WAREHOUSE AUTOMATION

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WAREHOUSE AUTOMATION

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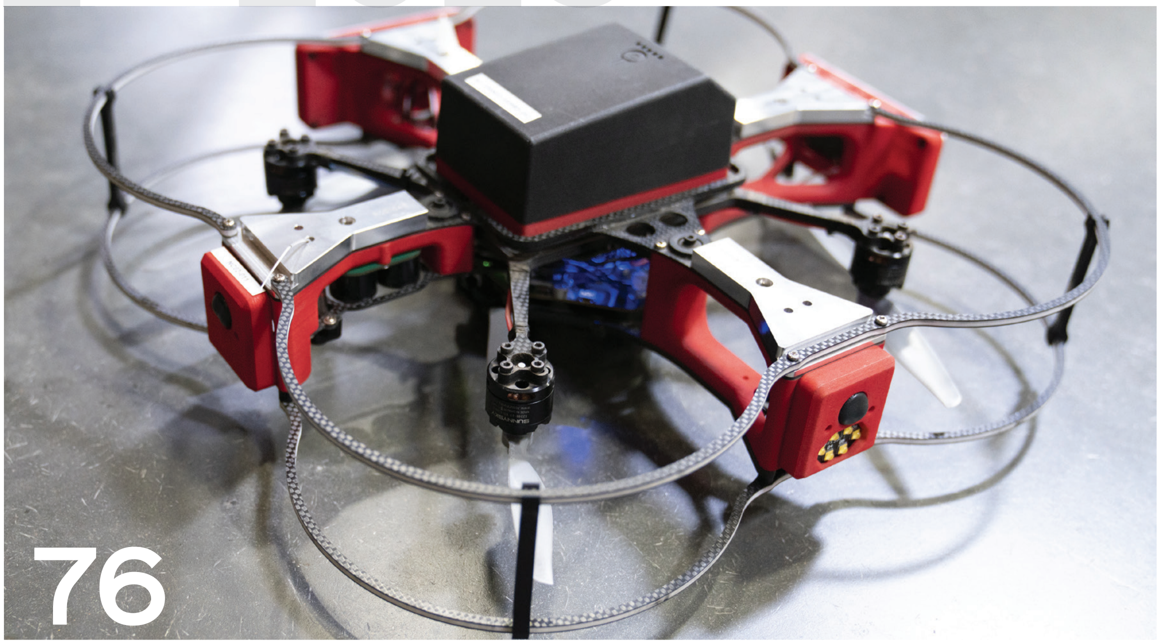

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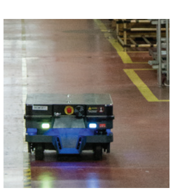
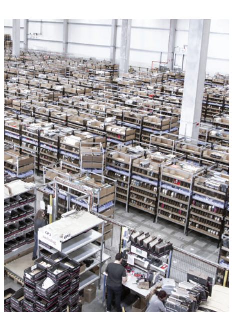




CarryPick is a modular storage and order picking system that can be designed for any space and moved or modified easily.

| *Courtesy of Swisslog*

From trend to trade: how automation evolves out of necessity

By Rachael Pasini • Senior Editor

What was unthinkable in the past has become commonplace in modern warehouses. Robots and scalable automation are now must-haves for thriving during market fluctuations.

Warehouse automation has been around a lot longer in the U.S. than people may assume. Though today we think of autonomous robots and software-driven machines operating continuously in human-free environments, automation looked different (and meant something different) in past decades. Its modern-day roots grew during the Technological Revolution, also known as the Second Industrial Revolution, which ushered in the 20th century. The birth of mass production called for new technologies and systems to make manufacturing and distribution scalable and more efficient. However, space and labor were key factors that kept the U.S. in manual mode much longer than other countries.

"Warehouse automation in Europe and Japan was probably 10 years ahead of the U.S. in terms of pick up because labor was more expensive in those countries and space was more restricted. Here in the U.S., companies had a lot of land and affordable labor," said Markus Schmidt, president of Swisslog Americas, a global warehouse automation provider. "But that equation has, of course, turned over the years."

COVID certainly changed the nature of warehouse operations since market demand shifted rapidly and e-commerce skyrocketed. Plus, after COVID, getting people to work in distribution centers was hard, so there was a drastic labor shortage amidst increasing consumer demand.

Before COVID, warehouse automation focused on conveyance and sortation for goods-to-person applications. Over the past five years, especially during COVID, interest in autonomous mobile robots (AMRs) increased to reduce labor dependencies, increase efficiency, and afford rapid scaling in the event of sudden market changes.

Take online grocery shopping, for instance. The dawn of mobile apps and real-time information exchange made it easy for consumers to order groceries online and have them delivered or ready for pickup at the store. While demand was manageable, personal shoppers walked the aisles and pulled items from shelves to fulfill individual orders. However, during the pandemic, online grocery sales increased suddenly, and safety protocols restrained manual fulfillment.

In response, new technology and small distribution centers emerged and picked grocery items efficiently and accurately with less labor. Such automation was unthinkable years ago because there was no need for it. Now, most advanced distribution centers have goods-to-person robotic solutions for item storage and picking.

"There are a lot of new companies with innovation entering the space, and there are a lot of established players. The industry overall grows about 20% year over year," said Schmidt.

Balancing storage and throughput

Back in the day, when labor was plentiful, the buzzword wasn't "automation" — it was "throughput." In the early 20th century, transportation advancements made it possible to deliver goods faster to a broader customer base. The focus was on making more products quicker and getting them into customers' hands.

But mass production came to a screeching halt during the Great Depression, which some claim was partially due to the overproduction of goods. As the economy started looking up, the Digital Revolution, or the Third Industrial Revolution, spawned around 1947 and paved the way for computers, advanced networking technology, and eventually automated storage and retrieval systems (AS/RS).

Yet as markets fluctuated, warehouses still felt the pangs of storing too much inventory that didn't move. So, throughput became a balancing act, and companies started valuing efficiency, flexibility, and scalability — both up and down.

Until recently, if a warehouse needed more throughput, it would add more storage capacity and labor. In today's automated systems, throughput and storage aren't strictly proportional.

For example, Swisslog's CarryPick storage and order picking system includes robots that carry mobile racks of goods, and warehouses can scale robots and racks independently.

"You can add more robots to get more throughput. Or you can add more racks to get more inventory," said Schmidt. "That flexibility is especially valuable for online businesses and all warehouses during peak retail seasons."

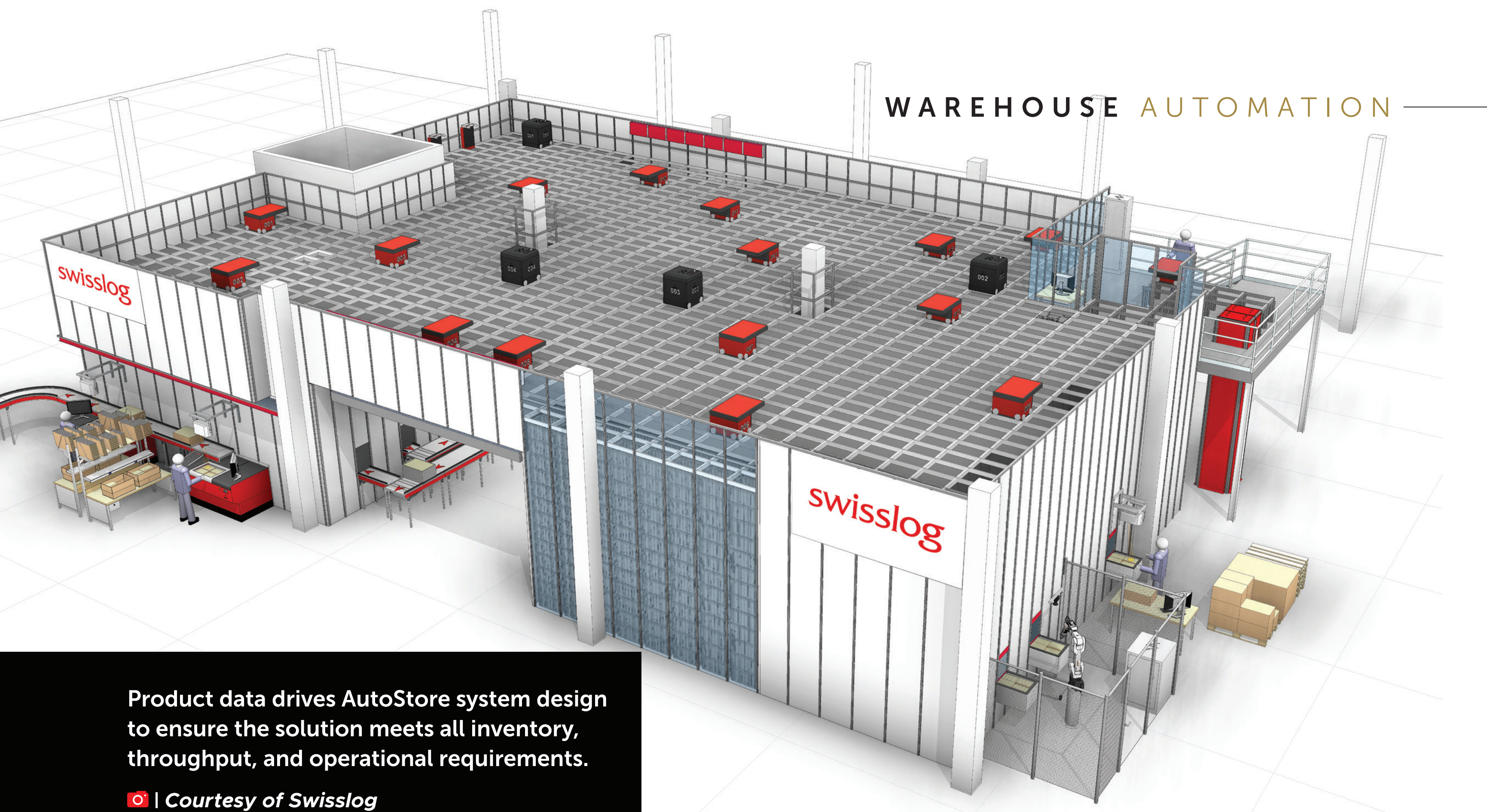
Adding or expanding automation

Once an automation system is in place, it's relatively simple to scale it to meet demand. However, how does a warehouse justify expanding or adding new automation, especially for goods with special storage or handling requirements?

Continuing with the grocery example, in an e-grocery warehouse, there are typically three major product categories that can be differentiated by temperature

Modern automated warehouses are flexible and can scale inventory or throughput independently.

| ***Courtesy of Swisslog***



Product data drives AutoStore system design to ensure the solution meets all inventory, throughput, and operational requirements.

| *Courtesy of Swisslog*

zone: ambient for dry goods, chilled for fresh produce, and freezing for frozen foods. Before COVID, frozen foods had relatively lower volumes than chilled and dry groceries. So, the first attempts to automate grocery order fulfillment focused on chilled and dry foods. However, as frozen food demand has increased, there's an opportunity to expand automation for this product category.

But in the case of frozen food, the automation technology must withstand freezing temperatures to operate properly. Plus, the frozen food section of the warehouse and all environments where frozen goods are stocked, stored, picked, and transported must maintain strict temperature requirements — not to mention any pickup holding areas or delivery vehicles.

With all the extra considerations, warehouses need to be sure that they have enough volume to justify automating new product lines with

AutoStore robots use 0.1 kW of energy per hour, providing an energy-efficient goods-to-person solution.

| *Courtesy of Swisslog*

AutoStore saves space and time with compact robots and vertically stacked bins organized on an aluminum grid.

| *Courtesy of Swisslog*

different, strict requirements. Or they need to consider an adaptable and scalable solution that can adjust throughput seasonally or in response to market changes.

One solution is to set up one or more micro fulfillment centers to address varying demand and product requirements. Micro fulfillment centers are small, automated distribution centers located close to the consumer with limited inventory and throughput to serve a geographical area.

The big challenge with micro fulfillment centers is sizing. If they are too small, the return on investment may be disappointing. But if they are too big, there may be too much distance between the distribution center and the consumer. Warehouses need to find that sweet spot that balances size and distance. For instance, a superstore that sells many different goods constantly may need one large distribution center with different temperature zones to fulfill orders for 3-5 nearby stores. Other companies may find it practical to set up multiple micro fulfillment centers, each tailored for specific product requirements.

Micro fulfillment centers can also benefit online-only retailers. Companies that want to expand to a different geographical area can build a small center to serve online customers only with no investment in a physical store. Brick-and-mortar companies are already experimenting with this concept by diverting online orders to online-only micro fulfillment centers and dodging store fulfillment completely.

Design, data, and decisions

Systems such as Swisslog's AutoStore take the guesswork out of warehouse automation. AutoStore is a standardized product with robots, specifically shaped plastic bins, and an aluminum grid on which the robots drive. Warehouses can select the size of the grid; how many bins, robots, and pick stations to include; where to locate the pick stations; and then Swisslog does the heavy lifting.

