Solution Guide

# 7 Space-Saving Technologies


kardex

# Solving the space challenge

One of the biggest challenges companies face in intralogistics is a lack of space, leading to inefficient storage, slower processes, higher costs, and lower customer satisfaction. In the time of Industry 4.0 and rapid technological advancements in production, alongside increasing e-commerce and omni-channel distribution, companies need to optimize their warehouse or production design with digitalized processes to remain competitive.

An investment in automated storage and retrieval systems (ASRS) enables highly compressed storage of the same number of stock-keeping units (SKUs) previously held in static shelving but within a significantly reduced footprint of up to 85%. That means less space is needed to store the same number, or even a higher amount, of articles. The floor space gained can then be leveraged by repurposing it via an internal expansion, such as adding other revenue-generating activities.

Different storage systems can be customized for various storage needs, from small to medium-sized lightweight goods to heavy-duty materials, pallets, and individual SKUs. This solution guide presents 7 technologies you should consider when space is an issue. It gives guidance on which solution is best for your SKUs and details how each solution provides significant space savings while at the same time increasing performance and improving labor requirements.



# Maximizing space

There are a variety of automated storage and retrieval systems that support businesses to save space. Depending on the stored SKUs, every company will have distinct requirements and, therefore, a different solution that best fits their business needs. The main difference is the dimension in terms of the size and weight of the articles.

This solution guide presents 7 technologies suitable for a wide range of applications, from small parts to heavier goods and pallets.

## 7 space-saving technologies

# Vertical Lift Modules

A Vertical Lift Module (VLM) consists of two columns of trays with an automated inserter/extractor positioned in the center. The extractor travels up and down between the stored trays, automatically locating and retrieving them as needed – similar to an elevator with doors that open on both the front and rear of the machine.

One of the main advantages of VLMs is the high storage density they provide. Unlike traditional static shelving, VLMs utilize height rather than floor space to store items. With a height of up to 30 meters, they take advantage of the entire available floor-to-ceiling height in a facility.

Although they can reach straight up to the ceiling, it doesn't mean they always should. It is important to define a good mix of space savings and throughput. Often, the taller the machine, the slower the throughput.

The VLM tray spacing allows dynamic storage – using a height sensor located at the back of the access opening, the height of all stored items on a tray is measured. The integrated software uses those numbers to direct the trays dynamically – as close as 25 mm apart from each other – to maximize storage density. The machine prioritizes compressed storage to ensure the highest storage density possible. For example, if the tallest item on a tray measures 15 cm tall, the VLM will store it inside the machine in a 17.5 cm space. If that product is picked and the tallest product remaining on the tray measures 10 cm tall, the VLM will automatically place the tray in a 12.5 cm tall location.

VLMs store items of various sizes, making them a versatile option for businesses with diverse and frequently changing storage needs.

A 6 m tall machine can provide 5,000 to 7,000 storage locations (each product roughly 150 mm × 150 mm × 100 mm).

**Vertical Lift Modules are ideal for**

- Maximum density in the smallest footprint (customers can choose standard machines between 2.3 m and 30 m in height and 1.2–4 m in width)
- Highly variable sizes (small, medium, large) and weights of stored parts
- Heavy items (up to 1,000 kg) that require lifting assistance for the operator to safely handle
- Frequently changing inventory mix

**Best Practice Example**

Kardex customer RYCO provides high-quality products for industries including mining, forestry, construction, utilities, defense, marine, oil and gas, and agriculture. They required a space-saving and less labor-intensive picking process to handle roughly 2,000 SKUs, many of which are small parts. Three Kardex Shuttle 500 units ensured fast and accurate order fulfillment, and following an assisted warehouse move, unit height increased from 8 m to 11.5 m, and inventory storage capacity increased to 114 m² within a small footprint of only 26 m².

Read the full case study

# Vertical Carousel Modules

Vertical Carousel Modules (VCMs) are built with a series of carriers attached to a chain drive in fixed locations. Movement is powered by a motor that sends the carriers in a vertical loop around a track in both forward and reverse directions – always choosing the shortest way to deliver the needed articles on the carrier to the access opening.

They provide maximized storage in a compact footprint by leveraging a facility's overhead space, with a height of up to 10 m.

