading capabilities, and Dexterity’s AI models to continue learning more about the optimal brick layering and wall design.

There’s a lot more to DexR than just “another brick in the wall.”

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*Tim Culverhouse is the Editorial Director of Robotics247.com.*

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# RAC 24

# FANUC America showcases robots for warehouse applications

## AI-guided robot arms demonstrates order picking and depalletization

BY ROBOTICS 24/7 STAFF

**W**arehouse and manufacturing robot manufacturer [FANUC America](#) recently demonstrated robots performing a variety of tasks at MODEX 2024.

FANUC said it showcased automation products equipped with AI-enabled machine vision designed to help companies future proof their supply chain.

The company demonstrated robots performing automated induction, palletization and depalletization, as well as cobot setups for [order fulfillment](#) and a vertical put wall.

### Automated handling of difficult-to-segment boxes, bagged items

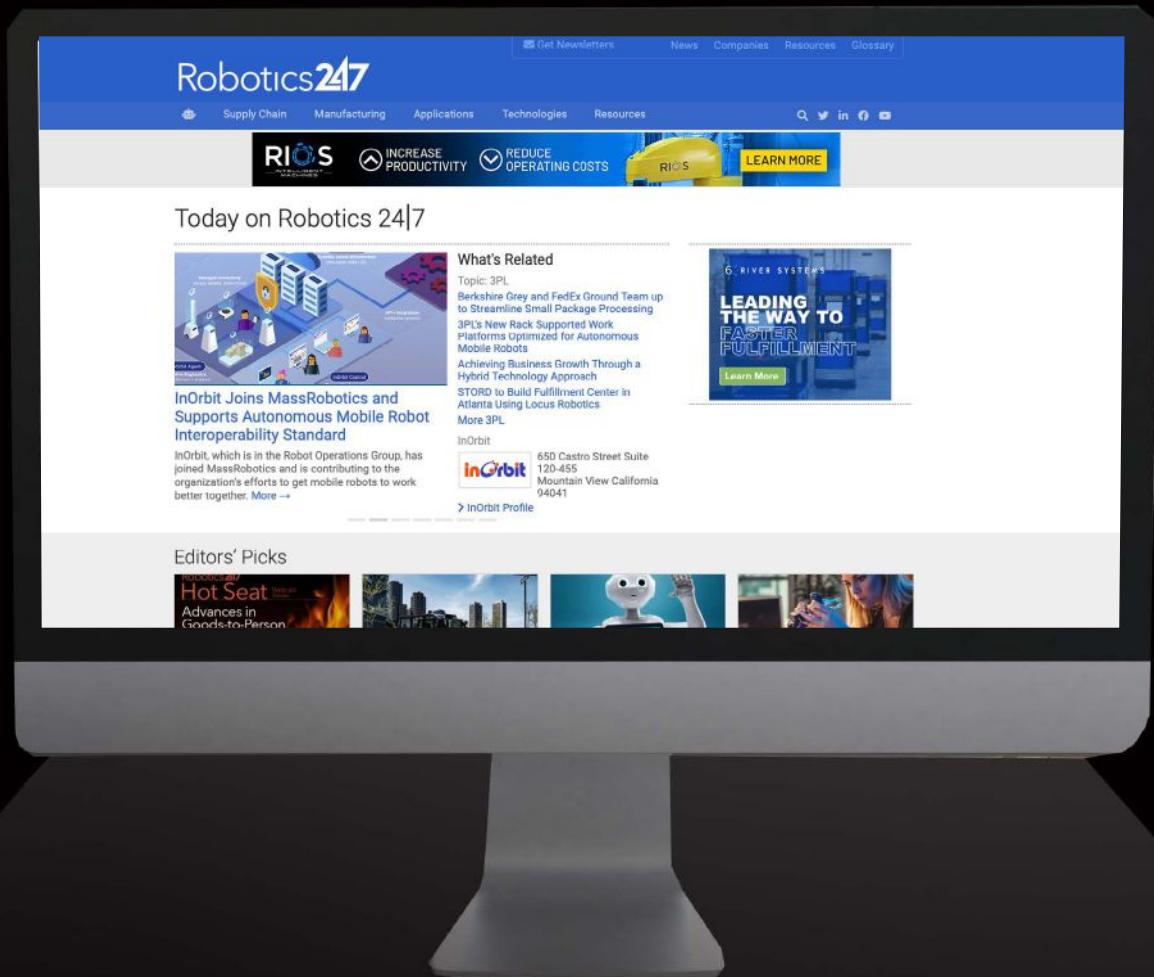
The new FANUC M-710iD/50M robot arm - combined with two iRVision 3DV/1600 vision sensors - used FANUC's iPC box-detection software to locate boxes within stock carts. The

*A FANUC CRX-20iA/L performed empty-for-full bin swapping as part of an order picking demonstration alongside two CRX-10iA robot arms and a Locus Robotics AMR at MODEX 2024. Source: FANUC*



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FANUC's new M-710iD/50M demonstrated palletizing and depalletizing of difficult-to-segment boxes using two iRVision 3DV/1600 sensors and iPC AI-powered software. Source: FANUC

robot depalletized boxes from one cart, then palletized them on an opposite cart.

