OVERCOME MANUAL DEPALLETIZING CHALLENGES WITHOUT SACRIFICING PRODUCTIVITY

How Automation Is Tackling One of the Toughest Distribution Center (DC) Jobs

Honeywell Intelligrated®

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INTRODUCTION

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In recent years, the number and variety of products available to e-commerce consumers have expanded dramatically. Many companies have doubled the number of SKUs they offer simply to provide more consumer-friendly options. And there's no end in sight.

With this diversity of SKUs has come an ever-expanding variety of pallet load patterns. Even when a company receives multiple pallets of the same SKU, the SKUs can vary from pallet to pallet. This has traditionally complicated the automation of depalletizing, since robots have typically required each different load pattern to be pre-programmed. At the rate SKUs are expanding, constantly programming new patterns is neither practical nor cost-effective. As a result, depalletizing remains a manual operation in most DCs.

Another major hassle this trend has created is that an increasing number of goods are received by retailers and e-commerce operations as mixed-SKU pallets, whether they come from manufacturers, distributors, transhippers or wholesalers. In addition, retail distribution operations build mixed-SKU pallets in their operations while batch picking store replenishment orders in a bid to achieve efficiencies in picking. The processes of breaking down these pallets and placing their contents into storage or a warehouse automation system are common bottlenecks for these operations — and are becoming growing threats to profitability.

DULL, DIRTY AND DANGEROUS

While most DCs still use manual labor to break down pallet loads, it's a physically demanding job that's difficult to staff. What's more, manual lifting and handling tasks like these are among the leading causes of injury in a DC. Shoulder and back injuries account for more than 36 percent of cases that lead to missed workdays. Strains and sprains are also common hazards that result from lifting loads improperly or handling items that are too large or heavy.

Even when manual operations are running smoothly without injuries, depalletization output is variable and limited by human constraints. Worker fatigue, for example, can cause productivity to diminish over the course of a shift. Inefficiency can also result from a variety of other factors, including absenteeism, distraction and lack of supervision.

Most challenging of all, however, is simply finding enough labor in the first place. In 2020, the number of unfilled warehouse and DC jobs rose to 1.2 million in the U.S., only partly alleviated by a massive short-term spike in the unemployment rate as a result of the pandemic. Globally, it's estimated that the warehouse sector employed the equivalent of 8.5 million full-time employees in 2020. But the number of workers the industry requires is expected to grow to nearly 13 million by 2025. This worker scarcity, plus rising minimum wage standards in high-population areas, is putting pressure on labor costs. In addition, strenuous jobs like unloading pallets have some of the highest turnover rates — in an industry that averages annual turnover of 44 percent or more — at a cost between $3,000 and $10,000 per lost employee.

THE CASE FOR AUTOMATION

With so many downsides to manual depalletization, automation would seem like an obvious solution. As already noted, however, flexible depalletizing has historically been challenging for robots to handle.

The job doesn't sound like rocket science. Pallets arrive with a virtually random assortment of items or SKUs, each potentially positioned, oriented and labeled in a different way. All you have to do is pick up each item and put it onto a conveyor. But while humans can easily deal with the perception and cognitive tasks involved — locating an item to pick, determining the best way to lift and move the item based on its size and weight, and executing the task successfully — robotic programming has taken a while to catch up. As a result, most automated depalletizing solutions to date have only been practical for operations that handle consistently sized cases and load configurations. These have typically required specialized expertise or costly third-party solutions to integrate, needed frequent operator attention and reprogramming to handle ever-changing SKU and load profiles, and often suffered from limited aftermarket support.

All of these limitations, however, have been overcome by major improvements in three key technologies:

- Significant advances in vision and perception
- Development of sophisticated machine learning
- Innovations in gripping technology

Together, these breakthroughs are driving fully automated solutions capable of meeting or exceeding the throughput of manual operations. This report will highlight the significant benefits these solutions have to offer modern DCs and other fulfillment operations. It will also examine the increasingly attractive business case for doing so.

SMART FLEXIBLE DEPALLETIZING COMES OF AGE

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While fully automated solutions for depalletizing have been elusive for many years, they're a practical reality today. Here's a quick summary of the technologies that are making them work.