In VCMs, the carriers are spaced evenly in fixed positions. Within a carrier, shelves and drawers can be added to subdivide the carrier to create individual storage locations that best fit the SKUs. They are frequently divided into two or three shelves to separate items for slotting and organization. Shelf levels can be manually adjusted up or down to compress the vertical space. It's critical to know the heights of the stored items when specifying the machine to have the shelves as close together as possible. This ensures high-density storage and avoids wasting available storage space.

VCMs are an ideal choice for storing products that are similar in height (usually under 20 cm) and whose sizes do not often change.

A 6 m tall machine can provide 5,000 to 7,000 storage locations (each product roughly 150 mm × 150 mm × 100 mm).

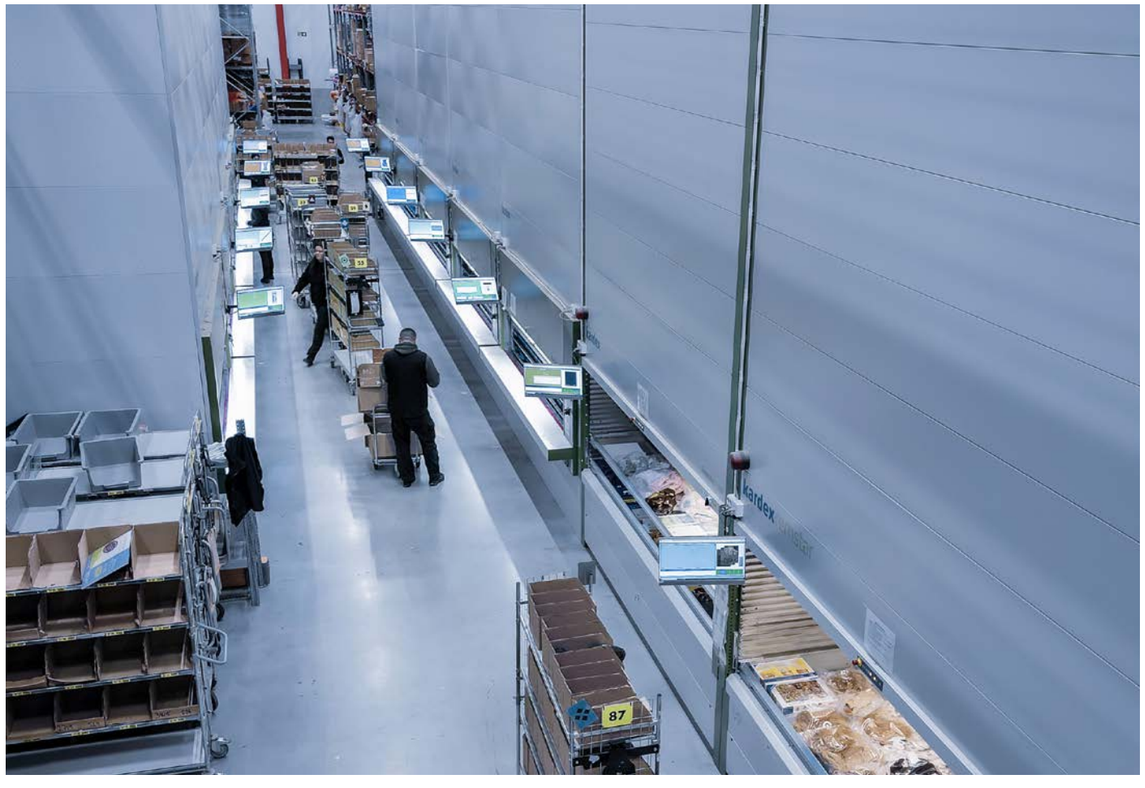
**Vertical Carousel Modules are ideal for**

- Warehouses with ceiling heights under 7.5 m
- Stored parts sharing relatively similar dimensions
- Items that can be hand-picked without lift assistance
- Production areas with their smallest possible unit depth of 1.25 m–1.7 m

**Best Practice Example**

Kardex customer Nowaste Logistics, a prominent 3PL provider in Sweden, needed an efficient and adaptable solution for its new customer. By implementing 10 Vertical Carousel Module Kardex Megamats, 3 Vertical Lift Module Kardex Shuttles and the Kardex Color Pick System, they significantly increased efficiency and throughput and minimized their footprint. The Kardex Megamats stored small to medium-sized items, while the Kardex Shuttles handled items from very small to large, providing high-density storage and increased throughput. The Kardex Color Pick System, integrated into their WMS, enabled fast, accurate picking and scalable operations. This solution doubled their efficiency, maximized throughput and saved significant floor space, handling up to 2,000 picks per hour at peak times.