FANUC said its AI-driven iPC enables picking in challenging lighting conditions and for boxes with patterns that are difficult to segment and determine edge locations. The M-710iD/50M's curved arm can reach into tall stock carts.

Additionally, a FANUC LR-10iA/10 robot arm demonstrated induction of bagged clothing items. The robot was guided by an iRVision 3DV/400 vision sensor mounted over a work cell, picking various

bagged clothing items from a tote and dropping them onto a conveyor belt.

#### **Integrated order fulfillment with Locus AMRs**

FANUC also showcased an automated order fulfillment system with CRX cobot arms and a [Locus Robotics](#) AMR. FANUC's robot arms used in the demonstration were equipped with iRVision machine vision sensors to scan QR codes as well as locate items and bins in their work areas.

CRX-10iA robot arms picked and placed items between shelves

and bins. The shelf-to-bin robot's 3DV/200 vision sensor was arm mounted, while the bin-to-shelf robot's 3DV/600 vision sensor was fixed. The company also offered an opportunity for visitors to program its CRX-10iA.

A CRX-20iA/L robot arm - also equipped with a 3DV/200 sensor - moved bins between tables and a Locus AMR, replacing full bins with empty ones. The AMR communicated with the CRX once it is in the correct position, and the CRX informed the AMR when it finished swapping bins.

FANUC said its CRX-20iA/L features a wide motion range, and can pick items or bins of varying shapes and sizes up to 20kg. The company said its order fulfillment setup can be scaled up or down for different operations.

#### **Vertical put wall combining motion control and robot arm**

FANUC also demonstrated a vertical put wall using its Power Motion i Model A Plus (PMi-AP) motion control system in conjunction with a CRX-10iA.

The PMi-AP controlled the put wall system, moving bins from the wall to a conveyor belt. Bins were then be conveyed to an access point for the CRX-10iA, which will picked and placed items between storage wall bins and order fulfillment ones.

FANUC said its PMi-A offers CNC-style motion control for automated assembly and other applications. The general-purpose motion control system is integrated through an ethernet connection, enabling communication between robots. •

# Mecalux launches robotic picking system with Siemens AI technology

Mecalux designed its new picking robot in Barcelona to enhance order fulfillment in warehouses and logistics centers

BY ROBOTICS 24/7 STAFF



*A Mecalux autonomous robot autonomously picks apparel in Spain. Source: Mecalux*

**Mecalux SA** recently announced a robotic picking system incorporating [Siemens'](#) SIMATIC Robot Pick AI vision software. It uses deep learning algorithms to streamline picking in warehouses, according to the Madrid-based company.

The new system integrates AI into the SIMATIC S7-1500 PLC to enable the collaborative robot to autonomously and accurately pick orders, Mecalux said.

“The technology partnership with Siemens has allowed us to join forces to create a highly flexible, safe, and user-friendly robotic solution that adapts to the specific needs of our clients,” said Javier Carrillo, CEO of Mecalux.

Mecalux is the parent company of Chicago-based Interlake Mecalux Inc., which claims to be a leading provider of metal storage and gravity-flow racks,

automation for moving pallets and boxes and warehouse management systems ([WMS](#)). The company was recognized in the 2023 *Gartner Magic Quadrant for WMSes*.

## **Mecalux provides precise picking**

Mecalux said the new picking robot is the result of its long-standing collaboration with Siemens to implement industrial automation to address logistics



Siemens SIMATIC S7-1500. Source: Mecalux

industry challenges. It developed the system at its technology center in Barcelona.

The system can operate 24/7 and execute up to 1,000 picks per hour, Mecalux said. The company has launched two robots - a cobot programmed to safely share workspace with operators and a system that works autonomously in high-performance pick stations.

A camera above the cobot's picking box captures a 3D image of the goods to prepare the orders.

Once the item has been selected, Mecalux said the cobot deposits it in the picking box with high precision, making the most of the available space. Mecalux has devised an algorithm to ensure that the cobot places the goods in the correct location.

Because cobots can handle a wide range of items, the technology is suitable for businesses from

all sectors looking to optimize order processing, Mecalux said.

### Siemens offers 'out-of-the-box' vision performance

Guided by Mecalux's Easy WMS software, the collaborative picking system can automatically change its grip depending on the type of merchandise to be handled, according to the company. Upon receiving a new box, Siemens' vision system and AI identify the items inside and determine the most appropriate way to pick each product.

Siemens said its S7-1500 PLC range is the most powerful hardware that it currently offers. With the TM-MFP (Technology Module-Multi-functional Platform), it is capable of executing the necessary algorithms. This is achieved while respecting cybersecurity standards and employing the SCALANCE X family of intelligent switches, Siemens said.

