

# GOODS-TO-PERSON SOLUTIONS: SOLVING THE CHALLENGES OF SMALL-ORDER FULFILLMENT



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## INTRODUCTION

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Many distribution facilities, and particularly those handling e-commerce, are embracing a goods-to-person approach as a solution to achieve improved efficiency in their small-order fulfillment processes. Representing a 180-degree turnaround from a fulfillment model where the worker goes to the goods to make the pick, in a goods-to-person model the picker is stationary, utilizing technology to facilitate the inventory storage and movement. Capable of handling thousands or tens-of-thousands of different SKUs, these systems allow inventory to be stored, picked, packed and shipped with a very high level of efficiency, optimized labor usage and minimized operational costs. Some of the latest automated goods-to-person solutions, such as those offered by Swisslog Warehouse and Distribution Solutions, are highly flexible and scalable, and offer attractive returns on investment.

As traditional retailers increasingly embrace e-commerce and omni-channel fulfillment, the need grows to support an ever-increasing number of SKUs that typically include both fast- and slow-moving items. From the moment the online order is placed to when it is picked, packed and shipped, every step in the process must be handled efficiently, consistently and cost effectively. Speed of order fulfillment, order accuracy, minimized returns and customer satisfaction are critical priorities.

The typical e-commerce consumer expects: cross-channel services such as 'click-and-collect' and 'order-to-deliver'; wider online SKU offerings; online storefronts; order accuracy; fast and free delivery; free returns; and a mobile retail site. When these consumer needs are compared to distribution in an e-commerce environment, they present significant challenges for e-fulfillment. These challenges include:

- a. Large SKU counts with a long, slow moving tail;
- b. High and unpredictable growth;
- c. High penalty for poor performance resulting in potential brand damage;
- d. Uncertain business terrain that demands flexible and adaptive solutions;
- e. Demand for real-time and accurate inventory visibility;
- f. Small number of order lines per order;
- g. High returns from end customer;
- h. Extreme peak season volumes.

# INTRODUCTION

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"E-fulfillment requires scalable operations and highly flexible systems to address these inherent challenges," said Roland Martin, Global Market Leader for E-commerce and Retail, Swisslog Warehouse & Distribution Solutions (WDS). "Within e-commerce distribution, where unpredictability is a constant factor, flexibility in the supply chain becomes critical. Flexibility can be derived from implementing the right automation that can support the fluidity that e-commerce services require.

"The right automation allows fewer manual touches, resulting in more accurate orders, improved ergonomics, lower labor costs and travel time, and fewer returns. It also saves space by operating in a smaller footprint," added Martin. "A successful e-commerce small-order fulfillment implementation requires carefully planned processes, scalable operations and highly efficient systems to address its inherent challenges. An automated goods-to-person is often the best approach."

In the automated goods-to-person concept, incoming goods or cartons are placed into totes or trays, which are stored in high-density automated storage and retrieval systems. As orders are required to be fulfilled, SKUs are automatically retrieved from storage and brought to the picker at a pick/pack station. Since the picker does not have to travel, the focus at the pick/pack station is on ergonomics and high productivity, eliminating the significant travel required in traditional person-to-goods picking operations.



## WEIGHING THE GOODS-TO-PERSON OPTIONS

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Automated goods-to-person solutions come in a variety of forms and configurations. They can incorporate high-density storage systems, pallet-based or tote/carton-based systems, horizontal and vertical carousels, robots and vertical lift modules. The goods-to-person solution selected needs to fully embrace the needs of the distribution operation. In the evaluation of different automated goods-to-person systems, a number of key points should be considered:

- + **Flexibility and Scalability** – When assessing a goods-to-person system for small-order e-commerce and omni-channel fulfillment, expanding SKUs, fluctuations in throughput volume and potential reduction of SKUs need to be considered. Seasonal influences, and the rise and fall of the popularity of items offered online,

necessitate the need for highly flexible and scalable goods-to-person automated systems.

- + **High-Speed Throughput** – Shuttle systems deliver extremely short order processing times, reaching up to 1,000 items and 600 lines per hour for each aisle.
- + **Redundancy, Avoidance of Single-Point System Failure** – Central to the performance capability of any automated goods-to-person system is its ability to access 100 percent of SKUs. If one section of the system was to be disabled for repairs, for example, the system would continue to operate at 100 percent functionality because of built-in redundancy.