"We look at a specific client application, figure out how much inventory they need, how much throughput they need, and then we design a solution specifically for that requirement using the AutoStore technology," said Schmidt.

Automation companies such as Swisslog rely on customer data to analyze and understand the customer's specific requirements and capabilities to tailor solutions. That means warehouses must provide lots of detailed product and operational data, especially when turning over manual processes, such as picking, to robots.

In highly automated distribution centers, the trend is to have robots automate the picking process. However, not everything is pickable by automation.

"I would say in today's world, probably 70% is pickable, and 30% is not," said Schmidt. "You need to make sure you get that percentage correct, and then you also need to design a way of dealing with products that are not automatically pickable because those you still need to pick conventionally."

Though robots take the limelight when building a fully automated or hybrid system, advanced software is the glue that connects and runs the warehouse. Integrating technology to operate as one cohesive system is complicated and gets interesting when robots, automated processes, and humans need to interact. Software needs to guide both technology and people to do the right things at the right times while monitoring equipment, inventory, and locations and communicating with other software, such as customer-facing apps that send notifications on order status.

Software orchestrates all the moving parts, synchronizes data, and helps make decisions. If a robot on the floor sees an obstruction in its path, whether nearby or far away, it will either need to stop, go around the obstruction, or navigate a different pathway. Plus, software is needed to instruct the robot to make local decisions or communicate with a human operator who can tell the robot what to do. Some decisions must be made locally in milliseconds, while others can be programmed more strategically in advance.

An industry ripe for bright minds

Today, the buzzword is "Industry 4.0," which translates "Fourth Industrial Revolution" into modern-day digital speak. With advanced technology and the adoption of cloud computing, the world is more intricately connected, which can make it quite brittle, as COVID revealed. Though history may repeat itself, the current trajectory is an upswing for automation.

As warehouse automation seeks to decrease dependence on manual labor, there's still plenty of room for engineers to build lucrative careers. Remember, what was unthinkable a few decades ago is now commonplace. More than ever, companies value innovation and creativity and want to stock bright minds to stay behind the economic cue ball. No one really knows what the future holds, but scalability, flexibility, and robots have already shifted from trend to trade.

"In schools and universities, there's a lot of teaching around automation and manufacturing. But I think we as a society have squeezed out the last little bit," said Schmidt. "In warehouse automation, where everything was conventional, we are just now entering the phase where real interesting automation takes place, and it's going to continue for a while." ● **WH**

Swisslog | swisslog.com

Designing the "last mile" in automation

To increase efficiency and boost productivity, Tier 1 automotive supplier Denso accelerated AMR deployment from warehouse to line-side production.

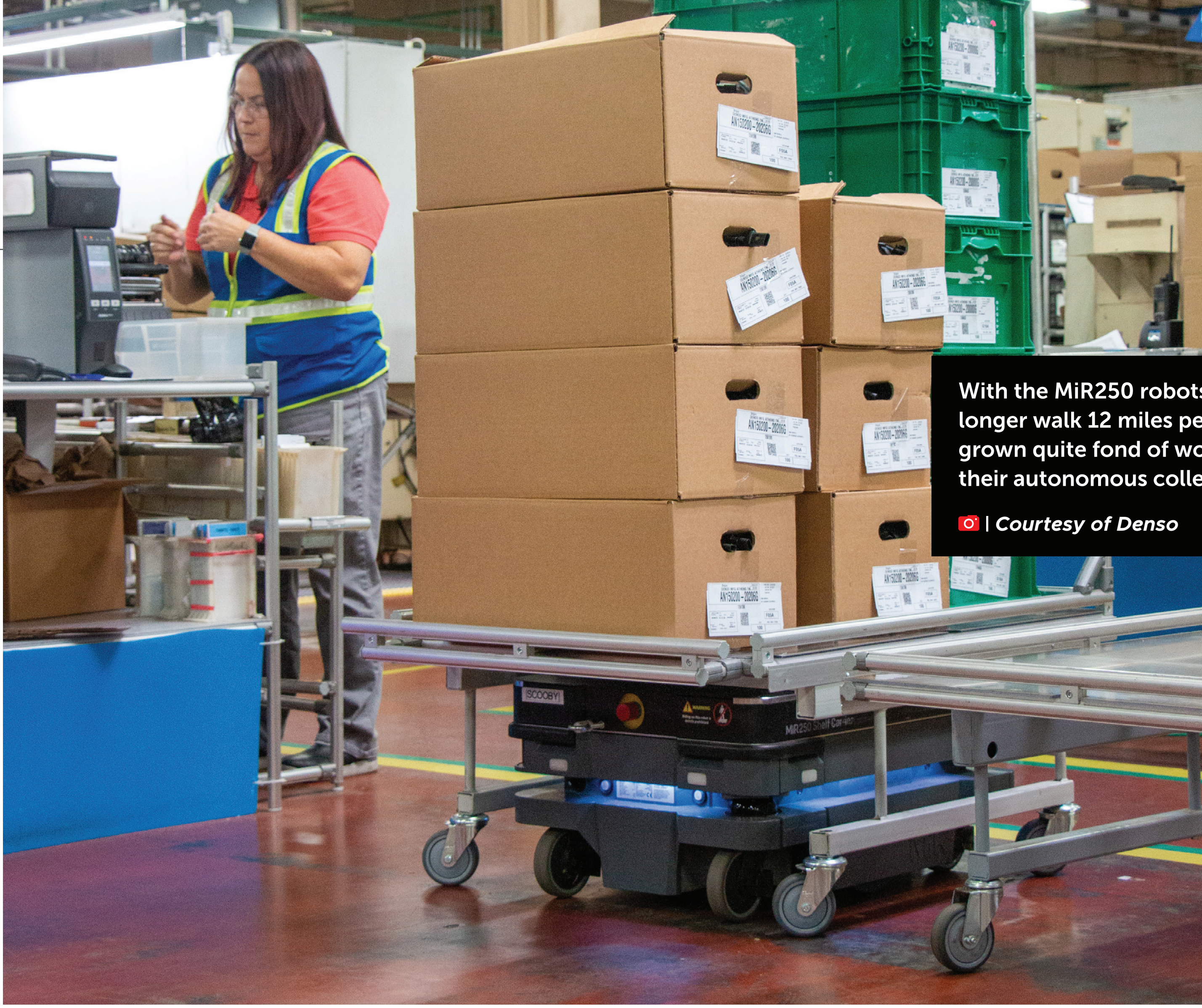
For many large manufacturers, material conveyance has been the "last mile" for automation. That's been the case for Denso, a Tier 1 automotive supplier that manufactures products ranging from spark plugs to fuel injectors in its 800,000-square-foot powertrain component production facility in Athens, Tenn. A renewed emphasis on improving manufacturing efficiencies and profitability, combined with a tight labor market, brought automated conveyance to the forefront.

Denso turned to Mobile Industrial Robots (MiR) to automate material conveyance and is now running six MiR250 robots through two production areas, including transport to and from the warehouse, to support line-side manufacturing, and including facilities and spare parts transport. The company also has five MiR500s for anticipated new business.

Inefficiency drove the move to AMRs

Like most manufacturers, Denso is always looking for opportunities to boost productivity and efficiency. "We knew we had a lot of people that were getting paid to move parts all day long, walking carts from one place to the other," said Travis Olinger, logistics and automation engineer in Denso's Total Industrial Engineering (TIE) group. "But if we have people that are only conveying parts, then that's a non-value-added activity, and we had plenty of open jobs for value-added activities within the production environment. We wanted to pay people to make parts for us that make us money, and not pay them to move parts that cost us money."

Research showed that Denso associates were walking up to 12 miles per day, moving material between production and the warehouse, and spending



With the MiR250 robots, associates no longer walk 12 miles per day and have grown quite fond of working alongside their autonomous colleagues.

| ***Courtesy of Denso***

about 60% of their time just pushing carts. As the team explored options for automated conveyance, it quickly became clear that automated guided vehicles (AGVs) and their infrastructure requirements and costs couldn't meet Denso's needs.

"We're an extremely dynamic environment," said Olinger. "We didn't want to have to go through that entire infrastructure change every time we moved something. The autonomous mobile robot was key to us: to be able to navigate on its own, with quick mapping, quick changes."

In-house testing on warehouse-production conveyance

The team brought MiR and other AMR options in house for testing, using the spark plug production lines as a pilot area. The processes included moving empty totes to production and full finished kit totes back to the warehouse.

"We set up a test course and we ran [the robot] through the wringer," said Robert Blackburn, project leader. "We were able to throw different things at it, different challenges, and get user feedback."

The MiR250 had recently been introduced, and the team was attracted to its 2-mps speed, the payload of 250 kg to handle heavy metal parts, and the ability to navigate narrow spaces.

"Honestly, my initial concern was safety," said Danny Thompson, logistics associate. "A lot of people were worried about them running into stuff or hitting something. I was very surprised at how well they responded to anything stopped — traffic or things that have blocked their pathway. The robot's able to communicate and move out of the way or make adjustments — or even come to a complete stop and allow the other foot traffic to continue on."

REST APIs integrated disparate systems

MiR partner Advanced Control Solutions (ACS) helped develop the third-party integration necessary to work with the REST API calls along with Denso's internal software to integrate with production.

"We use Fleet for our maps for all of our mission creation and our locations," said Olinger. "But we also wanted to be efficient with some proximity cueing and to allow the associates themselves to call for the robots and prioritize in FIFO [first-in, first-out] order. Also, the REST APIs enabled us to manage charging."

Denso can prioritize robots based on charging status and use a decision tree when a mission is finished. The system

The MiR250 robots boosted productivity and led to unexpected benefits, such as increased associate accountability during the parts ordering process.

| ***Courtesy of Denso***

looks for other missions available, checks for adequate charge percentage, and sends robots to missions or to charge as appropriate.

Denso has also been able to integrate the robot to automatically open the door in and out of a clean-room area, using the MiR I/O modules to send wireless signals to Wise Modules in the roll-up door controller. Fleet zones automatically send the appropriate signals via the I/O module when the robot approaches the door.

Associates were the key to success

To prepare for the MiR robot implementation, the TIE team studied the workers in the area to understand exactly what the job entailed, what aspects of the job could be carried out by a robot (conveyance), and what parts of the job would need to remain with the associate. From there, work elements were transferred until all conveyance could be handled by one associate. That person acted as the robot during the research period.

"The associate level was very much involved throughout the implementation of the MiR robots," said Blackburn. "Once we knew that they could handle all the robot elements, we knew that the robot could then take its place and become that associate. That's how the transition took place."

During that time, associates provided invaluable input and feedback to optimize the approach for better efficiencies. Associates are also very involved in the design of top modules for the robots.

"As we have designed those cart tops for different areas and different applications, the associates have been instrumental in those design processes because they're handling those carts every day," said Olinger. "From an ergonomic standpoint, we don't just want to replace the conveyance and then shift that work onto someone else. They're the experts. They're the people handling the carts, they're the people handling the parts. They are extremely helpful in those cart designs and making it a more efficient process."

Standardizing on the MiR250 shelf-lifter and ROEQ carts allows Denso to expand quickly into other areas using the same cart base and customizing it for each use. As associates approach the engineering team with requests for automated conveyance, they can easily design racks around the carts, helping to free up space, increase flexibility, and gain the advantages of automated conveyance more quickly.

Those efficiencies now extend to other areas as well. The facilities maintenance crew purchased carts and now gets supplies delivered automatically from receiving.

Initial successes led to unexpected benefits

After the initial success of the warehouse and spark plug area, Olinger and Blackburn turned to work-in-process (WIP) conveyance and quickly expanded into the gasoline plant. An unexpected benefit was the alleviation of tensions around whether workers had delivered parts correctly, on time, and to the right place.

"Now, on both sides, everyone has accountability," said Olinger. "We know what time parts were ordered, how many were ordered. We know what time it was completed, and when the robot picked it up. It took a lot of that tension away, and allowed departments to work together better, because all the information's available."

Results were immediate and ongoing with fast ROI

Denso's ROI plans for projects are typically less than two years, but the indirect cost reduction specific to the MiR robots replacing conveyance achieved an ROI in a year or less. Within six months of the project launch, Denso was able to cover all finished kit lines in the ignition plant with AMR conveyance and achieve a six-head-count reduction in workers manually moving parts. Those workers have moved to inspection processes or other roles that allow them to challenge themselves professionally and add greater value to the company.

Overall, employee morale has also improved, with employees recognizing Denso as an innovative company that

wants to make employees' jobs easier and that the company cares about the ergonomic aspect of the job.

"The thing I would say for anyone else that's looking at potentially rolling out AMRs for conveyance is that the benefits you're not thinking of now are almost going to outweigh what you are considering," said Olinger. "As you start to see the efficiency gains, and how it improves your overall culture, and then how departments will come up with their own ways to use them to save money, there is a broader benefit to be attained than just that initial indirect cost reduction. It's well worth that initial investment, and well worth that initial period of change."