"The AI algorithm has been pre-trained with millions of items to offer out-of-the-box performance," explained José Ramón Castro, CEO of Siemens Digital Industries in Spain. "It's able to make decisions in milliseconds on robust, collision-free picking positions for products presented completely arbitrarily."

"One of the key aspects of this solution is that it doesn't need to know the 3D model of the item in question beforehand," he added. "The advanced artificial intelligence algorithm acts as the brain, enabling the smart picking process."

The companies concluded: "With the launch of this innovative collaborative picking system, Mecalux and Siemens reaffirm their commitment to delivering cutting-edge technological solutions that improve operational efficiency for their clients." •



# Roboteon demonstrates vendor-agnostic integration platform

Software to enable fulfillment orchestration in heterogeneous environments

BY ROBOTICS 24/7 STAFF



*At its San Jose, Calif. Innovation Lab, Roboteon develops its vendor-agnostic robotic integration software and showcases its capabilities to prospective customers. Source: Roboteon*

**R**obotic integration software provider Roboteon recently announced the debut of its vendor-agnostic Robotics Fulfillment Platform at MODEX 2024.

After more than a year of product development, Roboteon demonstrated its software overseeing multiple robots from different vendors at the conference. The San Jose, Calif.-based company was founded in 2022 by Gana Govind, who also serves as CEO.

## Cloud-based software permits interoperability

Roboteon's Robotics Fulfillment Platform is a cloud-based, end-to-end software system that enables testing and deployment of robots and automation systems at distribution centers.

The vendor-agnostic integration software enables interoperability across robots from different vendors, even after initial deployment. Roboteon said its software can extend from core integration and workflow enablement to fulfillment orchestration across multiple processes and systems in heterogeneous environments.

The Robotics Fulfillment Platform leverages AI to optimize task flow and fulfillment execution. It also enables people, robots and other automation to work together by synchronizing tasks between humans and robots.

In addition to its software platform capabilities, Roboteon said it brings domain knowledge, especially for integrating robots and WMSes as well as deploying robots into traditional automation environments. •

# DAC Robotics selects OSARO mixed-case robotic depal for new integrated warehouse replenishment system

OSARO fulfills front-end role for DAC Robotics' fully automated inventory replenishment system

BY ROBOTICS 24/7 STAFF



*The DAC Robotics system combines the OSARO Robotic Depalletization System with DAC's latest automatic box opening ABOT and its automated decant robot. Source: DAC Robotics*

**DAC Robotics** teamed with [OSARO](#), a machine-learning-enabled robotics for e-commerce company, to launch a warehouse replenishment system that debuted at MODEX 2024

in Atlanta. The DAC Robotics system combines the OSARO Robotic Depalletization System with DAC's latest automatic box opening ABOT and its automated decant robot.

With the system, fulfillment operators and 3PLs can now deploy an integrated and fully automated system capable of performing three tasks: depalletizing, box opening and decanting.

### **Integration with DAC, OSARO**

“Today’s technology announcement is the culmination of more than three years of development, engineering and testing to integrate all automated work cells in the receiving and decanting process for warehouse intralogistics automation,” said Mark Ganninger, president of DAC Robotics. “With OSARO’s SightWorks Perception Software, we were able to design and deploy a system that met our exacting specifications.”

While many other tasks downstream from the loading dock have been automated, the hazardous manual tasks of unstacking, sorting, scanning, opening and decanting master pack box contents into standard totes are often still performed by humans. To automate the entire process, DAC Robotics looked for a depalletizing

system capable of unloading a wide variety of box sizes and shapes from a pallet and then handing off each box to an automated box-opening robot in preparation for decant.

The OSARO Robotic Depalletization System is equipped with OSARO SightWorks Perception software, which enables the robot to recognize, select and successfully grasp the varied sizes and materials of unevenly stacked packages commonly found on mixed-case pallets that arrive at a loading dock. The system can depalletize mixed-case pallets at rates that provide cost-effective automation of replenishment and reverse logistics.

“In today’s busy e-commerce and fulfillment warehouses, thousands of different SKUs arrive on mixed or homogenous pallet loads every day,” said OSARO CEO Derik Pridmore. “The variance and multiplicity of pallet stacks, mixed pallet stacks, box construction and box conditions can easily exceed millions of possibilities. OSARO’s robotic depal system is the perfect teammate for

DAC’s robotic box opener and decant system because it can maintain a high rate of inbound merchandise, 24/7.”

### **The fully integrated system includes:**

- **A DAC Robotics mixed-case depalletizing system**, powered by OSARO SightWorks Perception. The system can rapidly depalletize the most technically challenging mixed-case pallets.
- **A DAC Robotics ABOT** which features box metrology and dimensional capture to ensure precision opening of a wide range of box sizes and types prior to decant.
- **A DAC Robotics precision decanting system.** DAC offers fully automated precision handling of the most delicate glassware and foil packs to semi-automated designs that allow for necessary operator re-pack and consolidation functions, or additional process work to optimize and utilize the highest percentage of a re-packed tote’s capacity. •

# ATI Industrial Automation introduces MC-50 Manual Tool Changer for robots

ATI said its latest tool changer supports both collaborative and light industrial robots

BY ROBOTICS 24/7 STAFF

## ATI Industrial Automation Inc.

recently announced its MC-50 Manual Tool Changer, which it claims “provides unmatched performance, reliability and quality for the manual exchange of robotic tooling.”