# WEIGHING THE GOODS-TO-PERSON OPTIONS

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- + **Maximized Storage Density** – Those goods-to-person systems that are highly efficient have achieved a high density of space utilization. This means they have a space configuration that allows for the maximum number of bin positions to fit into the system, and utilize both the footprint and the facility height effectively.
- + **Simultaneous Storage and Retrieval** – Putting items into storage and retrieving items for orders simultaneously, as opposed to sequentially, can make a significant difference in the speed and efficiency for optimum handling of orders on a high-throughput basis.
- + **System Simplicity and Uptime** – The performance of any automated goods-to-person fulfillment system is only as good as its availability. Simplicity of process operation is fundamental to minimizing breakdowns, wear and maintenance requirements, and subsequent increased throughput with lower operating costs.



# STREAMLINED GOODS-TO-PERSON SOLUTIONS

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Goods-to-person systems vary in the extent to which they support all of the above attributes. Each operation needs to assess which characteristics are critical to its particular needs, and identify a system that best approximates these.

"An intralogistics challenge, like e-commerce and omnichannel fulfillment, as well as spare parts replacement, can be solved in many different ways," said Kenneth Hayer, Director of Consulting, Swisslog WDS Americas. "There is a diverse spectrum of technologies that can be used for each area – receiving, storage, picking, shipping. It is really about tailoring a solution that best fits the application."

The following goods-to-person solutions, offered by Swisslog, represent examples of the industry's most streamlined and efficient systems for goods-to-person fulfillment under different requirements:

## **CycloneCarrier® – Best-in-Class, High-Rate Product Throughput**

CycloneCarrier is a streamlined shuttle system for the dynamic storage and retrieval of light goods. It was designed for industries where high throughput and a high level of product availability are essential, such as e-commerce, pharmaceutical and fresh food. CycloneCarrier is exceptional for its ability to consolidate and release totes with product at high rates in required sequences.

High storage density, high-speed throughput and maximum product availability are key characteristics of CycloneCarrier. The system offers single-deep, double-deep and quadruple-deep storage of totes, trays and cartons, while highly-dynamic lifts and shuttle vehicles deliver short order processing times with an hourly throughput rate of up to 1,000 infeeds and outfeeds per aisle.

# STREAMLINED GOODS-TO-PERSON SOLUTIONS

Each storage level in an aisle is equipped with one shuttle vehicle, which is available with either fixed-width or flexible-and-adjustable load-handling devices (arms). The innovative load-handling devices ensure reliable control and safe loading, which reduces downtime. The clearance for the fingers on the arms, which pull or push the cartons and totes, is automatically checked prior to loading, and, if blocked, adjustments are automatically made so the carton or tote can be loaded safely.

"CycloneCarrier is unique in that the shuttle's load-handling devices can be moved independently, and automatically, to better grip product in lanes on either side of the aisle" said Kirt Laeske, Product Manager, Robotics Solutions, Swisslog WDS. "The device's fingers can open cartons independently, left or right. This provides advantages in pulling out boxes or cartons from the rack and makes the system even more reliable."

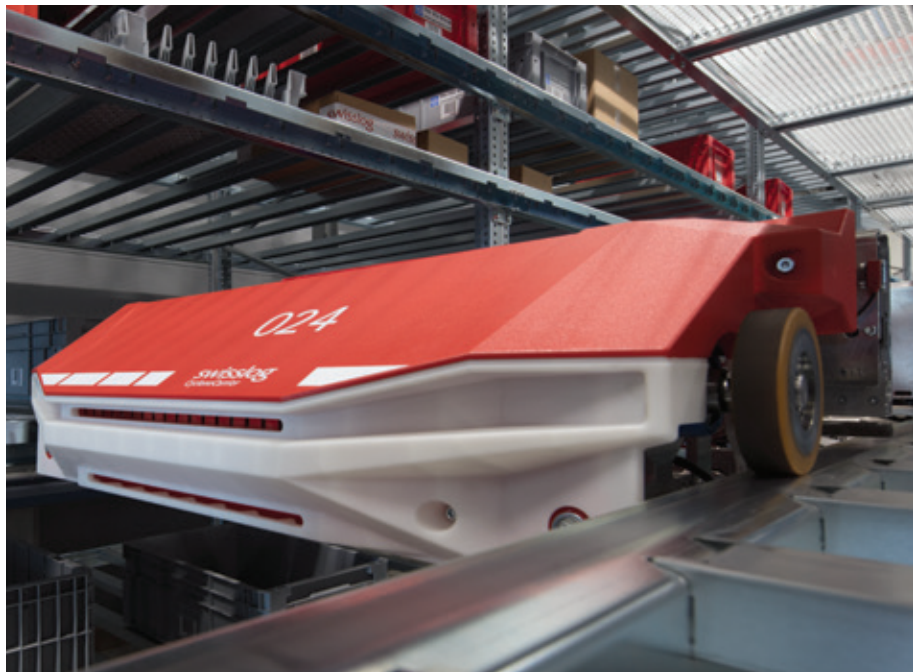
Each aisle has one lift for storage and retrieval. Transfer conveyors act as buffers between the lifts and shuttle vehicles, which are installed on each level of the customizable rack. A double-deck version with two conveyors is available for applications that require maximum performance.