REST APIs integrate Denso's internal software with the robots and production. | ***Courtesy of Denso***

Support and training guide fast implementation and ongoing success

Denso received extensive support from both MiR and ACS to ensure a smooth rollout and ongoing success. ACS delivered the robots and walked the Denso team through the initial setup and mission-creation and mapping process. From there, the robots' ease of use allowed the TIE team to move into new areas very quickly.

"Probably a day of setting everything up, and then another week of testing and working out all the little wrinkles," said Blackburn. "After we learned that first area, we were able to do it independently."

MiR provided a week of onsite MiR Academy training, including for Denso employees who could be groomed into super-user roles to support the project long-term. MiR has also assigned a Denso North America-specific contact, has created a group for Denso on the MiR community site, and conducts monthly meetings with Denso.

AMRs created a shift in planning and design

Denso has also purchased five MiR500s for anticipated new business. With automated conveyance and logistics now at the forefront of production decisions, the TIE team can better plan for things such as aisle widths, streamlined processes, and where to focus headcount with MiR conveyance systems in place out of the gate.

"Technology and innovation are very much a part of what we need to focus on going forward," said Blackburn. "Basically, if you're not going to focus on that, then you're doing your company or your plant a disservice by not coming out with the best ways to improve on existing manufacturing environments." **WH**

Denso | denso.com

During in-house testing, Denso was impressed by how responsive the robots were to obstructions and how they could quickly communicate and adjust based on objects around them.

| ***Courtesy of Denso***

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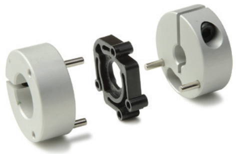

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PFS uses Vimaan's StorTRACK Air warehouse drone to improve inventory tracking and accuracy.

| *Courtesy of PFS*

Drones take the night shift for improved inventory tracking

By Rachael Pasini
Senior Editor

Gone are the days when inventory inaccuracy is just part of doing business. As new technology is increasingly affordable and pervasive, more third-party logistics (3PL) companies embrace innovation to improve their competitive advantage.

Inventory accuracy is one of the most important KPIs for any 3PL or warehouse. The higher the accuracy, the faster orders can be processed, leading to efficiencies that reduce overhead costs and increase the capacity to support more business. To achieve acceptable inventory accuracy rates, warehouses typically require extensive labor to manually audit stored goods (also known as cycle counting). Plus, many warehouses keep inventory more than 30-ft off the ground, posing safety hazards and slowing operations. However, as more 3PLs embrace automation, alternative solutions are taking flight.

For instance, PFS, an eCommerce fulfillment provider and business unit of PFSweb, has integrated Vimaan's StorTRACK Air self-flying warehouse drones to automate inventory tracking activities within its fulfillment operation that stores and picks, packs, and ships inventory for premier brands. Scanning inventory from the ground to the ceiling, the robots capture up to 1,500 locations per hour and deliver highly accurate inventory status details to the PFS Warehouse Management System (WMS). Implementation improves the accuracy and traceability of client product inventory across PFS fulfillment centers.

Manual inventory tracking is a labor-intensive, time-consuming, and costly process. Plus, today's labor market makes finding and retaining warehouse staff difficult.

Without drones, PFS personnel use ladders, lifts, and mechanical order pickers to manually count inventory with handheld RF technology. Team members can scan approximately 400 labels per hour, while the drones can do 1,500 labels per hour.

"A significant portion of the brands we support at PFS fall under high-value verticals and require 99.9% inventory accuracy, according to our service agreements," said Jon Gardner, SVP of fulfillment operations at PFS. "Drone automation offers a more efficient and accurate inventory management solution that enables us to better support our clients."

Especially with the rise in demand for multi-node fulfillment operations, tracking inventory more efficiently across facilities is more critical than ever. PFS plans to use approximately 12 drones per facility, where some operate while others charge, to cover the entire facility.

Image capture expands inventory options

Many warehouse drones are flying barcode scanners, but efficient cycle counting requires much more than barcodes to improve inventory accuracies. A complete view of inventory includes accurate counts, barcode capture, label reading, damage detection, and even reporting on items located in the wrong place. Finding a solution that can do all of this and support efficient WMS reconciliation delivers the most value across the entire warehouse.

Vimaan StorTRACK AIR drones capture images of inventory, while intelligent software uses optical character recognition (OCR) to expand the label types and configurations, such as a pallet or box. For example, premier brands with small-piece products typically come in cases with multiple items of the same SKU located within a larger box or bin. With image capture,

Warehouse drones make efficient use of vertical space, reduce safety hazards for associates, and speed up inventory tracking.

Courtesy of PFS

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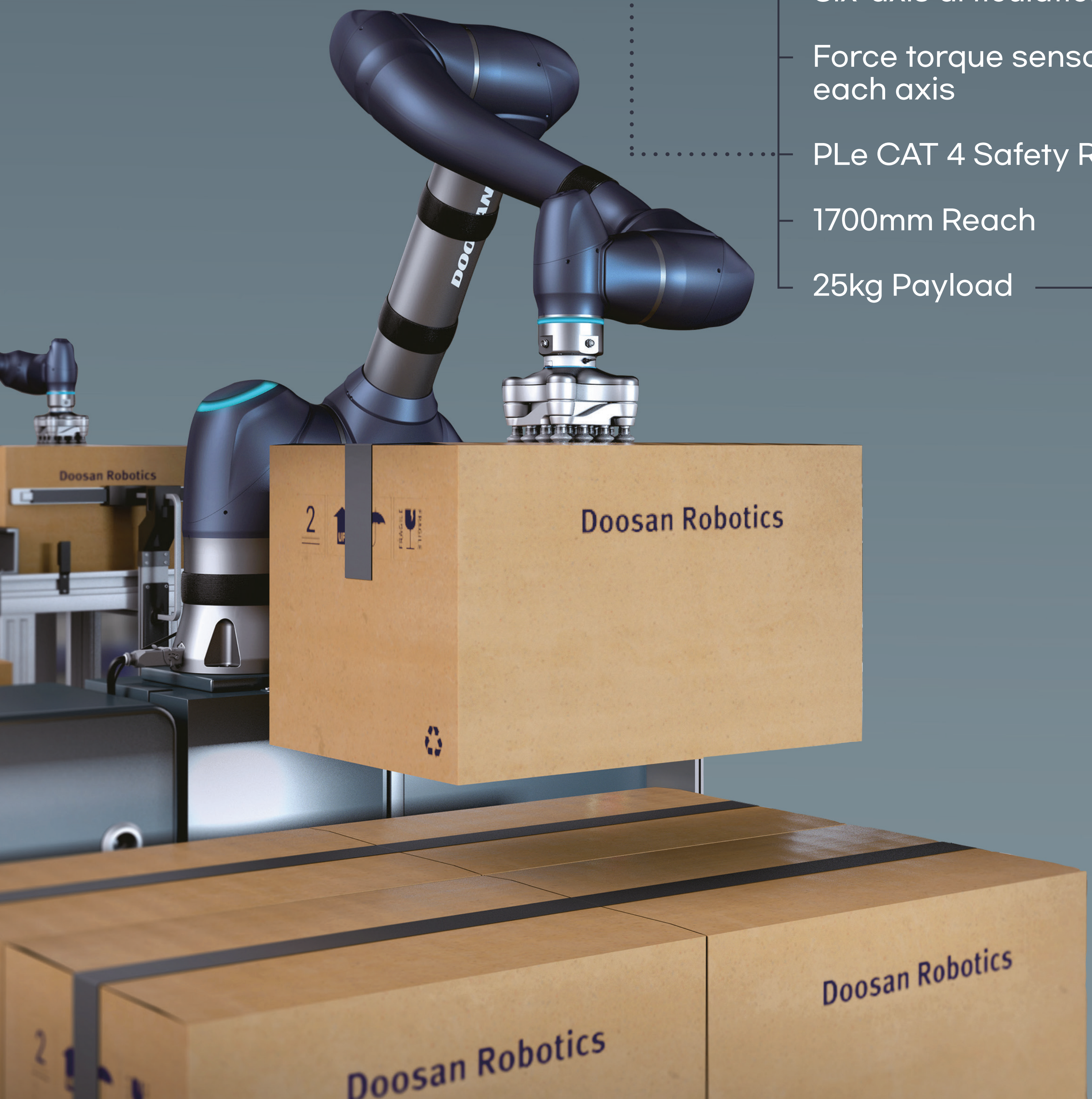


drones can efficiently scan case labels, and OCR can translate the information.

After scanning the designated inventory locations, the drones return to a data exchange location that downloads the data captured in flight. PFS compares what the drones saw to its WMS inventory and generates a discrepancy report if the drones' scans differ from the WMS data. This enables near real-time investigation against any discrepancy.

Air traffic control makes aisles safer

Warehouse staff typically schedule flight times outside operational hours to ensure no associates are in the aisles while drones scan inventory. The drones run overnight when fulfillment activities are either done for the day or slower, but they can operate during break hours if a discrepancy occurs and an area needs to be checked. Staff can also place caution lighting in an aisle to prevent employees or machines such as lifts from entering an aisle while drone counting is taking place if a count is required during operating hours.

"Drones reduce the amount of machinery required to perform audits and, therefore, we find that they create a safer warehouse environment," said Gardner. "Since employees and drones do not operate in a particular area at the same time, there is little interaction."

Because they fly in closed environments and around people, warehouse drones require highly robust collision and obstacle avoidance capabilities. Also, because the drones are operated indoors, they do not need to comply with strict FAA regulations or rely on GPS signals.

AI/ML computer vision improves tracking

Vimaan took care of all software integration, and PFS can use either an API or flat file to exchange inventory information. If the warehouse layout changes, such as a rack height or beam height, Vimaan reprograms the system so that the drones navigate accurately.

But the true advantage of the Vimaan inventory tracking and management solution is the proprietary AI-enabled computer vision, which extends beyond drone flight. The image capture technology allows for dimensioning in addition to OCR, and PFS is exploring other uses. For example, an image capture device can be set up at pack stations to capture a photo of orders as they are packed. The images can then be referenced for damage checks, shipping validation, dispute resolutions, and more.

Clear product labeling optimizes drone use

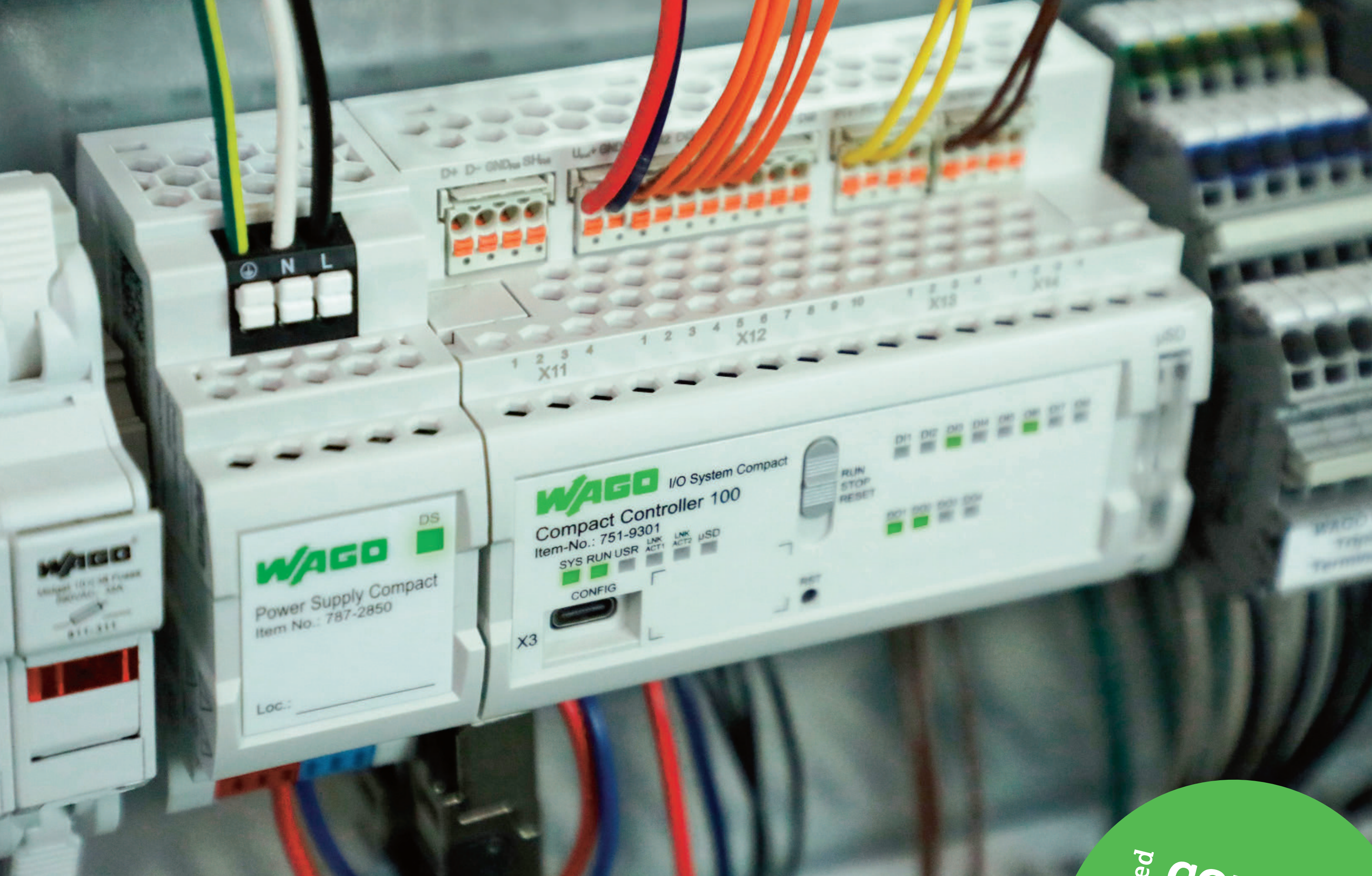
Drones are just one of many automation solutions that 3PLs and warehouses can leverage to increase efficiency and reduce costs. They help optimize vertical space without associated safety hazards or operational challenges. They also work with existing processes and environments so facilities can omit layout changes and focus on making existing processes more effective.