The patent-pending MC-50 has an intuitive design and ergonomic lever operation to enable fast changes of robotic end-of-arm tooling (EOAT) by hand, the company said. It also includes a safety latch button on the lever to provide secondary locking for increased safety and prevention of involuntary uncoupling, ATI noted.

## MC-50 designed for compatibility, endurance

The compact Manual Tool Changer is intended to be robust and supports application payloads up to 25 kg (55.1 lb.) on collaborative robots, the Apex, N.C.-based company added. The MC-50 can also support payloads up to 10 kg (22 lb.) on small industrial robot arms.

The MC-50 features an ISO 50 mm (1.9 in.) mounting interface on the master side and tool side, and it mounts directly to most cobots. ATI said its low-profile Manual Tool Changer “seamlessly integrates with many common cobot marketplace grippers and end effectors.”



*The MC-50 Manual Tool Changer is designed for robust, easy manual changes of robot grippers. Source: ATI Industrial Automation*

In addition, the MC-50 supports a variety of electrical and pneumatic utilities for downstream EOAT through four M5-integrated pneumatic pass-through ports and a mounting flat for optional ATI Utility Modules.

ATI said it is offering the new Manual Tool Changer to industry segments including electronics, aerospace, automotive and general industry. The company won a FANUC America Corp. “Innovative System of the Year Award” in 2023 for how its tool changers and robots helped Transocean automate drilling riser connections on oil rigs to improve worker safety. •

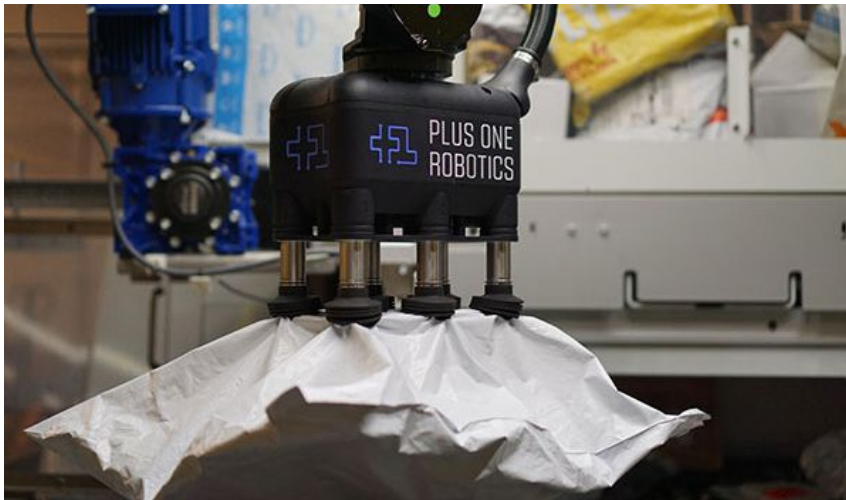


*The MC-50 is designed for safe, diverse use cases. Source: ATI Industrial Automation*

# How supervised autonomy keeps robot arms moving

Erik Nieves, CEO of Plus One Robotics, explains how purpose-built AI and human-in-the-loop teleoperation shortens cycle times

BY DONALD HALSING



*Even with the best technology, such as its latest individual suction cup control gripper, Plus One Robotics keeps a human in the loop to solve problems when robot arms get confused. Source: Plus One Robotics*

**W**hen people think of cobots, they usually picture people and robots working side by side in a shared space. But collaborative robotics also includes the fields of supervised autonomy and teleoperation.

Plus One Robotics creates machine vision and AI computing systems for parcel picking applications. In addition to its AI platform PickOne, the company provides its customers with a remote supervision service called

Yonder.

Plus One describes Yonder as a human-in-the-loop automation software suite for robotic applications. Through its Yonder RaaS offering, Plus One's crew chiefs serve as remote supervisors who can step in 24/7 when automated systems need human assistance.

Erik Nieves, CEO of Plus One Robotics, recently discussed the nuances of remote monitoring for autonomous robot arms with Robotics 24/7. Nieves explained what degree of freedom Plus One

gives to its AI control systems, as well as the types of situations that warrant human-in-the-loop intervention.

## A human in the loop to help confused robots

Plus One Robotics recently celebrated one billion picks performed by its machine vision systems. Yet even with a billion picks worth of data to feed into its AI models, Nieves said "We're still the ones telling you AI is still going to disappoint you on occasion.

"We built the company on the premise that the AI - as good as it ever was going to be - would not be good enough," Nieves said. "And so you needed to have a human in the loop."