Read the full case study



# Vertical Buffer Modules

A Vertical Buffer Module (VBM) contains an aisle in the middle of a multi-segment shelving system, where a moveable mast with a telescopic gripper operates. The unit controller sets the gripper in motion, picking up a discrete bin/tote and transporting it to a picking station.

Designed to reduce floor space, increase productivity, inventory control, accuracy, and ergonomics, VBMs provide many benefits for different customer applications.

One example is automated order consolidation. Consolidating picked items into individual orders is efficient but takes up considerably more floor space, labor, and capital. That's because most consolidation systems are either static, shelf-based systems that take up an enormous amount of space or highly automated sortation systems that are not cost-effective. The Kardex Miniload-in-a-Box* automatically and precisely consolidates orders before shipping or packing and retrieves order bins just-in-time and in sequence while saving floor space.

The main benefit of this solution is its flexible and scalable design to fit individual customer needs. The typical VBM is longer than it is tall, giving it a more rectangular shape. VBMs have a maximum height of 12 m, allowing most businesses to take advantage of their full ceiling height. To meet various demands, Kardex launched an upgraded version that extends up to 20 m long. Now, customers can customize the unit's dimensions up to 20 m long and 12 m high. This flexibility allows businesses to choose the storage capacity needed to store an increased number of SKUs on a minimum footprint and prepare for future growth.

A 10 m × 12 m (W × H) machine provides 1,440 bin locations (each bin 600 × 400 × 220 mm).
A 20 m × 12 m (W × H) machine provides 2,880 bin locations (each bin 600 × 400 × 220 mm).

VBMs provide a storage capacity of approx. 50.000 storage locations (each product roughly 150 × 150 × 100 mm), compared to the examples given for the VLM or VCM.

* formerly Kardex Compact Buffer

**Vertical Buffer Modules are ideal for**
- High-density storage (up to 12 m tall)
- Small items fitting in a 600 × 400 mm or 640 × 440 mm tote
- Items weighing up to 35 kg
- Automatic tray-based handling with conveyor connections
- Discrete item picking for increased inventory control (high-value items)

**Best Practice Example**
Kardex customer SHAKE-HAND, based in Belgium, focuses on distributing standard machine elements for the mechanical engineering industry. They needed a solution to provide more storage locations for their full bin picking within a small footprint to handle small parts, bigger items, and full cartons. SHAKE-HAND replaced their static shelves with three Vertical Buffer Modules Kardex Miniload-in-a-Box to fully maximize warehouse space. These three 18 m long machines doubled the available storage capacity.

Read the full case study

# Tip: Transparent, space-saving organization of storage locations

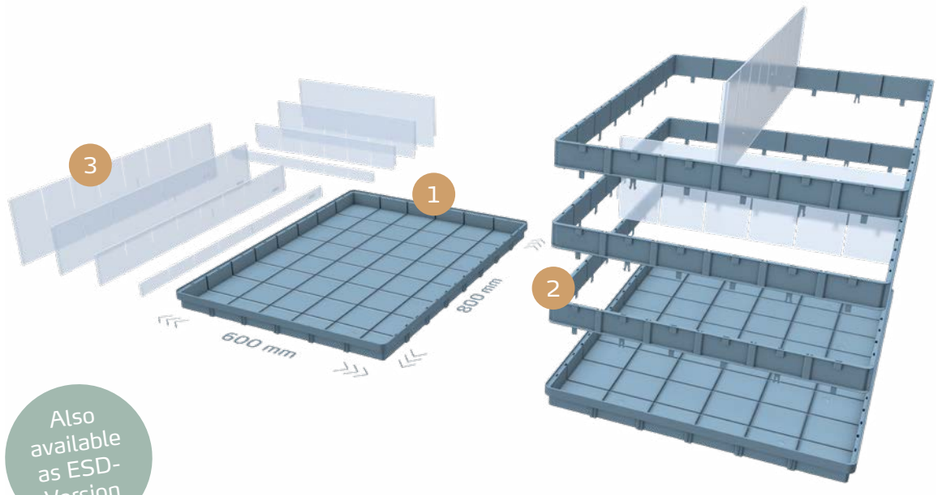
Keeping items within a storage system structured and organized minimizes search times and makes full use of the available space. To achieve this, Kardex designed a wide range of special storage and transport boxes for the Kardex Shuttle (VLM), Kardex Megamat (VCM) and Kardex Miniload-in-a-Box (VBM).