However, warehouses shouldn't deploy drones for the sake of using drones. It's about the value being delivered to the inventory management processes.

"With drones, warehouse design focuses heavily on clear product labeling," said Gardner. "Racking depth and labeling requirements are keys to designing a warehouse optimized for drone use. The layout allows the drone to move faster and see the label better and also optimizes space by allowing for more pick locations per square foot within the warehouse." ● **WH**

PFS | pfscommerce.com

Vimaan | vimaan.ai



Körber deployed 24 Locus AMRs to help make Lambert Vet Supply's warehouse safer and more efficient.

Vet supply distributor improves productivity and safety with AMRs

Long-standing partnerships make scaling warehouse automation systems easier. With Körber's insight and Locus Robotics' fleet of LocusBots, Lambert Vet Supply grew operations and improved employee well-being.

Business growth creates new problems — good problems, of course, but problems nonetheless. And warehouses and fulfillment centers in every industry face similar problems whenever they expand or open new locations.

For instance, Lambert Vet Supply (LVS), a distributor of veterinary supplies, has experienced growth and continuously seeks solutions to new problems. Established in 1994, LVS aims to provide pet owners with quality pet supplies, pet medications, and veterinary supplies. The company is headquartered in Fairbury, Nebraska, and has grown over the years to include locations in Belleville, Kansas, and Neosho, Missouri. Most recently, it's partnered with a warehouse network in Dothan, Alabama.

LVS had an existing partnership with Körber, an international technology group, and it was looking for a robotic product that could make its new warehouses more efficient and easily integrate into its existing K.Motion Warehouse Management System (WMS).

LVS decided to expand its relationship with Körber by deploying 24 autonomous mobile robots (AMRs) created by Locus Robotics.

Some background on Locus

In early 2022, Locus expanded its line of warehouse AMRs with the introduction of Locus Vector and Locus Max. These new form factors joined the Locus Origin robot to form a comprehensive family of AMRs for a broad range of warehouse use cases. The new line addresses use cases from e-commerce, case-picking, and pallet-picking to scenarios requiring larger, heavier payloads to support the full range of product movement needs in today's fulfillment and distribution warehouses. The LocusBot family includes:

Locus Origin: The company's flagship AMR that can operate for 14 hours on a single charge and has a payload capacity of 80 lb. Engineered for maximum warehouse efficiency, Locus Origin couples fulfillment productivity with agile maneuverability, incorporating navigation and vision system technologies. It works collaboratively with associates in dynamic warehouse environments.

Locus Robotics line of LocusBots includes the Origin, Vector, and Max and have different payload capacities for a broad range of warehouse use cases.

Körber turns challenges into opportunities with a depth and breadth of technologies and expertise to conquer supply chain complexity, *spanning warehouse management, warehouse control, robotics, voice, and simulation to address labor challenges through productivity gains and improve employee satisfaction and retention.*

Locus Vector: The industrial-strength AMR with a 600-lb payload capacity and flexibility for a wide range of roles from fulfillment to transport to put-away. Locus Vector features omnidirectional mobility and compact design.

Locus Max: The heavyweight AMR with a 3,000-lb payload limit and unparalleled flexibility to easily transport a wide variety of heavy materials, cartons, or pallets across a facility. Locus Max is ideal for industrial and material handling applications.

LocusBots are fully integrated within LocusOne, a multi-bot warehouse orchestration platform that delivers predictable, efficient, and scalable productivity and cost optimization for all product movement within the four walls of the warehouse. The platform centralizes and coordinates a dynamic, multi-bot fleet while also providing detailed, forward-looking, and actionable business intelligence and reporting for effective management and planning.

LVS chose RaaS for scalability

The company offers its LocusBots through a Robotics as a Service (RaaS) model. RaaS is subscription-based and helps reduce cost and operational barriers often associated with deploying new automation solutions.

For example, a company that owns its equipment depreciates it as a capital asset over its working life and is responsible for the maintenance and repair of the equipment over its lifetime. At the end of the product's life, the company is responsible for disposing of obsolete equipment. RaaS changes all of that. In a RaaS contract, the company only pays for what it consumes, and all of the deployment, integration, support, and equipment maintenance costs are included in the service level contract. This model not only allows the company to deploy quickly but also gives the company the ability to step in if a robot isn't operating correctly.

"Being a long-standing Körber partner and understanding our capability in delivering complete end-to-end software, robotics, and

operational solutions, Lambert looked to us when it was time to take the next step in their warehouse digitization journey," said John Santagate, vice president of robotics software, Körber Business Area Supply Chain. "The subscription-based model is ideal for Lambert as it provides a fast, cost-effective, flexible, and scalable robotic solution that will drive operational efficiency — next to making great strides to take account of their associates' health, safety and wellbeing."

Körber prioritizes employees

Employee well-being is essential for maintaining an adequate workforce, and employee involvement in deploying AMR solutions is critical. The Körber Supply Chain Benchmarking Report 2022 showed that hiring and retaining labor remains among the top challenges for today's supply chains. The report shows that only 37% of supply chain professionals have an adequate number of employees, and more than one in three turn over at least 50% of their warehouse associates each year.

"In an increasingly tight labor market, employee engagement is key to attracting and retaining employees. Equipping warehouse associates with the right tools and technology, such as gamification, artificial intelligence, and voice picking systems, will enable them to work as efficiently as possible while directly addressing labor challenges such as lower unemployment rates and high employee turnover," said Sean Elliott, chief technology officer of software, Körber Business Area Supply Chain.

Körber turns challenges into opportunities with a depth and breadth of technologies and expertise to conquer supply chain complexity, spanning warehouse management, warehouse control, robotics, voice, and simulation to address labor challenges through productivity gains and improve employee satisfaction and retention.

How LVS is doing

Since implementing the AMRs, LVS has seen improvements in efficiency, productivity, and employee health and safety.

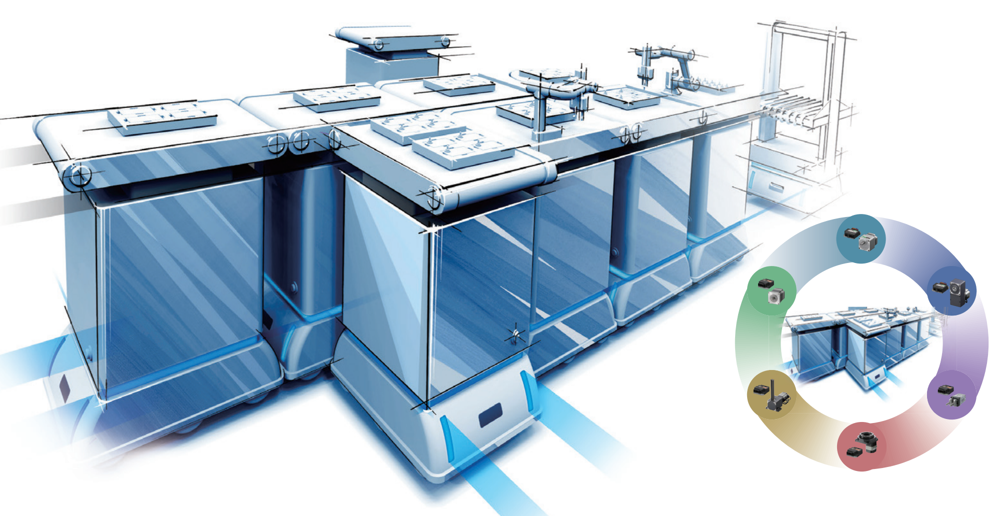
With the new system, warehouse associates' training needs have been significantly reduced, as has the amount of walking distance those employees have to cover. According to LVS, it's seen an up to 50% decrease in walking distance for its employees.

"We are experiencing record growth in both our consumer and professional pet-care e-commerce segments while navigating unprecedented and unpredictable labor challenges," said Tammy Schmidt, VP/COO, Lambert Veterinary Supply. "Being able to seamlessly integrate and ramp up and down, the Robots as a Service provides us with the needed flexibility and scalability to meet our growing e-commerce customer demand while maintaining a smaller dependable team of warehouse associates and reducing onboarding of new warehouse associates to minutes from weeks."

Altogether, implementing Locus' AMRs from Körber resulted in minimized exhaustion, stress, and risk of injury from activities, such as loading and pushing carts for warehouse associates, and increased productivity.

Körber | korber.com

Locus Robotics | locusrobotics.com



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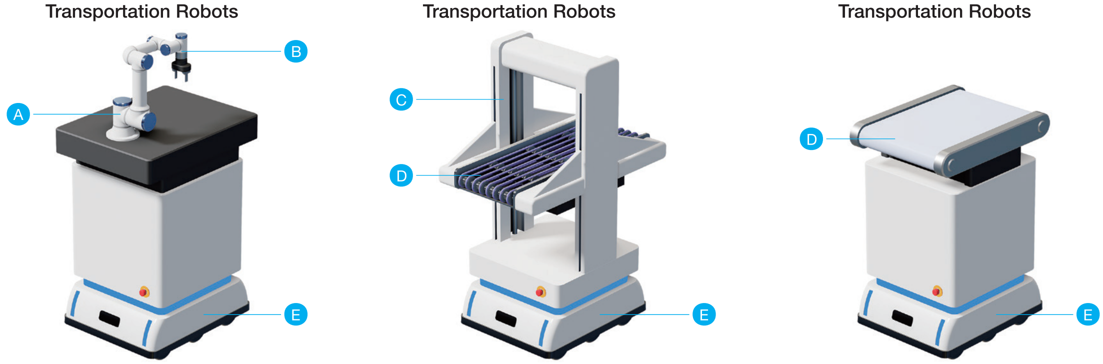


Vertically Articulated Robot A B
Articulated drive/**AZ** Series motor, mini driver
Hand/electric gripper **EH** Series, mini driver
Robot controller/**MRC01**

Lifting and Lowering Equipment C
Rack-and-pinion system **L** Series

Conveyor D
BLV Series **R** Type

Transportation Robot (Wheel Drive) E
BLV Series **R** Type

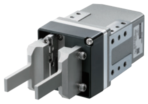
αSTEP AZ Series mini driver & motor/actuator

Mini Drivers
RS-485 Communication Type

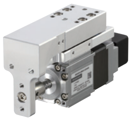
DC Input Motors

Rotary Actuators

Rack-and-pinion Systems



Electric Grippers



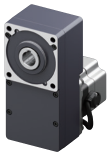
Compact Electric Cylinders

Electric Linear Slides

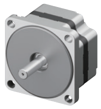
Brushless Motors BLV Series R Type

Battery Compatible
BLV Series **R** Type
CANopen

Parallel Shaft Gearhead



Hollow Shaft Flat Gearhead



Round Shaft

Benefits of Modular Automation

- Flexibility in Production Layout
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- High-Mix, Low-Volume Production
- Resolve Labor Shortage
- Space Saving
- Energy Saving

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Product News

So many exciting things are happening in warehouse automation with more innovative and efficient options than ever before. Here's a look at a few warehouse automation technologies that sprung up or were recently enhanced with new features.

Opex adds RFID scanning to Sure Sort

Opex is expanding the capabilities of its leading-edge Sure Sort warehouse automation technology to incorporate radio frequency identification (RFID) scanning to increase operational speed and efficiency. Sure Sort is a warehouse automation solution for distribution centers, retail stores, and third-party logistics companies that look for cost-effective and accurate order handling, cross-docking, and reverse logistics. Opex has added the option of RFID scanning capabilities to meet evolving customer needs, especially for apparel manufacturers and retailers.

Bar codes sometimes get hidden in garments and require additional operator handling, which slows operations. Because RFID employs radio waves, scanning does not require a visual connection. In addition to the apparel industry, RFID scanning is popular for cell phone and pharmaceutical processing.

With increasing labor costs and supply chain challenges, the demand for more responsive warehouse automation technology has never been more crucial. Sure Sort robotic delivery vehicles, iBOTs, quickly and accurately process up to 2,400 items each hour with as little as three operators and can recharge as they travel through the system.