Plus One's AI software, PickOne, runs on edge iPCs, allowing the robot arms to perform the vast majority of their picks autonomously. When the autonomous system does not reach a confidence threshold, it invokes Yonder to request human operator intervention. A crew chief will see what the robot sees and tell it which parcel to pick next.

"When a robot stops, seldom is it broken. Most of the time, it's just confused," Nieves said.

Nieves said there are two ways to improve efficiency and allow one crew chief to remotely monitor more robots. One way is to reduce the duration of each intervention. Interventions by Yonder crew chiefs usually take about six seconds. "They're not going to get much shorter than they are now," he added.

The other way to improve



*Through a combination of supervised autonomy and adaptable AI purpose-built for parcel picking, Plus One enables robot arms to handle variable package types. Source: Plus One Robotics*

efficiency is to reduce the number of intervention requests from the robots. With each intervention, Plus One collects data. “The most high-value pieces of data any system can have are the edge cases,” Nieves said.

Plus One then curates those human interventions, and adds data tags and attributes to help its AI model learn. When they release their next model, the AI might have learned how to process types of packages it hadn’t encountered before. As a result, the robots will be less likely to request intervention when they encounter those types of packages again.

### **Robots shouldn’t solve every problem on their own**

With intervention rates coming down and the number of robots overseen by each crew chief going up, warehouses could be on a path toward complete autonomy. While Plus One has deployed its systems globally to solve real-world warehouse problems,

Nieves said achieving a “dark warehouse” without a human in the loop is not sustainable.

Suppose a warehouse trained their AI vision system until it learned every SKU in the building, then started running entirely autonomously.

“This is going to work for about two days,” Nieves said. “And then there’s going to be some new package that you have to deal with, or there’s going to be the same SKU - the same item - but now it’s wrapped in different promotional packaging.”

Nieves explained the rate of change in a warehouse never reaches zero, which means an AI model is not likely to achieve full compliance. “Variability is the rule in the warehouse. Therefore, thou shalt have a human in the loop.”

Variability is not the only reason Plus One doesn’t feed every intervention back into its AI model. In fact, they cull their data so the AI doesn’t learn how to do things it shouldn’t.

“We do not want the AI to learn from every one of these interventions,” Nieves said. “When you get into real life, there are instances of errors in the world that you would not want the robot to learn from.”

For example, if a box opens up and spills its contents across the workcell, the robot might decide to pick up each individual item and put them onto the output conveyor. But if the downstream sortation equipment is designed for shippable parcels - not individual items - the mispicked items will cause problems.

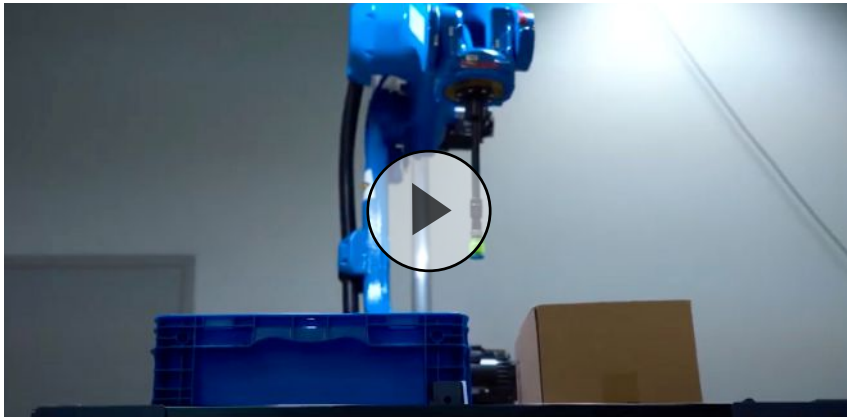
Nieves said Plus One’s service model is to use people in the workflow where it makes sense. “That’s why the company is called Plus One - because you add a human being to make the system more robust. The uptime, reliability, all of that goes up because you put smart people in charge.”

### **Adaptable, purpose-built AI for parcel picking to drive cycle time**

Plus One Robotics provides machine vision systems exclusively for picking and depalletizing packaged shippables, not individual eaches. Nieves said Plus One’s systems are used by major parcel couriers, including UPS, FedEx and DHL.

Plus One’s customers want faster cycle times for their applications. “In an each picking situation, you might do seven orders a minute,” Nieves said. “We have to live at 25 plus cycles per minute. So the robot never stops moving, which means the vision processing has to happen at that cadence.”

Rather than develop a gen-



eralized AI model to accomplish tasks, Nieves said Plus One has created a purpose-built, “adaptable” AI specifically for parcel picking. “A generalized model has to learn a bunch of stuff it may never use. An adaptable model learns what it needs.”

To achieve faster cycle times, each PickOne iPC runs off one GPU, allowing the system to process images faster than generalized AI. “We deal on the order of 10s of milliseconds,” Nieves said. “I don’t have to have a constellation of computational power.”