The Kardex Boxes are based on a simple system. They use a base box – available in different dimensions – which flexibly divides and quickly adapts at any time using transverse and longitudinal dividers. The innovative EasyClick system simplifies adaptions so that different heights and storage locations are possible within one box at any time.

The box itself weighs very little because it is made from lightweight materials. Tailormade for the Kardex Shuttle, Kardex Megamat, and Kardex Miniload-in-a-Box to fully use every millimeter available on a tray or carrier, you can load the tray with more goods than comparable box solutions allow.

Click here to learn more about the Kardex Boxes

# Components of the Kardex VLM Box




Also available as ESD-Version

**1 Base Box**
The base box is the most important unit in the Kardex VLM Box concept, as all other frames and dividers are based upon it.

**2 Frames**
With an EasyClick system, the frames can be placed on the base box and plugged into each other to adjust the height of the box quickly and flexibly.

**3 Divider**
This concept further increases the flexibility of the box to provide a comprehensive storage and classification system for the Vertical Lift Module.

The Kardex VCM Box and the Kardex VBM Box are based on the same concept.

# Bin Shuttle System

The Bin Shuttle System powered by ROCKETSOLUTION meets current and future requirements for handling and storing various types of totes and trays made of numerous materials. In the system, storage operations are carried out by taking over the load unit by the lift at the transfer station of the conveyor technology. At the storage level, the shuttle takes over the load unit and brings it to the storage location. Retrieval of the storage goods takes place in the same way.

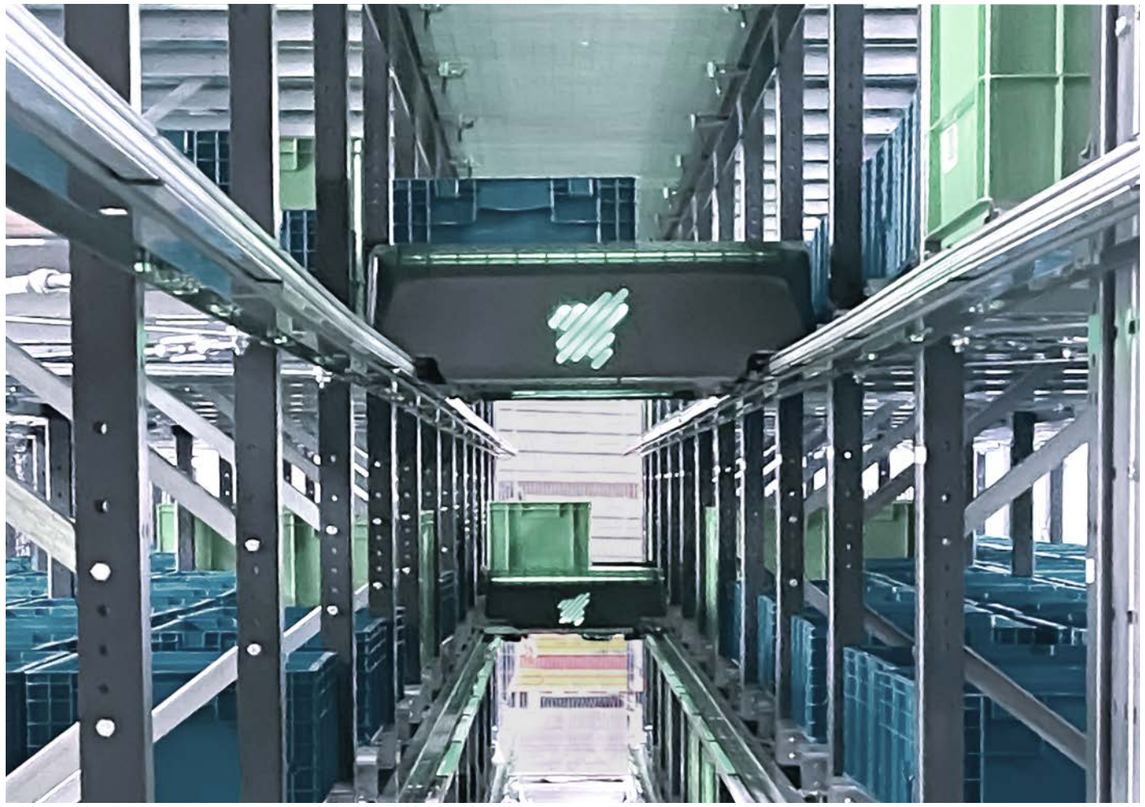
The system can be adapted quickly and easily to individual requirements and structural conditions. The application spectrum of the compact shuttle-system ranges from a slow-moving distribution warehouse to a highly dynamic buffer with a sorting function. With the Bin Shuttle System, capacity and performance in the warehouse are multiplied while simultaneously reducing costs. The needs of various industries can be satisfied with the Shuttle System. For example, returns in the e-commerce industry can be integrated into the picking process in a prioritized manner thanks to the high throughput capacity of the system.