Opex introduced Sure Sort in 2017 to direct a wide range of items, including cylindrical, clear, plastic bagged, and blister pack items up to 5 lb. It can handle products as large as 15-in. long, 12-in. wide, and 6-in. high.

Features include:

- iBOT technology powering robotic vehicles that are multi-directional, intelligent, wireless, and highly energy efficient
- Configurable sort bins, totes, and boxes
- OPEX scan tunnels that scan items on six sides and read up to eight barcodes on a given SKU
- Warehouse Management System (WMS) integration using a simplistic API
- Configurable LED pack-to-light system that notifies workers when orders are complete or additional actions are required
- An optional dimensioner that captures product attributes in real-time as items pass through the scan tunnel and provides up-to-date information to the WMS

Popular uses of Sure Sort include:

- Order fulfillment applications for e-commerce
- Retail store distribution (brick and mortar)
- Parcel sortation/presort by zip code or mail zone to reduce shipping charges
- Kitting for assembly of item-of-the-month clubs or meal delivery kits, for example
- Reverse logistics and replenishment
- Warehouse cross-docking, retail cross-docking, and sort-to-aisle where space is limited

Opex | opex.com

Opex's Sure Sort is a warehouse automation solution that now includes RFID scanning to increase operational speed and efficiency.

The Power of Vision

Murrelektronik has developed efficient and economical system solutions for integrating industrial image processing systems. The advantages include minimal installation effort as a result of decentralized, pluggable modules that can be mounted directly on the machine.

This achieves the goal of maximum performance with minimum wiring effort. The compact, powerful module is located right where it is needed. All in all, this saves installation time and reduces installation efforts while offering maximum availability enhanced by LED diagnostics each module. As a result, control cabinet components for connecting camera systems are replaced by a decentralized installation systems.

Xelity Hybrid Switch

Master Breakout Box

Injection Box

NEC Class 2 Splitter

stay connected

→ murrinc.com

Product News

Numina launches Pakt for pack and ship automation

The Numina Group recently launched Pakt, a fully productized pack and ship automation solution built for fulfillment operations. Pakt breaks down the financial and operational barriers for end-of-line automation by reducing pack and ship labor and increasing throughput capacity. In addition, Pakt connects with any robotic fulfillment technology, unlocking full throughput capacity potential in the modern, e-commerce-driven warehouse environment.

Pakt is designed for distribution centers (DCs) with eight or more employees in their packing and shipping departments. The system's modular design allows it to scale from 800 to 20,000 cartons and full case parcels per day.

Numina Group views fulfillment like a triathlon in that it has three events — picking, packing, and shipping — and warehouses are only as fast as their slowest event. After automating the picking process, the bottleneck often merely shifts to packing and shipping. Pakt eliminates the bottlenecks and labor that exist after picking, ensuring operations can fulfill orders faster and meet customer delivery expectations.

Numina Group's Pakt is a fully productized pack and ship automation solution that breaks down barriers for end-of-line automation and increases throughput capacity.

Pakt's components are powered by RDS, Numina Group's warehouse execution and control software, and include:

- **Scan, Weigh, Vision Audit:** Ensures that the right products have been picked into the right shipping container based on weight while capturing an image of the carton content.
- **Print, Fold, Insertion (PFI):** Automatically inserts any packing slips, marketing materials, or compliance documentation into shipping containers using a robotic arm.
- **Void and Auto-Taping:** Rules-based, system-directed void insertion and automatic shipping container taping.
- **Print and Apply:** Automatically manifests, prints, and applies labels for shipping, ASN, UCC, packing slips, packing sheets, and more.
- **Shipping Sortation:** Automatically sorts shipping containers based on parcel carriers, LTL, FTL, and exception designations.

Numina Group | numinagroup.com

Product News

Exotec releases three modular innovations for Skypod

Exotec recently introduced three new solutions that integrate with its Skypod system: Skypath (a new conveyor system), Skypicker (an improved picking solution), and Deepsky (new proprietary warehouse software). Each of these new solutions leverages Exotec's signature modular design allowing customers to meet their dynamic business needs by easily adding new solutions to their existing systems. The latest products bring Exotec closer to its vision of warehouses where people work smarter, not harder, through robotics.

Skypath is a modular conveyor system that can reach a maximum throughput of 2,500 totes per hour. The modular design consists of straight, curved, and inclined building blocks that fit most logistic needs and layouts and can easily adapt to customer needs.

Skypicker is an intelligent picking solution for modern warehouses. It features machine learning vision that automatically detects each item's dimensions to intelligently place items in preparation containers in a way that optimizes the available space and smooth package handling. Improvements to the system allow the Skypicker to reach outputs of up to 600 items per hour reliably.

Deepsky is an end-to-end warehouse software that integrates Exotec technology with most warehouse management and control systems and third-party automation equipment. It automatically collects data, feeds it into pre-configured dashboards for immediate visibility, and optimizes for consistent performance.

As inflation, economic headwinds, and labor shortages continue to place mounting pressure on supply chains, businesses worldwide are looking for ways to address their immediate needs while positioning themselves for an unpredictable future. Increasingly, this means doing more with less.

Exotec | exotec.com

Exotec's Skypicker picking automation solution uses machine learning vision to detect item dimensions, place them intelligently, and optimize available space.

Product News

Pio's product in-out warehouse automation solution enables more effective space usage and faster picking and packing operations.

AutoStore introduces Pio in North America

AutoStore has launched Pio, its product in/out warehouse automation system, in North America for the first time. The plug-and-play version of AutoStore's automated storage and retrieval system (ASRS) is tailored for small and medium-sized businesses.

Pio is a modular and scalable ASRS product that runs on standard plug-and-play software that can connect to the most common online retail and shipping platforms. The system is based on a pay-per-pick model. Similar to a robotics-as-a-service model, users will only purchase product bins and the frames that robots run on, while AutoStore owns and manages the robots, ports, and software.

Users pay a fee for each item picked, which can lower the initial investment for deployment, allowing retailers with smaller margins to access the system. Pio is aimed at small to medium-sized retailers that sell anything from apparel to sporting goods, crafts, and cosmetics. It doesn't require any added labor or floor space to be implemented.

AutoStore | autostoresystem.com

Product News

Brain Corp partners with Google Cloud on BrainOS analytics

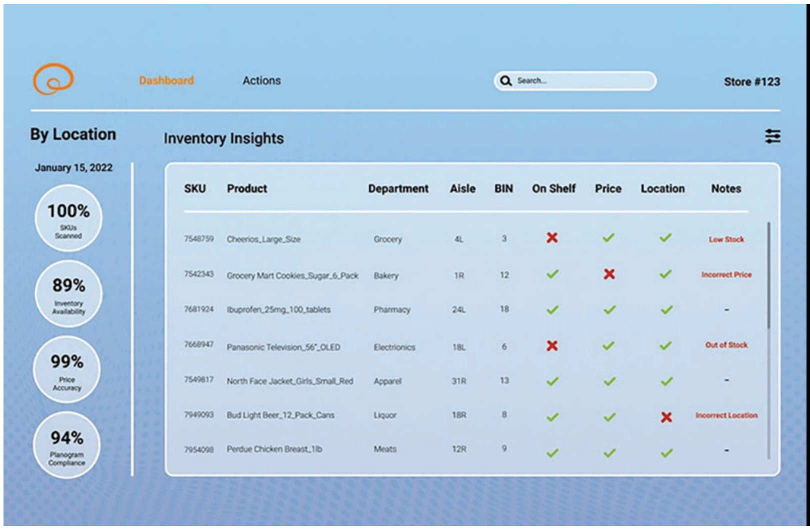
Brain Corp announced its BrainOS Inventory Insights, a new and proprietary solution able to deliver next-generation in-store inventory analytics to retailers. The solution is in partnership with Google Cloud.

Brain Corp, which already powers the largest global fleet of autonomous robots in public spaces and the world's largest fleet of robotic inventory scanners, will now offer retail customers a true end-to-end solution for analyzing the inventory data collected by its BrainOS-powered inventory scanning robots.

Using BrainOS Inventory Insights, retailers will be able to identify out-of-stock and low-stock events quickly, assess product details such as where an item is (product location), if it's in the correct place (planogram compliance), and ensure it's priced correctly (price tag compliance). By providing these highly accurate, actionable, and localized insights, retailers can intelligently manage their inventory, improve operational efficiencies, improve productivity, and elevate their customer shopping experiences across all channels to increase revenue, margins, and customer loyalty.

BrainOS Inventory Insights utilizes Google Cloud's Vertex AI Vision models, including the product recognizer and tag recognizer models, combined with Google Cloud's BigQuery, enabling Brain Corp to deliver this solution across retail segments at scale.

Brain Corp | braincorp.com



BrainOS helps retailers quickly identify out-of-stock and low-stock events and assess product details, such as location and price.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Revolutionize AS/RS with New Automation Technology

Today's e-commerce market demands that Automated Storage and Retrieval Systems offer real competitive advantages

By **Doug Schuchart**, Global Material Handling and Intralogistics Manager, Beckhoff Automation

Beckhoff's feature-rich EP7402 MDR controller benefits AS/RS applications.

The Automated Storage and Retrieval System (AS/RS) has become a fundamental piece of automated equipment in modern fulfillment centers. Once only attainable by larger-scale operations, new advances now make a wide range of smaller systems available at significantly lower cost. Micro-fulfillment has also driven smaller and more flexible AS/RS options to the market. Now, scalable AS/RS solutions are available for most any size fulfillment operation, making the AS/RS a central investment in modern operations of all sizes.

AS/RS systems maximize warehouse and distribution center efficiency by tightly integrating all areas of intralogistics and saturating facilities with highly automated equipment. Common elements found in an AS/RS can include:

- Shuttle systems
- Vertical and horizontal carousels
- Cube-based storage
- Unit and mini load systems
- Vertical lift modules (VLM) and indexing conveyors (VIC)
- Goods to operator and goods to robot (G2O/G2R) pick stations

As a leading supplier of control technology in material handling and intralogistics, Beckhoff offers a broad range of technologies to help automated equipment suppliers gain a competitive advantage.

Optimized industrial networking for AS/RS applications

EtherCAT, an open, real-time and deterministic Ethernet fieldbus communication protocol developed by Beckhoff, is the backbone of Beckhoff control systems. The EtherCAT Technology Group (ETG), an independent organization that manages the EtherCAT technology with all member companies, is the largest Ethernet and fieldbus organization in the world. Adoption in material handling and intralogistics is particularly high in part due to its almost unlimited capability to control numerous devices. One EtherCAT network can accommodate more than 65,000 devices on a single linear network, such as long conveying and sortation systems. It also offers the ability to add many branches with zero impact on the network performance. You can go big and go long without any worry about system communication limitations.

G2O/G2R pick stations are common elements in AS/RS solutions, as in this Honeywell Intelligrated system.

Being the fastest fieldbus in the world, EtherCAT also has considerable benefits for AS/RS motion control requirements, network security, digitization (IoT) and machine safety. Its openness enables unrestricted communication with all other open protocols to support any brownfield or greenfield installation such as EtherNet/IP, PROFINET, DeviceNet and PROFIBUS.

Beckhoff offers a large portfolio of control technology including a wide range of compact controllers, compact plug-and-play I/O solutions for any signal type, and a collection of compact, low-voltage drive technology ideal for mobile applications. Specifically for the motion control requirements of unit load and mini-load shuttles, customers can choose from compact drives that co-mingle with standard I/O signals on a traditional local or remote rack in IP20, and IP65/67-rated machine-mounted drives, as well as integrated motor drives. Drive technology is offered for servo, stepper, BLDC, as well as AC and DC motors. Beckhoff's powerful TwinCAT automation software platform supports simple configuration of motion axes as well as CNC functions required for gantry-style unit load storage systems.

Powerful machine controls for modern intralogistics systems

Beckhoff machine controllers with motherboards developed and produced in-house extend hardware lifecycle and offer on-board removable storage media. Local databases running alongside the PLC on the same device support local analytics of historical and real-time data with the help of the TwinCAT real-time integrated scope tools and analytics functions. This, along with the extensive diagnostics capabilities of EtherCAT, enables monitoring of equipment for predictive maintenance, ensuring the highest uptime in production and improved asset reliability.

Beckhoff combines functions integral to an AS/RS into one powerful machine controller, including vision, robotics, speech, HMI and machine learning. And for related material handling systems, such as G2O/G2R technologies, we offer innovative solutions, including Flying Motion with XPlanar and a motor-driven roller (MDR) controller that's manufacturer agnostic.

For more information: www.beckhoff.com/intralogistics

How Cognex is Enabling the Next Generation Logistics Facility

By **Ben Carey,** Director, Logistics Vision Products, Cognex Corporation

To move fast this year, logistics companies will be looking for solutions that automate processes and increase throughput while decreasing costs. End users and OEMs need solutions that don't require custom design and installation, but rather are standardized, easy to install, operate, and maintain, and solve multiple applications, rather than discrete devices that only satisfy a single need. And leading companies will also be looking for their solutions that include advanced data and analytics capabilities to enable better decision-making and troubleshooting.