But it takes more than Goldilocks-sized computing to speed up pick cycles. Plus One exclusively deploys camera-off-robot hardware placement for image acquisition.

After the robot arm picks a piece and moves out of the picking area, the camera captures the next image so the software can start analyzing it. “By the time the robot comes back, it already knows the next pick to take.”

Nieves said that while some applications may benefit from a camera-on-hand arrangement, the machine vision system is not imaging while the arm is in motion, which serializes cycle time delays.

### **Placement verification can keep downstream processes flowing**

Plus One’s machine vision systems are hardware vendor agnostic. After examining the picking area image, PickOne can deliver a six-degree-of-freedom pose to motion control platforms through a register, position variable, or fetchable array.

But PickOne doesn’t just take an image and send a command. Using a second camera over the placement area, PickOne validates that the robot arm placed the parcel in the correct position and orientation, a process called placement verification.

One reason PickOne checks placement and orientation is to prevent disruptions to downstream processes. Nieves said parcels need to be loaded at an angle on crossbelts that feed into high-speed sorting loops for the packages to merge correctly.

Another reason is to check for double inducts, or when the robot arm accidentally picks up two parcels at the same time. For some applications - such as depalletization - robot arms can increase throughput by picking multiple items simultaneously. However, singulation requires picking one piece at a time.

When a robot arm singulates packages, one objective is to orient labels so that scanners in sortation systems can identify packages. If a package is placed in an orientation with its label concealed and it enters a sorting loop alongside another parcel, the stray package could be missorted with the other package.

Plus One offers an individual suction cup control gripper that can match the shape of the target parcel and avoid accidentally grasping adjacent parcels. But even with the best AI, machine vision, and gripper hardware, double inducts cannot be completely eliminated.

While human-in-the-loop robotics is about setting limits on which problems robots should not attempt to solve on their own, Plus One has devised double induct solutions that robot arms can execute autonomously. One option is for the robot arm to “recover” one of the parcels, hold it while the other parcel clears the placement area, and then set it back down.

For parcel carriers such as DHL, Plus One developed an offering that keeps a human in the loop, but not through teleoperation. When the system sees a double induct, rather than attempt to solve the problem itself, PickOne instructs the conveyor to run backwards into a reject bin. Nieves said the robot can continue picking without impacting cycle time while an employee handles the double induct manually. •

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*Donald Halsing is Associate Editor of Robotics247.com.*

# Kawasaki Robotics partners with Olis Robotics to offer remote monitoring, control of its industrial robots

## Companies hosted interactive display at MODEX

BY ROBOTICS 24/7 STAFF

**Olis Robotics**, a Seattle-based remote error recovery for industrial robotics company, recently announced a new partnership with Michigan-based Kawasaki Robotics, a supplier of industrial robots and automation system. The partnership will offer customers the ability to restart production faster, reduce troubleshooting and downtime costs by up to 90%, and gain access to expert support quickly.

The companies showcased their partnership at Kawasaki's booth during MODEX 2024 in Atlanta. Louisville, Ky.-based CRG Automation, an integration house, also joined the companies during the show. The trio of companies demonstrated a robotic corner board system - integrated with a mixed palletizing and depalletizing cell - featuring a Kawasaki RS007L robot that automates placing corner boards on pallets being wrapped, ensuring overall load stability.

### Human safety on the mind while operating robots

Olis users connect directly to their robots through an on-premises device via a secure connection, avoiding the risks and complexities associated

with cloud-based systems. To ensure physical safety, Olis is designed to always obey the robot controller's safety restrictions.

"We're seeing a growing demand for remote robot monitoring and recovery capabilities; adding Olis to our industrial robots is a game changer for the market," says Paul Marcovecchio, director of the GI Business unit at Kawasaki Robotics.

The system - which handles multiple SKUs of unstructured products - is equipped with Olis Robotics' remote error recovery software that lets users experience how the system alerts them when the robot unexpectedly stops, and when picking or placing a part fails. After a system failure, the users can utilize Olis to run a tool inspection routine and perform remote error recovery, allowing the robot to resume its cycle and get back to work.

"We're incredibly excited to start working with Kawasaki integrators to deploy and retro-fit Olis units with Kawasaki robot



*Olis Robotics and Kawasaki Robotics announced a partnership to enable Olis's software to work on Kawasaki robot arms. Source: Kawasaki Robotics*

arms," said Fredrik Ryden, CEO at Olis Robotics. "Kawasaki's commitment to a world-class buying experience and quick ROI in a wide range of applications is a perfect match for Olis."