By rotating the storage totes, the lateral storage density is increased, which, with the comparatively 50% smaller aisle width, results in the best possible overall use of the available storage space. Compared to a standard shuttle-system, with a storage area of 11,900 m³ and dimensions of 50 m x 17 m x 14 m (L × W × H), storage capacity can be increased by 107%, and throughput can be increased by 33%. With a maximum height of 30 m and a maximum length of 150 m, the Bin Shuttle System can fulfill high-capacity requirements.

A 33 m × 13 m × 14 m (L × W × H) Bin Shuttle System powered by ROCKETSOLUTION provides space for 34,000 storage totes. Each tote with outside dimensions of 600 × 400 × 220 mm (L × W × H).

**Bin Shuttle Systems are ideal for**
- Maximum storage density
- High availability and process reliability
- Simple integration with low requirements for the floor slab
- Flexible scalability in terms of dimension and storage capacity
- Micro-fulfillment solutions and short delivery times

**Best Practice Example**
A well-known clothing company faced the challenge of optimizing its warehouse for different distribution channels (retail and wholesale market, online sales, and marketplaces), while centralizing the storage space in-house. Due to the Bin Shuttle System powered by ROCKETSOLUTION, the utilization of space was optimized and an area of 2,750 m² was saved, which can now be used otherwise. With the help of the Shuttle System, seasonal fluctuation peaks can be handled smoothly. With a system performance of 500 totes in and out per hour and aisle, the customer benefits from a better performance as well as lower labor costs through automation and better time efficiency.



# Cube Storage

The cube storage system AutoStore™ enables high-density storage on a small footprint. Items are stored in bins neatly stacked next to and on top of each other inside an aluminum cubic grid system, using the available vertical height of the warehouse. Battery-powered robots present these bins at ergonomic workstations, installed on any grid side, in a tunnel, or above/below the grid on a different floor level.

Applicable across multiple industries and able to handle a range of small parts, AutoStore systems empowered by Kardex help businesses to significantly save space. A big advantage of this technology is its flexibility in terms of shape. It can be installed to fit any warehouse shape or size and placed around columns, on mezzanines, and on multiple floor levels, adapting to individual needs and enabling optimal use of the existing warehouse space.

Providing maximum storage density, AutoStore offers four times the capacity in the same space compared to conventional manual storage. There is no wasted space as AutoStore works completely without aisles. The bin storage cube can be configured up to a height of 5.4 m, plus a minimum of 1.6 m extra space for the robots to drive on top of the cube. Higher storage heights are possible by building AutoStore systems on mezzanine platforms. Installing a mezzanine above the AutoStore cube is also possible, offering extra space for the workstations or other manual areas.

The average AutoStore system holds 34,000 bins, but this can vary. AutoStore solutions have been built with only a few hundred or, in some cases, more than 400,000 bins. Three bin heights provide flexibility to fit different storage needs, and each bin can be subdivided into up to 32 compartments using moveable dividers to hold multiple product categories.