But historically, machine vision technologies have been complex, powerful solutions that brought warehouses to a new level of automation. However, these solutions were not as pervasive because they still required a skilled engineer to operate and maintain and were challenged by the high level of variation and variability within logistics. But the recent acceleration of logistics operations caused by the pandemic and unprecedented growth in e-commerce has flipped the typical machine vision technology model on its head.

While the ultimate goal of logistics companies is to have 'dark warehouses' that require few workers and rely on automation and robotics, the reality is that many companies are simply trying to evolve into a more automated, connected facility. This is why technology providers have shifted their focus to the development of standard, easy-to-use vision solutions for logistics, enabled in large part by advanced technologies such as AI.

Partnering on Standardized Solutions from Inbound to Outbound

At Cognex Corporation, a machine vision leader for over 40 years, we've committed to creating products and solutions that will help logistics firms increase throughput, improve productivity, ensure traceability, and keep costs down. Our portfolio helps customers optimize all areas of the warehouse – from inbound and order fulfillment to sortation and outbound – with standard solutions that bypass the need for custom installation and are easier to maintain and lead to quicker ROI.

Most recently, we've released our new ***Modular Vision Tunnels***, which represent the next iteration of logistics technology innovation. These standard solutions, which accurately read codes on packages at high speeds with short gaps, are helping leading logistics companies progress on their journey toward the next generation facility.

These 5- and 6-sided tunnels are quick and easy to install and address multiple challenging applications such as inbound receiving, outbound truck loading, and high-speed ship sorting. They don't require a high-level engineer to configure and only need minimal human intervention to operate, relieving challenges related to the labor shortage. ***Edge Intelligence*** data analytics software is built within these tunnels, allowing customers to easily set up and maintain the tunnels with real-time insights into performance and maintenance.

Optimizing the DC with Easy-to-Use, Scalable Devices

Across other areas of the facility, Cognex is helping logistics providers be more accurate and efficient. The new ***In-Sight 2800 Detector***, built upon AI-based edge learning technology, solves multiple sortation applications (item detection, item classification, and process issue detection) with a single device. Edge learning technology simplifies these applications for users of any skill level and represents an easy way for warehouses to automate, without a major learning curve.

Sortation integrator, SDI, is already using the In-Sight 2800 Detector at several leading retailers to accelerate item detection and classification. "The biggest feature of the In-Sight 2800 Detector as far as we're concerned is the edge learning technology," says Dave Bodenheimer, VP, Research and Product Development at SDI. "The ability to ignore noise on trays and detect a wide variety of products, the ease of training of the system, are all things that brought us to the new Detector."

Cognex's ***hands-free barcode reading solutions***, which are mounted overhead, allow workers to use one fluid motion to scan boxes in any orientation. These solutions are simple to learn and install and free up workers from the repetitive 'pick up, put down' motion that handheld scanners require. Hands-free solutions offer a quick ROI and support revenue recovery, which can be instrumental in gaining more support for automation projects.

Come see us at ProMat at North Hall (N6301) to experience these solutions in action. Visit ***www.cognex.com/logistics*** and view our ***Logistics Solutions Guide*** and ***ROI Calculator*** to learn more.

COGNEX

How to Promote Warehouse Conveyor Safety

Conveyors are an integral part of many warehouses and factories, especially in material handling and packaging applications. They are found in a variety of settings, from small businesses to large distribution centers.

Conveyors can make a facility much more efficient and productive, but if they are not used correctly, they can pose a danger to staff.

By knowing how important it is to follow safety rules and make sure they are adhered to, businesses can create an environment that shows employees their health and safety are a top priority.

Good safety starts with setting operation procedures

One of the best ways to promote safety is to make sure there are set operational procedures.

Some operational basics should require that employees know how to safely start, stop, and operate conveyors, as well as what to do in case of an emergency. More detailed instructions could show the right way to clear jams or do regular preventive maintenance.

Once the procedures have been established, ensure that all appropriate employees are properly trained. Any employee who works with or around conveyors on the warehouse floor must understand their proper operation so they can safeguard themselves and the equipment.

This education shouldn't only occur for new hires. Rather, it should be a part of ongoing training and education, giving companies the ability to refresh procedures to ensure worker and equipment safety. It's important that this critical information be readily available to employees and, most importantly, be enforced.

Enforce safety standards

The U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) has published several safety standards for conveyor systems. Companies can mitigate injury, reduce downtime, and prevent equipment damage by adhering to these standards and establishing well-defined safety protocols.

The OSHA safety guidelines cover everything from guards and moving parts to emergency stop devices and lockout/tagout. For a company to adhere to these safety standards, it must determine how its organization will define safety and the methods to enforce them.

These safety standards are part of daily operations, so a facility must be organized and systematic about how each standard will be presented and implemented. Details matter.

Inspect and maintain the conveyor system

Regular safety checks on the conveyor system are an important part of making sure that employees are safe and that the equipment works.

This inspection should be conducted by a qualified technician and include a thorough examination of all components, including the belt, pulleys, motors, and other moving parts. Any damaged parts should be repaired or replaced as soon as possible.

In addition to routine inspections, it is also important to regularly clean conveyors, removing debris that could cause problems or impact performance. In general, a clean workplace is important for running a business well and keeping workers safe.

Choose the right conveyor

Using a conveyor eliminates the need for employees to lift heavy objects or walk long distances, reducing the risk of injuries in the workplace. It's important, however, to understand the best type of conveyor for your facility.

When choosing a conveyor system, it is important to select one that best matches your application. You should never have to settle for a conveyor that's good enough. Conveyors today are engineered for specific applications to best meet you production and safety goals.

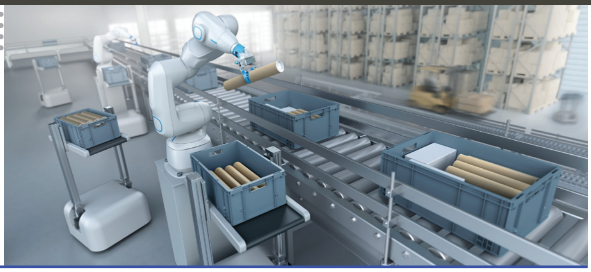
For example, if you are conveying heavy or abrasive materials, a more heavy-duty conveyor rated for that load is required. Operating in an area with limited space? Consider a lift-gate conveyor or a system designed with tight turns. For operations that heavily involve e-commerce, logistics, packaging, palletizing, a conveyor with a painted frame adds much needed durability for those types of demanding, 24/7 environments.

Choosing the right company

Equally as important as selecting the right conveyor is choosing the company behind it. Dorner, a leader in industrial and commercial conveyors, has the equipment and experts to create a safe and effective working environment. As an ISO-certified manufacturer, their conveyors perform to standards that maximize production and output.

Dorner conveyors help increase productivity while promoting safety in your facility.

DORNER®
By Columbus McKinnon



Festo Solutions Boost Intralogistics Productivity

By **Franklin Vanderpool,** Industry Segment Manager, Logistics Systems, Festo

Original equipment manufacturers (OEMs), integrators, and end users require dynamic and reliable ways to move goods. Festo, a leading automation supplier, offers world-class electric and pneumatic automation solutions for Intralogistics – the art of optimizing, integrating, automating, and managing the logistical flow of information and material goods within the walls of a fulfillment or distribution center.

Festo also offers productivity tools, global support, and custom solutions that ensure component interoperability and bring OEMs and integrator solutions to the market faster with less engineering overhead.

Electric automation

Festo offers the world's most complete interoperable electric automation product range that provides design symmetry, streamlines design and acquisition, lowers inventory, and ensures global technical support. Key Intralogistics components include EMMT series servo motors for controllability and path accuracy in positioning applications and a space-saving single-cable solution that reduces installation effort.

EGC series axes are ideal for linear gantries and cantilevered axes. Linear actuators in the ELGA family deliver speed, acceleration, and accuracy in the most demanding applications. CMMT, a compact servo drive series, offers precise force and speed. Auto-tuning supports easy commissioning and automatically optimizes control behavior of rotary and linear motion.

Electrics with the simplicity of pneumatics

The Festo Simplified Motion Series (SMS) axes offer an alternative to more expensive and complex traditional servo motion. SMS takes proven ball screw axes, toothed belt axes, mini slides, electric cylinders, piston rod, and rotary actuators and integrates them with an onboard servo drive. Users commission two-position functionality via onboard push buttons with no additional software. When controlled with IO-Link, positioning along the axis length is infinitely variable.

Core pneumatics components are readily available

The company offers innovative and high-quality pneumatic solutions from servo pneumatics to the world's first intelligent valve terminal, the VTEM, to the industry leading DFSP stopper cylinder. Festo's core range of components meets most application needs and is readily available for quick shipping, which lowers supply chain risk. Plus, the new Festo Pneumatic Essentials program — a one-stop-shop for the 16 most applied pneumatic components — feature innovative compact design for today's smaller footprint machines and competitive prices.

AI for higher uptime, quality, and energy efficiency

The Festo Automation Experience (AX) is a new artificial intelligence platform for predictive maintenance, predictive quality, and energy optimization. Using advanced analytics, Festo AX maps data to learn a component, machine, product, or energy system's healthy state. It provides early-warning actionable information to correct anomalies when data trends out of normal.

Seamless connectivity: direct integration into host systems

Festo servo drives, integrated drives, remote I/O systems, and valve terminals are integrated into electric and pneumatic automation systems. OEMs and integrators combined Festo electrics and pneumatics into larger environments using Ethernet-based protocols, and function blocks simplify integration with Rockwell, Beckhoff, Siemens, Omron, and others.

Festo emphasizes connectivity to Ethernet-based protocols through IO-Link. Its most advanced remote I/O solutions, including CPX-E and CPX-AP-I, enable fast connection to host PLCs and the widest possible range of automation components from Festo and third-party suppliers.

CPX-AP-I, a new generation decentralized I/O, connects valve terminals and digital and analog I/O to the integrated system. CPX-AP-I can accommodate over 80 digital and analog input blocks, valve manifolds, and IO-Link master modules per system, with cable lengths up to 50 meters (164 feet), making it ideal for Intralogistics systems.

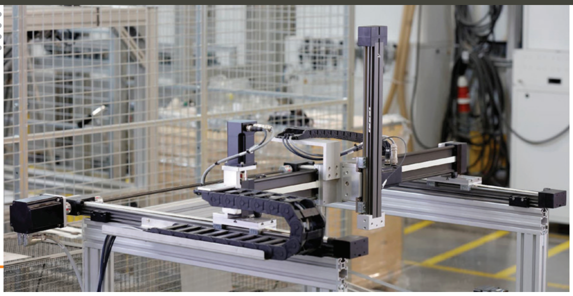
Productivity tools

Using Festo online engineering productivity tools, such as Handling Guide Online, engineers can quickly and easily define mechatronic 1D, 2D or 3D kinematics. They can also select the matching motor and servo drive or valve terminals plus the remote I/O system, reduce design time from hours to minutes, and ensure interoperability of components.

Learning

Festo Didactic takes lifelong learning and mechatronic technical training to a new level. It provides lab-based equipment that replicates real world automation to two-year educational institutions and trains at customer sites. The Festo Learning Experience (Festo LX) is a new online portal to make it easier to create individual learning experiences.

FESTO



Why gantry robots have become an essential automation solution

By Dylan Pollack

A gantry robot (sometimes referred to as a cartesian robot) uses XYZ coordinates to move multiple axes—typically three—to a specific location within its workspace. gantry robots can be extremely beneficial for engineers that are looking to automate their warehouses, improve their current systems, or solve unique design challenges. In this blog post, we will explore a few applications where gantry robots have an advantage in comparison to other automated systems, along with the types of motor controllers and drivers needed—we will even offer a tool that will help you design your own custom gantry robot at the end.

Believe it or not, gantry robots are actually used often in everyday life. Whether it is a two-axis gantry robot, such as a crane, which can move large parts of a multiple story-high building, or even a 3D printer within a much smaller area of operation, both still rely on the same mechanics to complete the process. The benefits of a gantry robot are endless since they cater to most applications that require automated assistance—pick and place, labeling, measuring, and other processes that require both speed and precision with an outstanding return on investment. The ability to automate these procedures with a gantry robot system will allow you to turn an operation that would normally take an assembly line of three to four people into a process that requires just one, or possibly even no one, depending on how intricate the system is, i.e. peripheral AI.

A key benefit offered by a gantry robot over other automated solutions, such as an articulated robot arm or a SCARA robot system, is that they provide a more flexible workspace while enabling a much faster pick rate. The cube-shaped workspace of a gantry robot allows for easier calculation of coordinates without the constraint of a SCARA or other robotic arms' reach. Since robotic arms and SCARA robots require a round or multi-axis workspace, the circumference will always need to be factored in when planning out coordinates. However, a gantry robot system has definitive corners to its workspace which allows for much simpler calculation.

XXL Gantry

Another aspect to consider is that most robotic arms will be defined to certain sizes which will limit its workspace, whereas a gantry can be multiple meters long! The igus® XXL Gantry, which is a large DIY, 3-axis linear gantry robot that has an action radius of 2,000 x 2,000 x 1,500 millimeters and is particularly suitable for palletizing applications of up to 10 kilograms, is a perfect example of this.