When service and maintenance is required, vehicles, lifts and conveyors are easy to reach through built-in maintenance

aisles. The shuttle's plug-and-play design allows for quick replacement, if required, affecting throughput only on the aisle where the shuttle is located.

As part of a complete solution for light-goods handling, CycloneCarrier's storage-and-retrieval application software manages transport tasks for all movement of goods throughout the system, integrating seamlessly with associated logistics processes. For example, CycloneCarrier can be used as a feeding engine for goods-to-person picking or as an intelligently designed buffer system for order consolidation. The shuttle system can handle a wide variety of cartons, trays and totes, transporting even critical goods safely and securely in both ambient and chilled environments as low as 32° F. The system permits a variety of dimensional configuration options to meet individual space requirements.

High storage density, high-speed throughput and maximum product availability are key characteristics of CycloneCarrier.



# STREAMLINED GOODS-TO-PERSON SOLUTIONS



## AutoStore® – Maximized Storage Density and Configuration Flexibility

AutoStore is a highly automated robotic goods-to-person system, designed for handling high volumes of both fast- and slow-moving small-order and small-case-pick SKUs, for fulfillment operations that require outstanding storage density and a high degree of flexibility for dimensional configuration. This system is ideal for retrofitting into existing buildings, making optimal use of the available cube. AutoStore delivers the highest cubic-space density utilization of all goods-to-person small-order/small-case automated storage and pick systems.

The goods-to-person system is made up of a three-dimensional grid of self-supporting bins that are moved to pick stations by independently operating robots. The robots are equipped with a lift for picking up, carrying and putting product into the bins that are stored within the grid. Each robot has two sets of wheels that enable it to move along X/Y axes. This makes it possible for all robots to reach any position on the grid, eliminating single-point system failure and providing 100 percent product redundancy. The robots communicate via wireless controls to the software and pick stations through a standard application interface (API).

When a robot delivers a bin to a pick station, the worker picks the required number of units and the robot returns it back

to storage. The new bins are delivered back-to-back, and the operator rarely has to wait for bins. Picking and putting can be executed simultaneously. A variety of work station configurations can be deployed to allow batch picking based on orders or SKUs. Any order can be redirected to any one of the pick stations, at will, as the need arises. An operator panel on each pick station displays the pick status information for any order.

AutoStore holds approximately 30 minutes of live picking tasks (more than 700) in its queue at any one time, and continuously optimizes the delivery of bins to pick stations. It automatically rearranges the storage position of goods in the grid by keeping the more frequently requested products higher up and closer to the transport grid for faster access times. Ninety to 95 percent of what is picked most often is in the three upper layers. This minimizes the time to access goods, increasing efficiency.

The system stores goods with minimum space requirements, using the available storage space to the maximum. The bins are stacked on top of each other, which makes it a very compact solution. This results in up to 60 percent better utilization of space than other automatic storage systems, and 300 percent better than in conventional rack systems. In typical installations, up to 87 percent of the available cube space can be utilized for storage.

AutoStore can be configured to fit different building heights, span multiple levels and even surround obstacles in the warehouse, such as pillars or walls. If future needs warrant, additional storage space can be added by simply extending the system's grid. Additionally, pick rates can be enhanced by adding more robots to the system – almost any number of robots can be added depending on required throughput. These changes can be implemented while minimally interfering with ongoing warehouse operations.

"Because AutoStore uses no conveyors, it is much less noisy than typical goods to person installations with conveyors," said Juergen Baeumle, Head of Consulting, Central Europe, Swisslog WDS. "This can be an important consideration for many distribution executives."

Swisslog is the largest, most experienced global distributor and integrator of AutoStore, which is a registered trademark of AutoStore AS, and manufactured by the company in Norway (the AutoStore logo is a registered trademark of Jakob Hatteland Logistics AS).

# STREAMLINED GOODS-TO-PERSON SOLUTIONS

## CarryPick® – Modular Robotics Quickly Adjust to Changing E-Commerce Needs

One system that embodies simplicity and uptime is CarryPick, a modular robotics solution that is flexible, scalable and quickly adaptable to changing demands in warehousing. The automated storage and goods-to-person order picking system is specifically designed for fulfilling e-commerce business where product variability, delivery time and cost efficiency are critical. Its modular concept perfectly fits into existing buildings with low ceiling heights, and it can be extended and relocated on very short notice.