A 22,1 m x 33,8 m x 5,4 m (L x W x H) AutoStore system provides space for 34,000 storage bins, with outside dimensions of 649 × 449 × 330 mm (L × W × H) for each bin.

**AutoStore systems are ideal for**
- Oddly shaped or high buildings up to 8 m
- Maximum density in the smallest footprint
- Any requirements: customers can choose from different types of AutoStore workstations based on their space and throughput needs
- High scalability in terms of capacity and throughput
- Expansions without interrupting ongoing operations

**Best Practice Example**
Arbeitsschutz-Express is a medium-sized wholesale company that has established itself as one of the German market leaders in e-commerce. To keep up with their fast growth and continue their reliable delivery to customers, the step towards automated order fulfillment was unavoidable. Arbeitsschutz-Express replaced their static shelving with an AutoStore system empowered by Kardex. Previously, they used 3,000 m² of storage space which was 110% utilized. Today, with their AutoStore system, Arbeitsschutz-Express is storing even more SKUs on a floor space of only 1,400 m, which is currently 60% utilized and therefore offering a lot of potential for further growth.

# Miniload System

Miniload Systems meet various requirements. With a height of up to 24 m, they feature various load-handling devices and provide single or multiple-deep storage. Stacker cranes manage all storage and retrieval operations. They efficiently and optimally store articles in totes, cartons, or on trays.

The solutions can flexibly be individualized for the needs of different industries. One key factor of intralogistics is the so-called lead time of an order. In short, the time it takes to bring a stock article into a delivery unit. Building a miniload system can significantly reduce this lead time compared to manual storage, thus fulfilling an important need. Because of the scalability, the system optimally utilizes the entire available height. This results in saving space as well as guaranteeing high capacity and throughput.

One example is using high-density storage of miniload systems as buffer storage for production, increasing the available production area for further growth. Other typical applications are storage for spare parts, order picking, or distribution storage.

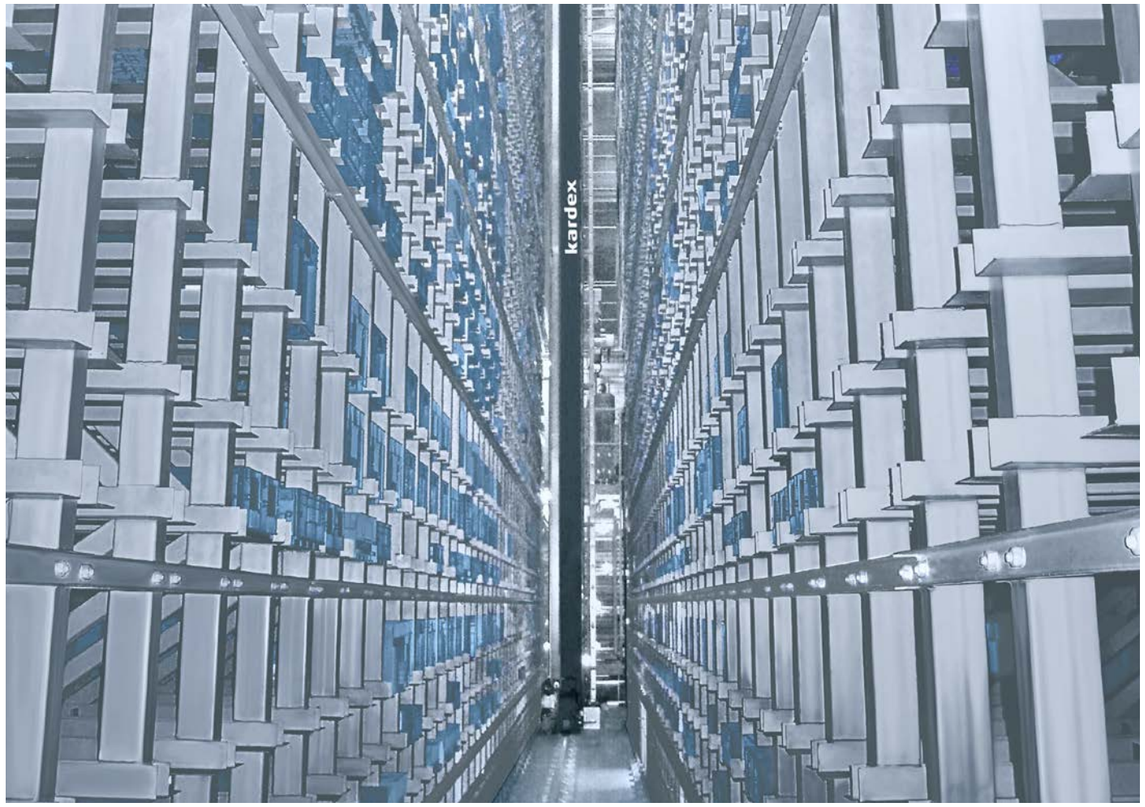
The systems, which have proven themselves over decades, offer reliable operation and thus require relatively little maintenance. Compared to other solutions, miniload systems can handle load units weighing up to 50 kg.