Keep In Mind—The Power Source and Control System

When it comes to motor controllers, you will typically need something that can control the power running through the motor, and depending on the application, you may need a controller that can also read data from the motor.

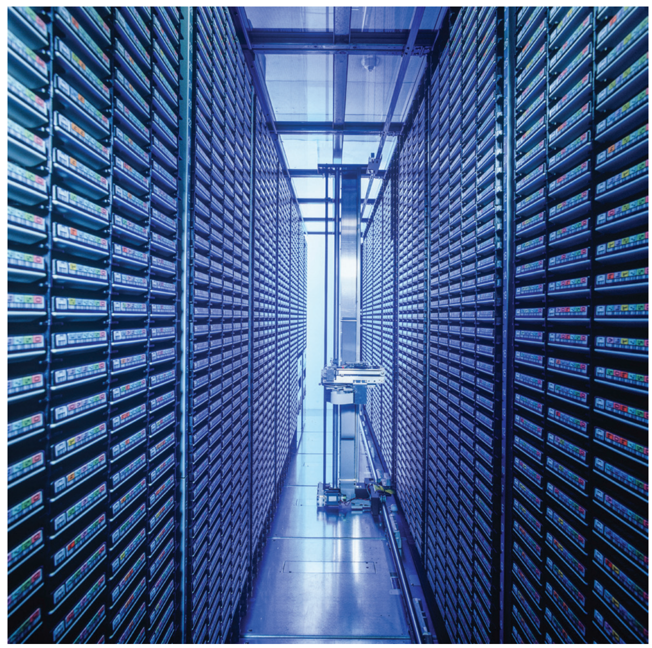
There are generally two types of controllers:
• Motor cards, also known as motor driver, motor amplifier, power amplifier, output stage, etc.
• PLC or master controller, which is a device that would do most of the reading and processing data such as controlling the speed, reading the encoder, processing other signals like limit switches.

Again, both of these depend on exactly what you need your linear actuator and/or motor to do.

These motor controllers may also come in many different variations. Although some controllers may only have switches and buttons that you can interact with, others may contain software interfaces that are capable of making precise adjustments to the motors' capabilities. These controllers have the ability of working in tandem with a master controller to create a top-level control system. A common and popular example of this would be a CNC machine and its control system. These machines are equipped with motor drivers and other elements that are all regulated and controlled by the master system, combining it into a user-friendly digital interface.

An igus® gantry robot can be controlled directly by our own Robot Control system, which offers many advantages—smooth motion with 1/256 microstepping, Trinamics Stallguard2 and CoolStep Technologies for energy saving, an intuitive programming environment with 3D interface, and more. It is also possible to use your own control system with an igus® gantry robot, or alternatively, you may operate each axis individually with its own control system—for example, with our D1 or D3 dryve motor control system. With this configuration, you will need an additional master control system to control the coordination of the movement. Please note that a control system is not included in the box with an igus® gantry robot, but can be optionally obtained from us.

Reliable Motion Reinvents the Warehouse



Automated systems and machines are revolutionizing storage and retrieval systems to support the demand for faster processes and efficiency gains. Sophisticated conveyors, sorters, palletizers and robotic systems can move product more quickly and reliably than traditional warehouse machinery, but they require exceptional motion products to provide accuracy and longevity. Here is an overview of some of the advanced, high-performance motion devices available and the features that make them well-suited for use in modern, automated warehouses.

- **Linear Roller Guides,** such as the Super MX Series from IKO International, are desirable whenever a mechanism must handle heavy loads in any direction or large moment loads. Using cylindrical rollers that make a larger contact area with the raceway than guides that use steel balls, they offer higher load ratings. The large contact area also provides exceptional rigidity with less elastic deformation under load for stable performance.IKO Super MX also has built-in C-Lube technology which provides long-term maintenance-free operation. Since lubrication maintenance is reduced, these guides are particularly beneficial for robotics in warehouses where tight spaces make lubrication difficult. And, their interchangeability allows them to be matched, replaced or freely added without replacing an entire bearing and rail assembly, giving engineers greater design freedom.

- **Crossed Roller Bearings.** For applications with complex rotary motion requirements, crossed roller bearings can provide high rotational accuracy and are engineered to handle radial, thrust and moment loads at the same time. Different types of crossed roller bearings can be chosen depending on the intended task and can provide extra-high rigidity or satisfy restrictive space and weight requirements for robotic devices that perform light-duty wrist and arm motion.IKO International's lineup of crossed roller bearings provide rigidity, smooth motion and accuracy in a wide variety of sizes and types to fit various rotating and positioning mechanisms. IKO offers standard, high rigidity and mounting hole type and slim and extra slim versions to meet a range of size and application requirements. Bearings are also available with rubber seals to protect against dust, dirt and grease.

- **Linear Ball Spline Guides.** Available in standard and C-Lube models, these guides have an external cylinder that enables smooth linear motion along a spline shaft, making four-point contact with the raceway. This construction allows the cylinder to move with high accuracy and rigidity, even during fluctuating and complex loads common in material handling applications such as pick and place machines. Flanged and long type cylinders are also available.

Move Goods With Confidence and Efficiency

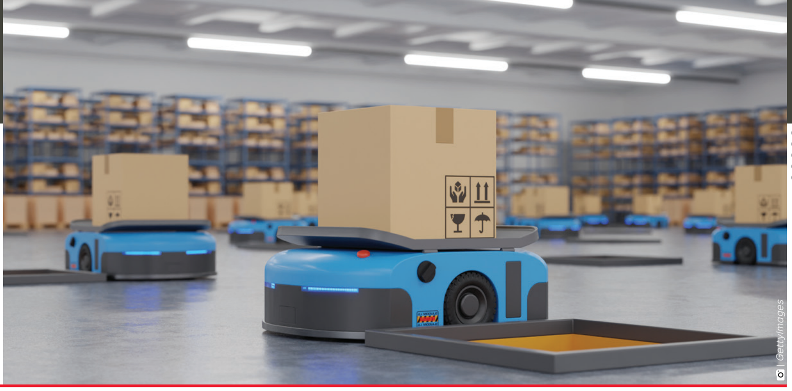
Motion products are proving essential to the automated machines and systems that are transforming storage and retrieval operations. IKO International's lineup of linear roller guides, crossed roller bearings and linear ball splines gives machine designers the rigidity, accuracy and smooth motion these systems require along with design freedom and protection from harsh industrial conditions. That means goods can move quickly, efficiently and reliably, and machines can run longer, providing a better return on investment for automated warehousing systems.

For more information about IKO International's motion products for automated warehouses, contact us.

IKO

Innovation, Know-how & Originality

Drive Systems Used in Warehouse Automation



AGVs in logistics

Where there is e-commerce, there is inevitably logistics management. After all, what could be more efficient than a network-connected **fleet of AGVs** to travel around huge warehouses and find the required product in record time? These automated guided vehicles have enabled the automation **of all these internal transport tasks.** They are able to retrieve goods at height in vertical warehouses before transporting them to the conveying chain. In order to meet the high productivity requirements of order preparation, these AGVs must:

• **Be compact and offer high power density.** The robots must occupy as little space as possible in order to adapt to the confined spaces. Therefore, they need compact motors without compromising on power.

• **Implement SS1 safety regulations** to avoid obstacles and collisions with human operators. In terms of the drive, this involves using integrated temperature sensors in the motor as well as electronics to prevent the risk of overheating.

• **Be connected to the other AGVs in the fleet,** in order to be maneuvered simultaneously within the same space. This connectivity is enabled by EtherCAT, CANopen or I/O bus communication.

• With or without electronics, the IDX 56M motors meet all the criteria, whether used for a traction, lifting or steering system.

Conveyors

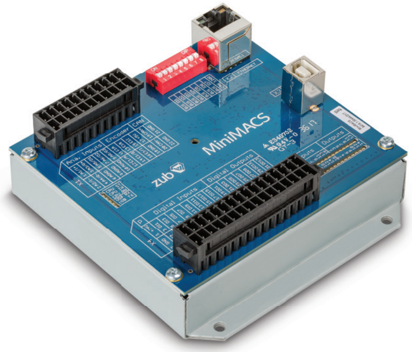
Whether rollers or belts, **conveyors** take care of transporting goods to the operations area, where they are scanned, for instance. During this stage, **maintenance challenges are decisive, as the slightest breakdown would result in huge losses.** Choosing a reliable, connected drive system to minimize maintenance operations is therefore key. This way, **motors with integrated electronics can be controlled remotely** and perform diagnostics or an update without having to be near the machine.

• With its communication buses, the range of **IDX 56L motors** can be controlled remotely, simplifying all your maintenance operations.

Packaging machines

To arrive safely at their destination, goods need to be correctly packaged and labeled. Depending on the size and shape of the product, the packaging machines take care of this stage using **multi-axis systems**. Generally equipped with several independent motors, these machines require a master controller to **synchronize all the operations in the chain**. There are also major challenges here in terms of compact size, maintenance, and connectivity.

The ZUB master controller from maxon allows IDX 56M or 70 motors to operate in complete harmony: while one retrieves a box, the other is already preparing the tape to seal the parcel.

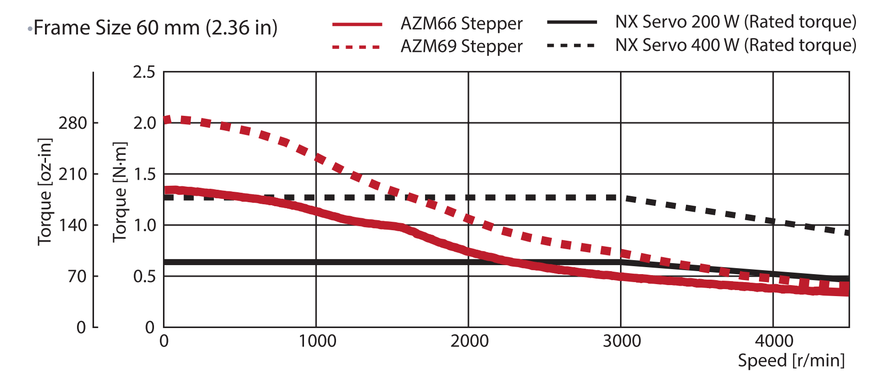


For more info:
Growth in automation in e-commerce - drive.tech

maxon

The choice between servo motors and stepper motors

By **Johann Tang,** Oriental Motor USA Corp.



•Data for the speed–torque characteristics is based on Oriental Motor's internal measurement conditions. If the conditions are changed, the characteristics may also change as a result.

When both servo motors and stepper motors satisfy the basic requirements of a positioning application, it's important to have a deeper understanding of the two technologies.

Motor design

A **stepper motor** design uses an axially magnetized rare earth permanent magnet that is sandwiched between two toothed rotor cups. A rotor cup can have either 50 or 100 teeth, and the two rotor cups are skewed at half a tooth pitch. For a stepper motor, every tooth on both rotor cups becomes a pole.

A **servo motor** design uses a radially magnetized rotor instead of teeth, which is the main reason servo motors have significantly fewer poles. The low number of poles also requires the use of encoder feedback to minimize error, which increases the motor body length.

Stop accuracy

The stop accuracy of a stepper motor is dependent on its winding characteristics, rotor construction accuracy, and number of teeth/poles in its rotor. The stop accuracy of a servo motor depends on assembly accuracy, encoder resolution, and operating algorithm.

For both, friction torque or gravitational load can alter the actual stop position, so there's a small error (+/-0.05° at most) as you move from position to position. While a **stepper motor** offers better repeatability at 7.2° increments or almost perfect repeatability at 360° increments, a **servo motor**'s stop accuracy can be improved by increasing the encoder resolution.

High-speed performance

The high pole count of **stepper motors** allows them to generate high starting torque and run smoothly at low speeds. However, the torque decreases in the high-speed region due to high winding inductance, pole count, and L/R constants. The low pole count and winding inductance of **servo motors** allow them to maintain their torque better throughout their entire speed range.

The performance differences between a stepper motor and a servo motor can be best shown by their speed-torque curves. Stepper motors generally work better for short distances at low speeds while servo motors work better for long distances at high speeds.

Closed-loop feedback

A servo motor system has to operate with closed-loop control, and a stepper motor typically operates with open-loop control. A **servo motor** uses feedback in order to control the motor's position, speed, or torque. A **stepper motor** is commanded to move to a specific location without the need for feedback but could lose synchronism due to overload.

The addition of closed-loop feedback does complicate the driver design and increases the number of components. In addition to a pulse generator, phase sequencer, and FET from a typical stepper motor system, a servo motor system also contains a rotor position counter, F/V converter, current amp, speed amp, position amp, and deviation counter. All of these components are required to run the motor in a PID loop where the driver constantly computes errors and adjusts the proportional/integral/derivative gains for correction on the fly. This is why servo motor systems are more expensive and requires more processing time.