CarryPick consists of only four components: mobile racks, automated guided robotic vehicles, Swisslog's ProPick® workstations and SynQ software. The multifunctional workstations are continually supplied with mobile racks by the automated guided vehicles. Controlled and monitored by the SynQ warehouse management system, CarryPick combines storage with replenishment and picking functionality, and handles returns in a very efficient way.

The modular design permits starting out with a basic version that consists of a limited number of components. As fulfillment needs grow and the warehouse and picking capacity needs to be expanded, it is easy to add workstations, mobile robots and racks to the system. It can easily integrate into existing structures. The storage space does not need to be lit, ventilated or heated, which results in remarkable energy savings in the entire storage area.

"Whether a small e-commerce start-up or a large retailer that needs an e-commerce fulfillment center, CarryPick permits e-commerce fulfillment to be set up in a small facility without the need for a 30 – 40 foot clear ceiling height, and without investing a large amount of capital up front for automation," said Jeff Ross, Vice President Implementation for E-Commerce/Retail, Swisslog WDS Americas.



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"CarryPick's best application is for medium- and slower-moving SKUs, where the picker would be traveling the greatest distances between picks," continued Ross. "This is where picking productivity will see its greatest gains – the bins are doing the walking instead of the picker. It takes all of the picking travel out of the equation."

CarryPick supports storage in cartons, bins or single items in its mobile goods carriers. The robot vehicles lift and transport shelving on an optimized route to workstations. At each ergonomic workstation, customer-specific processes are integrated using both pick-by-light and put-to-light techniques, which provide increased productivity and maximized pick quality.

"The mobile robots process orders independently within the system," added Laeske. "Because of their small size, they can move quickly between and under racks. The vehicles are able to lift goods with a weight of over 1,300 pounds."

CarryPick robots can be used in any industry or location and quickly adapt to changes in conditions, such as product heterogeneity, volume and performance. Each mobile rack within the CarryPick system can be variable. Depending on the requirements, the rack can be equipped with bottom inserts, compartments, drawers, bins or hanging bars. This allows the storage of products with a variety of sizes and weights.

The system utilizes a fleet-manager control center to coordinate the interaction of the robotic vehicles. Dynamic route planning and integrated power management make it possible to optimize order handling. A Wi-Fi network is used for communication with the robots.

The high-performance SynQ warehouse management system controls order processing, stock replenishment and returns handling. SynQ performs a continuous physical inventory of the stock to check and safeguard delivery reliability. It ensures fast-moving items are stored closer to the workstations, while slower-moving items are placed in the back of the warehouse. The software offers advanced visualization options, as well as a wide palate of data analytics.

# STREAMLINED GOODS-TO-PERSON SOLUTIONS

## AutoPiQ – Humans Teamed with Robots to Improve Picking Performance

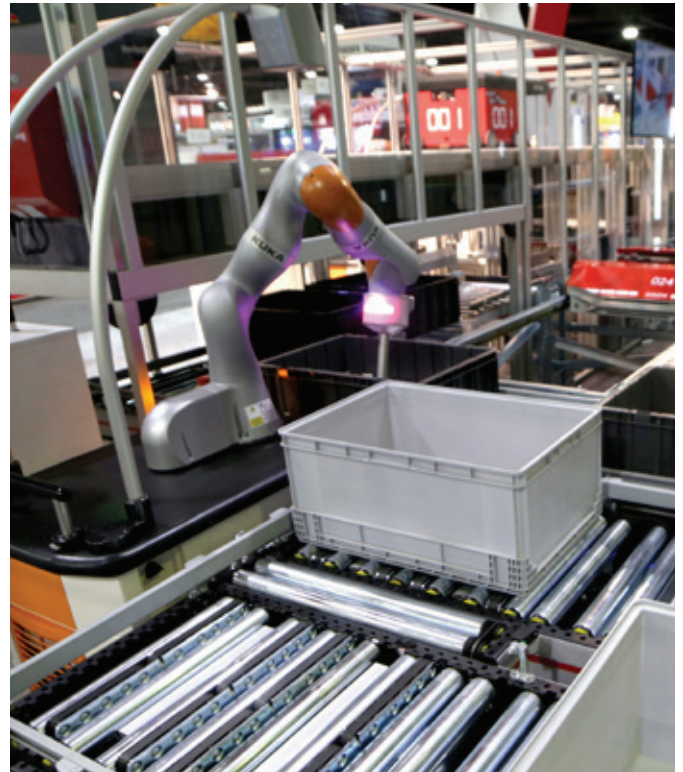
This fully automated picking station teams humans with robots, enabling direct cooperation between the picker and the robot. The core component of this solution is KUKA's highly sensitive LBR iiwa lightweight robot. AutoPiQ intelligently complements light goods-to-person systems, and delivers accelerated and improved picking performance.