Conveying technology can create a link to various areas in the company. Picking workstations can also be connected practically and directly to the system. When planning these, Kardex pays close attention to today's ergonomic requirements.

For example, a three-aisled and double-deep miniload-system, 28 m × 8m × 12 m (L × W × H), can provide 15.120 storage locations with outside dimensions of a standard tote of 600 × 400 × 220 mm (L × W × H).

**Miniload Systems are ideal for**
- Individualized solutions with high flexibility
- High throughput requirements even with a payload up to 50 kg
- Optimal space utilization – height up to 24 m
- Reliable solution also for temperature-controlled environment up to –28°C
- Guaranteed process operation 24/7

**Best Practice Example**
The production area of a manufacturer in the food & beverage industry reached its capacity limits. The shipping area was expanded by a miniload-system and a connected conveying technology to create more space for production. Automating manual storage areas, previously located in the production area, and centralizing them into a single storage system, saved a large amount of space in both areas. Overall, the miniload system aids the complete order-picking process, and the factory is now equipped to cope with constant growth.



# High-Bay Warehouse

With a height of up to 45 m and providing single or multi-deep storage, Kardex high-bay warehouses offer maximum flexibility and optimal use of available space. These high-bay warehouses can store pallets, cage boxes, and special load carriers depending on customer requirements. Storage and retrieval, alongside material flow, are carried out via partially or fully automated processes.

The modular stacker cranes for the automated storage of pallets have multiple uses and numerous configurations. Their high and compact design ensures efficient space utilization in a high-bay warehouse. Even in challenging environmental conditions such as deep freeze storage or explosion-protected zones, Kardex stacker cranes execute a high performance. Combined with a high-quality storage technology system like the Kardex MSpacer, performance increases further. This innovative telescopic fork reduces “space consumption” by approximately 10% compared to a conventional high-bay warehouse with double-deep storage.

The Kardex portfolio and wealth of experience stem from providing individually tailored automated storage and retrieval solutions for tires, kitchen panels, paper rolls, trolleys, and frame racks.