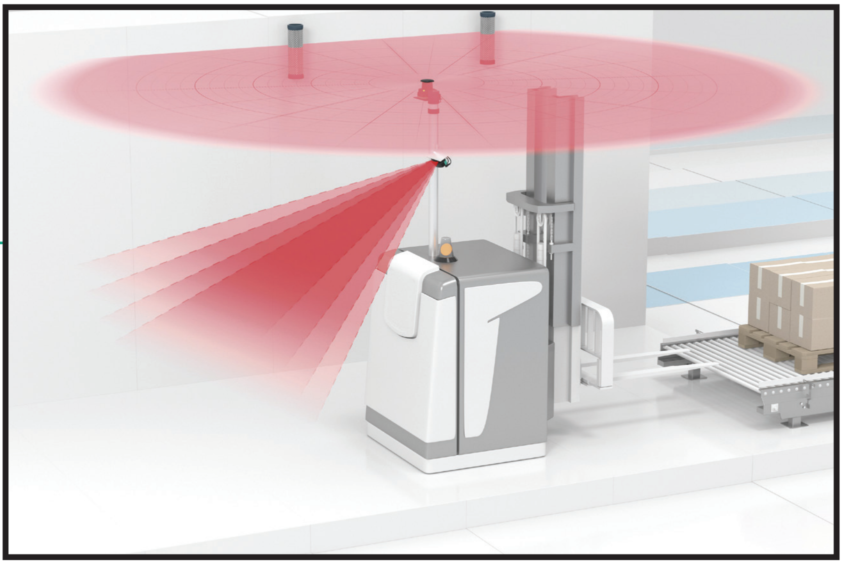
Efficiency

Most **stepper motors** use a current chopper driver technology, which provides a constant current supply regardless of load. Current is proportional to temperature, so a stepper motor's duty cycle needs to be limited to about 50%. **Servo motors** offer more efficient current control because it only draws the current it needs. However, they use more power to generate holding torque than stepper motors.

Closed-loop feedback allows more efficient current control, which affects motor temperature, duty cycle, and performance. Efficient current control also lowers noise, vibration, and energy consumption. Stepper motors tend to vibrate more when not properly sized, while servo motors tend to "hunt" more if not properly sized or tuned.

For users who are looking for a middle ground, closed-loop stepper motors are another alternative.

Orientalmotor



The Evolution of AMR Navigation

By **Zach Steck,** Market Specialist, Material Handling – AGV/AMR

In the world of autonomous mobile robots (AMRs), navigation is the greatest challenge facing material handling design engineering teams. Most commonly, this is accomplished using 2-D LiDAR scanners to identify structures in an environment and map the surrounding area. Data from the scanner, and possibly other sensing technologies, is input into user-created software to determine the robot's location on a virtual map. This navigation technique, which does not require additional hardware such as tapes, wires, or reflectors, is called "natural feature navigation" or "free navigation." The 2-D LiDAR scanners used to accomplish this task provide highly accurate angular position data up to a full 360° rotation, as well as distance feedback per angular step. 2-D LiDAR has undoubtedly been the optimal solution for this type of free navigation in the market for many years.

As self-driving robots continue to evolve, new technological advances are solving increasingly complex applications and behaviors. The goal is to improve warehouse efficiency, accuracy, productivity, and throughput. One example of a growing trend in the AMR market is the introduction of mobile collaborative robots or "Cobots." A cobot is a robot designed to interact directly with a human in a shared space. This means that humans and robots must coexist in close proximity. Collaborative robots are designed for the purpose of performing specific tasks, allowing the human worker to focus on more important priorities. This interaction between robots and humans creates new challenges for AMR navigation, where advanced sensor technologies become even more critical to the design and implementation of the machine.

Traditional 2-D LiDAR solutions offer many benefits, but for this challenging application, there is one key drawback: they can only detect a target in a single plane. Imagine a scenario where a robot is following a human target with a single-plane scanner. If the target bends down to pick up a dropped object, it will no longer be detected by the scanner. For this reason, these applications would need to use a system or scanner that can monitor objects at various height levels. This is where 3-D LiDAR or multilayer LiDAR sensors have become the ideal solution for these types of support task robots. They offer the same advantages as conventional LiDAR solutions by providing a high sampling rate and measurement density while enabling object perception in a 3-D space.

In general, the 3-D LiDAR or multilayer LiDAR sensors provide information that is critical to the navigation and maneuverability of the robot. Another important aspect of these cobots is safety. The self-driving robots must be able to safely navigate the facility and perform tasks such as following a human target without putting the robot itself or others in the facility at risk. As a result, it is common practice to incorporate additional safety-related sensor technologies to perform specific tasks such as collision avoidance. These products carry safety approval to ensure that personnel working in close proximity are protected from harm by providing the necessary redundancy and self-monitoring features. One example technology for this purpose is safe ultrasonic sensor systems. Safety ultrasonic sensors deliver reliable protection results in any environment due to their natural resistance to dirt and debris. Combining 3-D LiDAR with enhanced safety solutions changes the game for collaborative robots and makes material handling easier than ever.

PEPPERL+FUCHS

WAGO's 221 Series Lever Nuts

Raising the bar for electrical applications

In true WAGO fashion, the manufacturer is continually innovating and improving its product offering. WAGO's 221 Series Lever Nuts are an excellent example of this, representing the company's answer to the twist-type splicing wire connector. This termination device quickly and easily connects different wire sizes and types, using 2, 3, and 5-wire connectors.

"A few years ago, WAGO developed the original 222 Series LEVER-NUTS®, which has been effective and successful," shares Evan Syens, Product Manager, Electrical Splicing Connectors with WAGO Corporation. "However, innovation doesn't stop for us just because a product has hit the market. We never settle for 'good enough' and are always striving for better. WAGO is all about ongoing advancements."

To this end, WAGO created their newest version wire-connector solution, the 221 Series LEVER-NUTS®— and they've quickly become one of the company's top-grossing products.

"The biggest difference between the original 222 and the latest 221 Series is the size, as the newest version is smaller," says Syens. "But, perhaps, the most notable feature of our 221 Series LEVER-NUTS® products is their transparent housing, which is significant."

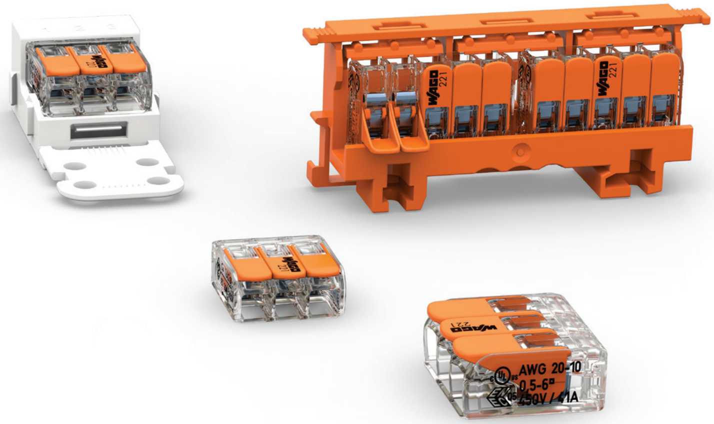
This is because with a typical twist-type connector, it's impossible to know how secure the wire connections are for each terminal, which is a maintenance and safety concern.

"The clear housing completely takes the guesswork out of the installation process," Syens explains. "Without it, how would you know how many twists are ideal for a secure connection? There's room for error. In fact, installers will often secure wires with electrical tape to maintain the twist-type connection. But that's unnecessary, thanks to WAGO's innovation. Simply pull the orange lever up, insert a stripped conductor (according to the strip-length gauge on the side of the 221) and push the lever back down. That's it. You're done."

Since every 221 Series LEVER-NUTS® also includes CAGE CLAMP® technology (the spring-pressured connection technology that WAGO pioneered back in the '50s), installers can also ensure a secure a reliable connection. The CAGE CLAMP® is starting to become the industry standard for electrical interconnection technologies.

What's more, is WAGO has incorporated test slots in the LEVER-NUTS® Series for additional safety — one in the direction of wire insertion and one on the opposite side. This allows an installer to insert a test probe into the slots to determine if a wire is live.

"Another unique feature about these products is that they're reusable, without any added steps. For example, there's no need to re-strip the wires. Simply lift the lever and connect the new wires," he says. "Again, it's that simple."



***WAGO's 221 Series** Lever Nuts*

WAGO offers two different versions of the 221 Series:

- The original variant: 24-12 AWG
- The 10 AWG variant: 20-10 AWG

"The 20 to 10-gauge version also has three variants — a 2, 3, and 5-conductor, which goes up to 600 volts and 30 amps. And, as for the operating temperature, each variant is approved to 105° C," says Syens.

Along with these innovative connectors, WAGO also offers a line of mounting carriers that can be mounted onto a DIN Rail or chassis, easily cleaning up your cabinet, panel, or junction box.

"It's really about peace of mind because with CAGE CLAMP® technology, you can be confident in a secure connection for your application," says Syens.

Whether for an electrical contractor, DIY home projects, lighting applications or use in hazardous locations, WAGO's 221 LEVER-NUTS® Series offers fast, safe, and dependable connection technology.

"Now when people see the orange lever, they associate it with WAGO and know the product can be trusted."

Features of the 221 Series

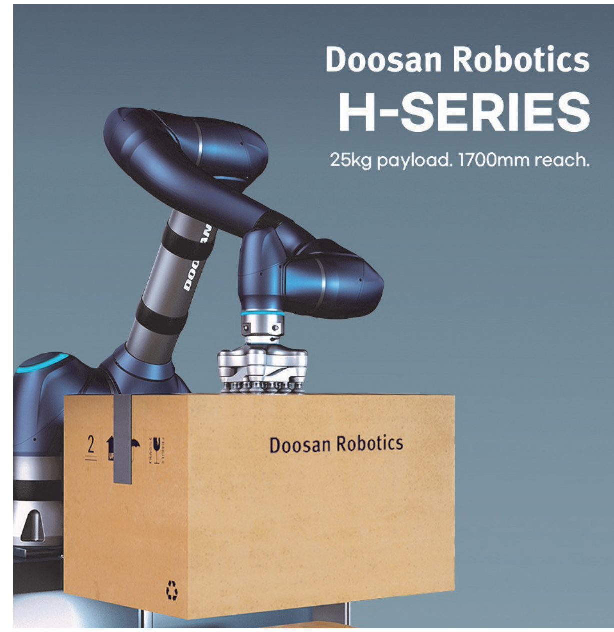
- *Terminate conductors from 24–10 AWG (with two models: 24-12 AWG and 20-10 AWG)*
- *Connect solid, stranded, and fine-stranded conductors*
- *Combine different wire sizes and types*
- *Install devices with higher levels of power consumption*
- *Save time connecting wires without the use of tools*

WAREHOUSE AUTOMATION

Doosan Robotics

Doosan Robotics Leading the Charge in Palletizing Innovation

Known for their dexterity and safety, Doosan Robotics H-SERIES cobots are the most powerful in the marketplace, providing unrivaled and precise performance in palletizing. Featuring a maximum reach of 1700mm and 25kg payload, Doosan's H-SERIES not only has a higher payload and longer reach than competitors, but it can also safely perform highly complex tasks using precise force and compliance control based on the 6-axis force torque sensors. With the highest collision sensitivity in the industry our cobots can also be trusted to share space with personnel, all while enhancing production output and maximizing labor. Doosan Robotics also delivers in a fraction of the time of industry competitors, with an average delivery time of four weeks.



Doosan Robotics

Doosan Robotics

doosanrobotics.com

WAREHOUSE AUTOMATION

Murrelektronik, Inc.

Murrelektronik's modular plug & play solutions allow you to get your vision system up and running quickly thanks to our IP67 rated modules that can be mounted on the machine. This decentralized installation concept significantly cuts planning and installation efforts. Control cabinets can be smaller and cable runs shortened when the modules are put where they are needed. In use, the detailed LED diagnostics in our solutions reduce your equipment downtime if a fault occurs in the system.

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WAREHOUSE AUTOMATION

Parvalux

Why Do AGVs Need Reliable Motors?

Any automated system is only as good as its reliability. An automated guided vehicle (AGV) needs to do the job it is programmed to do, without error, quickly and efficiently. Therefore, the role AGVs play in materials handling is essential and their reliability is dependent on the component parts used to manufacture including robust motors. Motors for AGVs must be reliable and low maintenance and they need to be capable of being in operation 24/7 without loss of functionality.

The type of motor needed for your AGV depends on the type and size of the automated guided vehicle you have, and how much weight it will be expected to transfer at any one time. A motor that is too small won't be able to function long and one that is too big and powerful could cause functionality issues.

The recommended motors for AGVs are brushless DC motors. Brushless motors are more powerful, quieter and lower maintenance solutions that suffer less wear and tear than standard DC motors. By using the appropriate motor for the equipment it can reduce maintenance costs and diminish lost revenues from downtime.

Parvalux offers an expanded selection of brushless motors that are highly efficient with a high starting torque. If you need something more specific, our expert team can design and build custom brushless DC motors for AGVs used in industries all over the world.

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