AutoPiQ is equipped with state-of-the-art sensor technology and a 7-axis gripper. When networked with automated goods-to-person warehouse systems, such as CycloneCarrier, AutoStore or CarryPick, LBR iiwa is able to assist human workers with picking tasks. As such, AutoPiQ is an automated picking solution only; it does not provide storage and retrieval functions.

The AutoPiQ solution is designed for repeated single-item picks for fast fulfillment of orders. It is based on a shared picking principle. The robot picks the items that it is able to pick – which can be up to 95 percent of the product range – and a worker finishes the order. Both can pick into the same bin or split orders into two lines depending on requirements.

Innovative 3D vision technology is used for object recognition in the source bin. It consists of a 3D camera detecting a point cloud as well as a 2D camera identifying the product contours. In combination with the software algorithm, the intelligent vision system determines grasping points of unknown products. The robot features a multifunctional gripper family, allowing it to be adapted to most applications. Depending on the product, the gripper is able to pick small, medium and large items using a combination of suction and mechanical grasping.

To enable high performance, the robot works primarily in a fast-speed mode. Once a human enters the safety zone, it automatically switches into human/robot cooperation mode for safety. This robot will sense the human and slow down to prevent injury to the worker.



"Smart human-robot collaboration makes order fulfillment significantly faster, less error-prone and more flexible," continued Martin. "Automated pick stations, like AutoPiQ, can be operational 24 hours a day, 7 days a week."

Not only does AutoPiQ support the picking process by working hand-in-hand with humans, it permits workers to focus more on value added services.

"As a result of the close cooperation between Swisslog and KUKA, industry solutions, like AutoPiQ, are becoming the centerpieces of state-of-the-art material flow and logistics concepts," explained Martin. "These systems perfectly suit the requirements of e-commerce, pharmaceutical and spare parts logistics."

AutoPiQ intelligently complements light goods-to-person systems, and delivers accelerated and improved picking performance.



# STREAMLINED GOODS-TO-PERSON SOLUTIONS

## Tornado Miniload Crane – AS/RS Technology for Case Handling in E-Commerce and OCF

The Tornado miniload crane transports light goods like totes, trays and cartons fast and reliably for e-commerce and omni-channel fulfillment and replenishment. Typical areas of application are distribution centers, production storage, buffer storage, chilled or frozen storage to minus 18.4° F, and stainless steel applications in the food and beverage sector, such as the meat industry.

The Tornado crane moves up and down a single aisle to both store and retrieve products in a single-deep or double-deep configuration. It is the world's fastest miniload crane, due to consistent weight optimization, modern control technology and an energy-saving design. The Tornado is designed from the ground up to be quick, efficient, and effective in mini-load automated storage and retrieval operations.



## DELIVERING PRODUCTIVITY

Fast, efficient and correct delivery is a strong competitive advantage in any market, and streamlined, automated small-order goods-to-person fulfillment will define retail success, and specifically e-commerce success, in this era of global reach and niche retailing.

"It is important to fit the system to the requirements," said Baeumle. "For example, CarryPick can deliver throughput of up to 1,200 order lines per hour. For this throughput it is quite efficient. AutoStore throughput starts in the range of 300 lines per hour, and reaches up to 3,000 order lines. But for the big players even that may not be enough. They need a system that can handle many more thousands of lines per hour. For them, CycloneCarrier would be a better fit. Starting at 600 lines per hour, the system can exceed 10,000 lines with ease."

Utilizing a streamlined, highly-efficient automated goods-to-person solution, an omni-channel or dedicated e-commerce

fulfillment center can expect to see a doubling or tripling in picking activity over conventional manual-based picking methods.

"We see a much more willing attitude on the part of logistics executives toward accepting automated goods-to-person solutions," explained Ross. "The technology has definitely advanced over the past five years. It is very clear that these high-performance systems can deliver the productivity they require."

With the emergence of a more highly-streamlined good-to-person capability, a level of flexibility and efficiency above and beyond the capabilities of conventional automated and manual small-order pick systems has been realized. Design flexibility, optimized space utilization, improved productivity, increased accuracy and reduced labor needs are the key benefits of this new generation of automated goods-to-person storage and picking systems.