THE VISION

The core of automated depalletizing solutions is an articulated robot arm, guided by advanced vision and perception technologies that make it possible for a robot to pick single-SKU or mixed-SKU cases from a pallet onto a fixed or mobile location. Computer vision identifies the precise location of every item on the pallet, while perception software automatically recognizes a wide variety of packaging. The system also notes any potential orientation challenges, such as packages that aren't level on the pallet. This technology enables a robotic depalletizer to seamlessly handle a continuous flow of mixed-SKU or single-SKU pallets — in any sequence — without requiring any pre-programming, minimizing the need for operator intervention.

THE LOGIC

Modern robotic depalletizers use advanced machine learning capable of accommodating the unique challenges of the task at hand. Motion planning optimizes the movements of the robotic arm to ensure maximum picking speed and efficiency. The control logic also senses the weight of each item as the robot lifts it, and automatically responds with the ideal lifting force.

GETTING A GRIP

Gripping technology on the robot's end-of-arm (EOA) tooling enables automated depalletizers to work faster with less product damage compared to manual crews. The robot is capable of handling loads of up to 80 pounds, from as large as a microwave oven down to the size of a small tissue box. When the perception software identifies an item that isn't lying flat on the pallet, the gripper automatically compensates by adjusting to the correct angle.

BENEFITS OF A SMART FLEXIBLE SOLUTION

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Smart flexible robotic depalletizers alleviate many of the most common concerns associated with manual handling operations, offering significant advantages to workers and operators without sacrificing the flexibility inherent in manual operations.

OPERATIONAL FLEXIBILITY

Smart flexible robotic depalletizers have the ability to autonomously process single- and mixed-SKU pallets in any sequence or pattern. This enables the depalletizing cell to work continuously without interruption. Best of all, no pre-programming is required for the solution to function.

This versatility includes pallets up to 8 feet tall when layers above 72 inches are built with consistent SKUs — a task that would normally require a mechanical pallet lift or other expensive equipment. The robot can automatically detect and remove slip sheets, further increasing the range of pallets that can be handled by automation. It can also integrate with automated pallet feed systems — enabling continuous operation without human supervision — or signal an operator to perform a change-out when it detects that a pallet is empty.

Equipped with smart flexible handling capabilities that leverage artificial intelligence (AI), gripping technologies and motion planning, depalletizing robots can seamlessly transition from mixed-SKU to single-SKU pallets — in any pattern or sequence — without requiring additional programming or operator intervention.

FASTER THROUGHPUT AT LOWER OPERATIONAL COST

Automated depalletizing solutions provide consistent, predictable throughput. While an individual operator's rate can range from 150 to 600 cartons per hour (CPH), this rate can degrade throughout a shift, depending on the length and frequency of breaks, distractions, lack of supervision or poor ergonomics. Standard operation can also be disrupted by worker absenteeism, employee turnover or labor shortages.

A robot cell works in the same CPH range, but can achieve higher depalletizing rates by operating consistently without interruption over multiple shifts. Depending on the configuration, the system is capable of operating with little or no human oversight. By reducing labor dependency in this way, the solution helps to control labor costs without sacrificing productivity.

The robot can employ a variety of throughput-increasing strategies, depending on the pallet being processed. Multiple smaller items can be picked simultaneously, increasing throughput. The robot can also boost throughput when it detects consistent layers, as well as adjust speed and motion paths based on item height and/or weight.

Even unstable pallets pose few challenges. If a box falls to the floor, it can be retrieved automatically, as long as it's within the robot's safe operating area. If your depalletizing cell is configured for manual replenishment, the robot can also determine when the current pallet is empty and signal the operator for a change-out.

Reliable depalletizing rates are of growing importance as consumer preferences continue to accelerate the rate of packaging changes and the increasing SKU mix DCs handle every day. Since depalletizing is one of the most common bottlenecks, the throughput advantages of an automated solution can generate return on investment (ROI) very quickly by enabling your DC to keep up with its daily order volume.