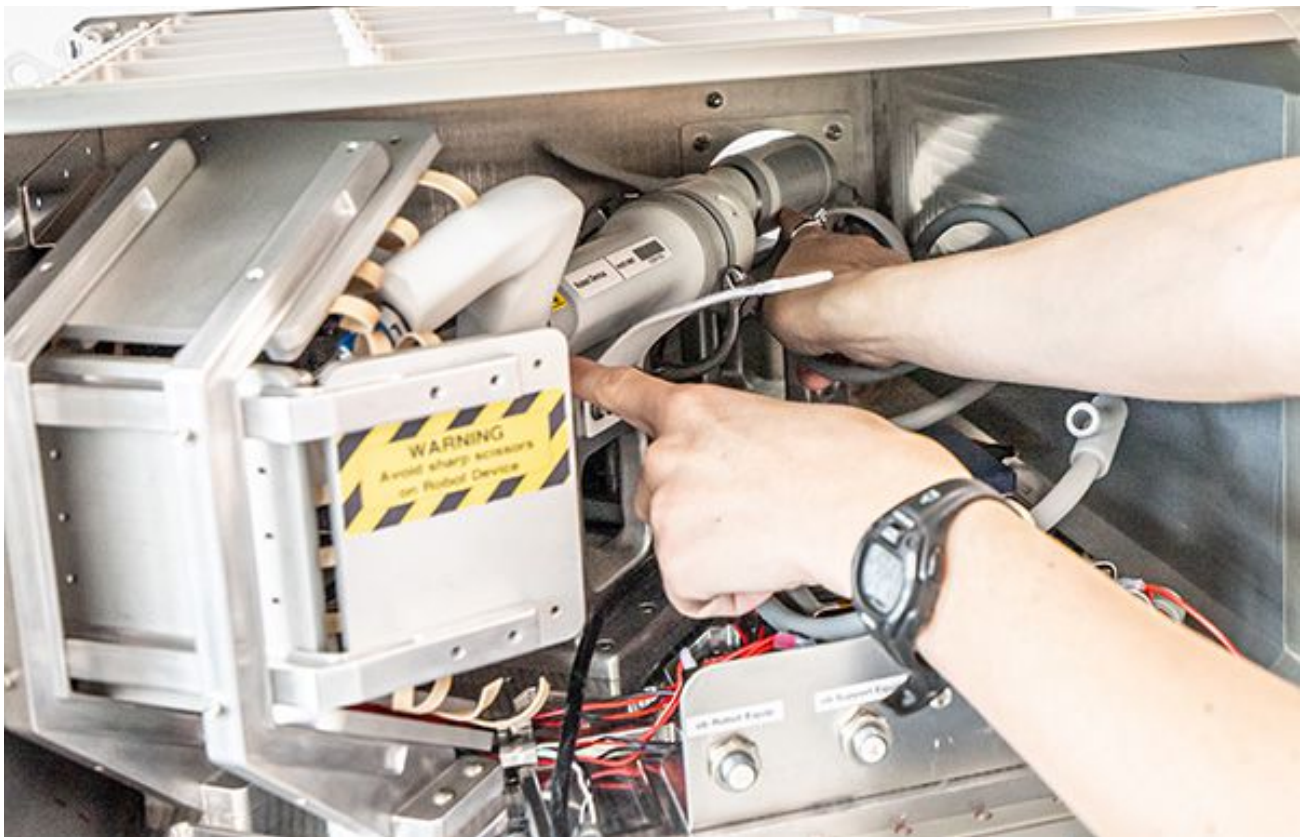
Ryden also highlighted Kawasaki's robotic durability, giving end users maximum control of a highly customizable product. Another key element of the partnership Ryden noted was Kawasaki's extensive integrator network. According to Olis, the company provides integrators time-saving bandwidth through the remote support capabilities, enabling them to grow up to 25% faster.

The Olis remote monitoring and error recovery offering will be available for any Kawasaki robot model in Q2 of 2024. •

## Virtual Incision's spaceMIRA surgical robot tests long-range remote capability on ISS

The spaceMIRA becomes the first surgical robot on the International Space Station through partnership with the University of Nebraska and NASA

BY ROBOTICS 24/7 STAFF



*The spaceMIRA from Virtual Incision was tested on the International Space Station to demonstrate the remote-control capabilities of the surgical robot. Source: Virtual Incision*

**Virtual Incision**, the developer of the mini robotic-assisted surgical device (MIRA), announced that spaceMIRA was tested on the International Space Station. The device was aboard a Northrop Grumman Cygnus cargo spacecraft carried by a SpaceX Falcon 9 rocket.

The 2024 technology demonstration mission is driven by a grant awarded from NASA to the University of Nebraska through the Established Program to Competitive Research (EPSCoR).

### **Remote-controlled surgical devices on Earth**

Testing with spaceMIRA on the ISS assessed the impact of zero gravity when performing simulated surgical tasks. During a portion of the experiment, a surgeon operator at Virtual Incision's headquarters in Lincoln, Neb. utilized remote-controlled technology to direct the movements of the robot.

Learnings about remote surgery could potentially impact healthcare in space and across the globe. In the U.S. alone, one-third of counties do not currently have access to a local surgeon, and the shortage of surgeons could rise to more than 30,000 within the next 10 years. Remote surgery could serve as an option for these patients by enabling procedures to be performed from a distant location.