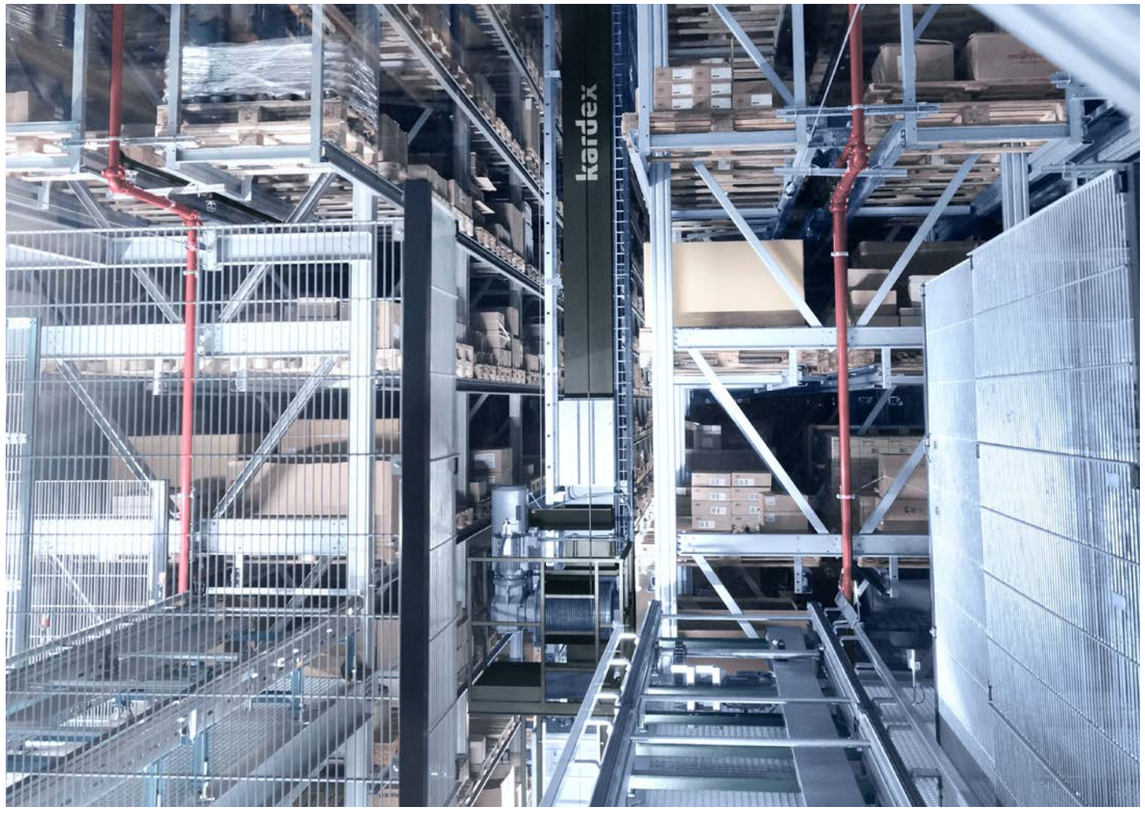
With years of experience working with complex material flow systems with our wide range of conveying elements, our solutions are reliable and high performing. With an extensive portfolio of continuous and discontinuous conveyors, Kardex meets the individual requirements for automated transport.

**High-Bay warehouses are ideal for**

- Top performance on a small footprint (up to 45 m high)
- Optimal space utilization (operations on different levels)
- High-density storage (e.g., multi-deep storage)
- Various loading units (pallets, cage boxes, special load carriers)
- Use in controlled environments (e.g., cold and deep-freeze storage, clean room conditions)
- Individualized solutions

**Best Practice Example**
The Berner Ges.m.b.H., based in Braunau am Inn, is the Austrian subsidiary of the internationally active Berner group – a direct seller of tools, equipment, and materials for craftsmen, garages, and the workshop industry. Due to continuous growth Berner needed a highly efficient new pallet warehouse with a high number of storage spaces to ensure sufficient capacity for the future. Kardex Mlog was commissioned to build a fully automated high-bay warehouse for 5.560 pallets equipped with conveying technology. The patented teleskopic load-handling device, Kardex MSpacer, which enables double-deep storage and doesn`t waste any space, played a key role in the construction.

Read the full case study



# Conclusion

By implementing automated storage and retrieval systems, businesses can maximize inventory density and reduce storage space costs.

Depending on their product portfolio, customers should consider the solutions described. All of them immediately reduce the number of square meters required to store items within static shelving in two ways:

1. Utilizing previously unused overhead space
2. Compressing items stored within the technology for greater storage capacity

If you want to reduce your footprint through optimized warehouse design, Kardex can help with a smart portfolio of automated solutions tailored for any size and shape of space. An investment that, in time, will help your business to grow.

## About Kardex

Kardex is a leading intralogistics solution provider of automated storage, retrieval, and material handling systems in an attractive and growing market. With two entrepreneurially managed divisions, Kardex Remstar and Kardex Mlog, as well as Corporate Ventures (Rocket Solution, SumoBox, Kardex AutoStore Solutions) offering complimentary cutting-edge technology, Kardex developed into a global industry partner.

Efficient and reliable warehouse management software solutions are as crucial for the productivity of modern warehouses as hardware components. Kardex offers modular IT concepts tailored to our individual intralogistics processes and warehouses.

Contact us