OVERCOMING MANUAL HANDLING CHALLENGES

Smart flexible depalletizing cells can deliver immediate benefits by eliminating many drawbacks of manual handling. For example, they significantly mitigate potential operational risks that can be caused by labor scarcity. Freeing workers from back-breaking labor not only reduces employee injuries, it enables them to be shifted to higher-value jobs.

Automation also simplifies management's tasks by delivering reliable results and improving expense visibility. Teams can be scheduled with far greater accuracy, eliminating common worker frustrations that can impact employee retention.

EASY DEPLOYMENT AND OPERATION

Depalletizers are simple and intuitive systems that can be deployed quickly without making major changes to your operation. Their modular designs enable a variety of flexible configurations (see page 7), any of which can be operated with a simple and intuitive user interface.

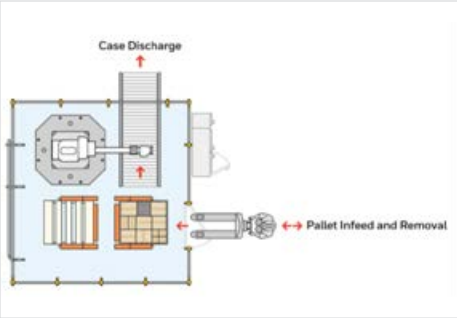
Modular configuration options ensure that turnkey depalletizing cells integrate seamlessly into your existing workflows, conforming to suit your DC's specific footprint and operational needs.

The basic configuration in this example consists of a robot, its base, a single-case gripper, plus an integrated vision hardware mounting and safety system. The robot is enclosed inside a safety fence with a lockable motion disconnect switch and optional trapped key. Pallet infeed and removal are managed by a human operator. Despite its small footprint, this layout provides all that is needed to automate one of the most strenuous jobs in a DC, while offering simple integration with downstream systems.

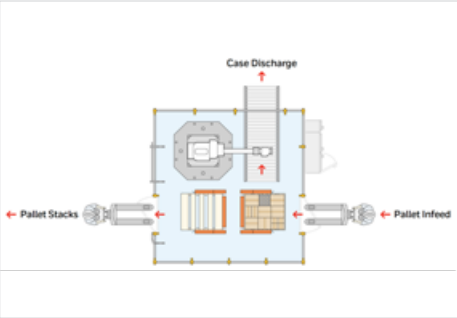
The performance of the base configuration can be enhanced with a variety of options that improve system throughput, enable longer sustained automatic operation, and reduce the need for operator support. These include pallet handling by the robot itself or a dedicated pallet stacker, automated infeed and discharge options (with feed conveyors capable of staging multiple pallets for the cell), and single-side options that reduce operator travel.

For maximum flexibility in the smallest possible footprint, the depalletizing robot can work in conjunction with autonomous mobile robots (AMRs). Capable of moving loads of up to 2,500 pounds, pallet conveyance AMRs enable continuous operation of the system — with no human intervention — while providing the flexibility to stage pallets and empty stacks virtually anywhere the robot is capable of traveling.