"When we started this work at the University of Nebraska, we shared a collective vision that miniRAS could make robotic-assisted surgery available to any patient, anytime, anywhere," said Shane Farritor, Ph.D., co-founder and chief technology officer at Virtual Incision and professor

of mechanical engineering at the University of Nebraska. "Exploring the use of miniRAS in extreme environments helps our teams understand how we can remove barriers for patients."

The ideal device for these applications would be controlled by a surgeon through a console, enabling them to direct the movements of a camera and instruments inside the patient's body. This type of technology, called robotic-assisted surgery (RAS), has been available for decades.

While some exploratory work in remote surgery has been conducted, it is still typically performed with the surgeon in the same operating room as the patient. Although there are many complexities associated with remote operations, miniaturization of RAS could be a breakthrough by dramatically simplifying workflows at the site where the patient is located.

### **Development of spaceMIRA on ISS and in operating rooms**

MIRA, the first miniaturized robotic-assisted surgery (miniRAS) device in develop-

ment, is roughly 1,000 times lighter than existing technologies. As the only small form factor RAS device, Virtual Incision has the potential to make remote surgery more feasible by enabling transportation, storage and setup time at faster rates. The University of Nebraska researchers leveraged MIRA's unique design to create an iteration that enables pre-programmed as well as long-distance remote surgery operation modes.

"As thrilling as it is to have our technology in space, we expect the impact of this research will be most notable on Earth," said John Murphy, president and CEO of Virtual Incision. "The introduction of miniRAS has the potential to revolutionize healthcare by making every operating room robot ready. We are taking a significant step by developing MIRA, an investigational device currently under review by the FDA. The testing with spaceMIRA will tell us more about the future potential of miniRAS as it might be applied to remote surgery applications." •

# Skyline Robotics, Principle Cleaning Services to bring window cleaning robots to London

Partners plan to deliver a range of services to measure building facade health

BY ROBOTICS 24/7 STAFF



*Skyline Robotics uses robots and teleoperation to automate skyscraper window cleaning. Source: Skyline Robotics*

**Skyline Robotics** announced that it has partnered with Principle Cleaning Services to bring its award-winning Ozmo cleaning robot to London. The companies said they plan to go beyond cleaning to provide data, insights and analytics on the health of

building facades.

Skyline said that it and Principle’s ultimate goal is to deliver environmental, social and governance (ESG) monitoring to building envelopes in London.

“Having demonstrated Ozmo’s value in New York City, we’re



excited to expand operations and partner with Principle to bring our robots to London,” said Michael Brown, CEO of Skyline Robotics. “London has more BMUs [building maintenance units] than the rest of Europe combined, making it a key global geographic location to showcase the impact automation can have to help achieve business growth.”

### **Skyline Robotics automates work at heights**

New York-based Skyline Robotics said its flagship product, Ozmo, combines AI, machine learning and computer vision with advanced robotics and sensors. It said the robot can clean windows up to three times faster than humans without putting workers at risk.

The company claimed that Ozmo is “the world’s first high-rise window cleaning robot ... disrupting the \$40B window cleaning industry as a safer, more

efficient, and more effective alternative to humans.” It added that it hopes to automate all types of work at heights.

In addition, since people are still needed to operate Ozmo, the robot is not replacing window cleaners but accelerating a future in which humans and robots work together, said Skyline. The startup obtained its first patent for Ozmo in May 2023 and raised \$3.35 million in funding in August of the same year.

Skyline received a 2023 Prop-Tech Breakthrough Award for “Construction Robotics Solution of the Year” and was named to the 2023 BuiltWorlds *Robotics 50 List*. The startup also received a 2023 RBR50 Robotics Innovation Award.

### **Principle Cleaning Services**

Founded in 1989, Principle Cleaning Services said it is a market leader in providing corporate, commercial cleaning in London.

Its clients include well-known landmarks such as The Shard, 20 Fenchurch Street, and 30 St Mary Axe, and it provides indoor and outdoor cleaning robots.

The employee-owned company said it has an annual turnover of more than £80 million (\$97.3 million U.S.) and employs over 2,500 people. Principle will be the exclusive provider of Ozmo in London. It said it is planning an operational rollout for that market, “transforming Principle’s window cleaning offering.”

“Principle is committed to investing in a future where humans and robots work collaboratively together,” said Tom Lloyd, CEO of Principle Cleaning Services. “Through this partnership with Skyline Robotics, we’re securing all future capabilities to service customers for decades to come.”

The global market for window-cleaning robots could expand from \$85.17 million in 2022 to \$264.18 million by 2030 at a compound annual growth rate (CAGR) of 15.2%, according to Contrive Datum Insights Pvt. Ltd. The research firm said that North America had the largest market share, but demand is growing worldwide.

“Our clients always expect us to deliver new value and innovations to them as leading asset managers in our market,” Lloyd added. “Our pillars are ‘people, sustainability, and innovation,’ and with Ozmo, we feel we’re not just meeting, but [also] exceeding expectations.” •