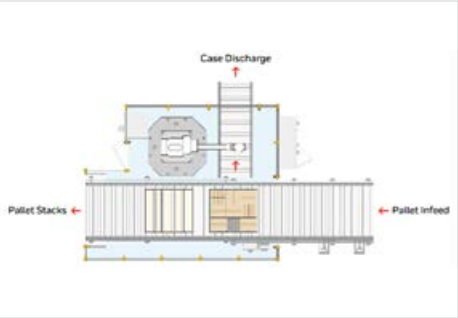
FLEXIBLE SYSTEM CONFIGURATION



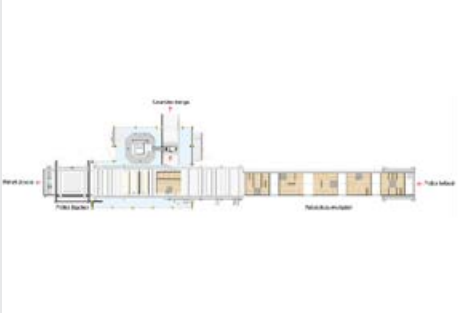
Manual feed



Robotic pallet handling

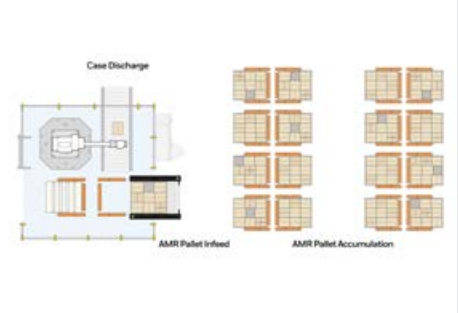


Automatic infeed and discharge options



Automatic pallet stacking

Single-side options



Integration with AMRs

CONSIDERATIONS FOR SUCCESSFUL DEPLOYMENT

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While many suppliers offer automated depalletizing solutions, few can claim to recommend robotic applications based on end-to-end knowledge of the logistics ecosystem. Look for the system capabilities and partner traits detailed here to ensure the most reliable performance and rapid ROI.

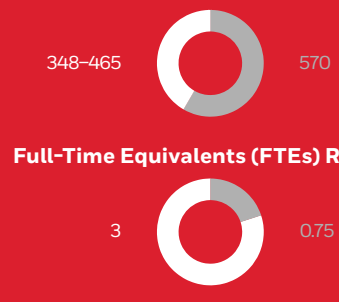
- **Flexible configuration** — Your depalletizing solution needs to conform to the layout of your unique operation, not the other way around.
- **Easy integration** — Depalletizing cells should integrate seamlessly with your existing infrastructure.
- **Intuitive user interface** — You should be able to operate your system with simple, easy-to-understand controls that require only minimal training.
- **Turnkey deployment** — Your partner should be able to install a complete, ready-to-use system in short order, including safety risk assessments on all deployments. You shouldn't need highly specialized workers to operate the system or complicated third-party integrations that could hinder future upgrades.
- **Strong aftermarket support** — Don't settle for a partner who's just interested in making a quick sale before moving on to the next customer. You may pay a bit less upfront, but you're likely to spend a lot more over time — and probably sooner than you expect.
- **A3 certification** — Look for a partner who is recognized by the Association for Advancing Automation (A3) as a Certified Robot Integrator. This designation is only awarded to organizations which have already achieved high levels of proficiency, experience and safety.

A3 ROBOTICS | CERTIFIED Robot Integrator

- **Bottom-line focus** — Any depalletizing solution should be deployed with the goal of improving your operation's success and profitability. This is best accomplished by a partner who can provide quantifiable insights that will optimize designs, meet your goals, solve problems, reduce risks, and improve performance.
- **Alternative financing options** — Your partner should offer one or more financing options that enable you to lower your investment threshold, capture value over time, and drive faster ROI. For example, the Robotics as a Service (RaaS) model provides a means to robotically depalletize mixed-SKU pallets while lowering the initial expense of a robotic solution deployment by as much as 80 percent.

SAMPLE LABOR SAVINGS*

450–600	Cases per hour (CPH)	600
PEAK LABOR RATE		PEAK ROBOT RATE
78%		95%
TYPICAL LABOR UTILIZATION		TYPICAL ROBOT UTILIZATION
348–465 CPH	Full-Time Equivalents (FTEs) Required	570 CPH
DERATED HOURLY PERFORMANCE		DERATED HOURLY PERFORMANCE
3	2.93–4.15	0.75
ANNUAL FTEs to run manual depalletizing cell	ANNUAL FTE SAVINGS**	ANNUAL FTEs to supervise robot



* Additional savings can be realized through: Fewer safety instances / injuries, lower associated costs; Reduced burden on front line supervisors, reallocate to more critical operations; Increased value through processing more items throughout your DCs

**Includes productivity gains from consistent robotic operation

SMART ROBOTICS ENABLE A SMARTER DC

At Honeywell Robotics, we care about delivering measurable results, not just a piece of technology.

Smart flexible depalletizing offers both technical and operational innovation and helps to ensure your success with a practical solution to a long-standing challenge within warehouse operations. Depending on the complexity of your needs, mixed-SKU depalletizing cells can be seamlessly integrated into most operations in a matter of weeks, relieving your valuable workforce of an arduous and back-breaking task while enabling them to focus on higher-value work with better retention rates.

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