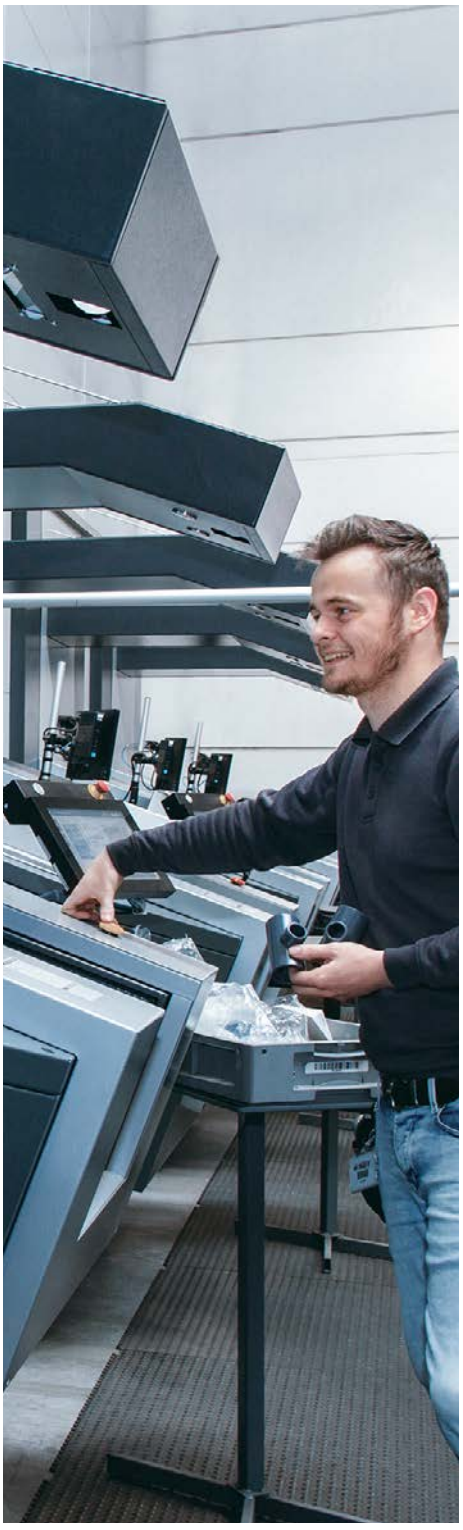
Buyer's Guide

Vertical Storage Solutions



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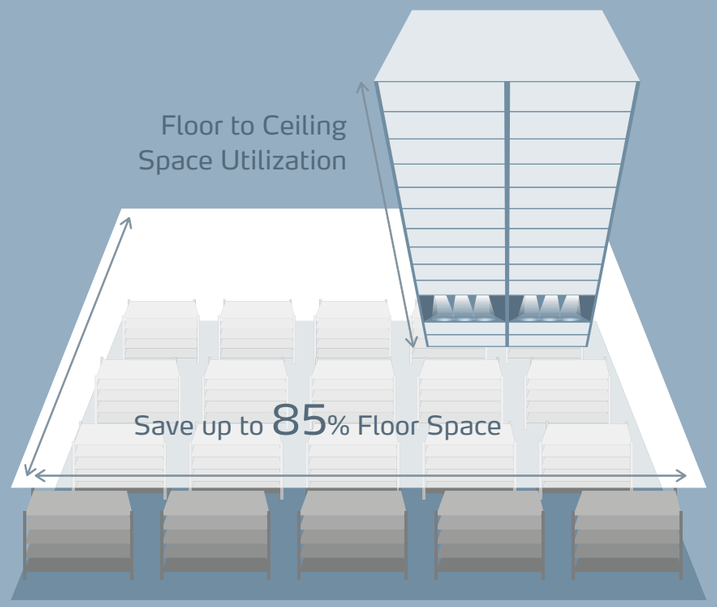
Vertical storage solutions

Companies are adopting warehouse automation technologies to solve a variety of challenges. Vertical automated storage and retrieval systems (ASRS) support faster picking processes, space savings and reduced labor requirements. Integrating vertical ASRS utilizes the floor to ceiling height of an operation. Maximizing the full vertical height within your existing space can increase storage capacity while reducing floor space requirements. This allows a company to reallocate previously wasted space to other revenue generating activities.

From storing small to medium sized light weight goods, to heavier duty materials to individual SKUs, there is a vertical storage system built for a variety of storage needs. This guide will explain the differences between three vertical ASRS – the vertical lift module, vertical buffer module and vertical carousel module – as well as provide some considerations to make the best decision for your business.

Ultimately, no matter what solution you choose, you can expect a significant space savings, faster picking processes and reduced labor requirements.



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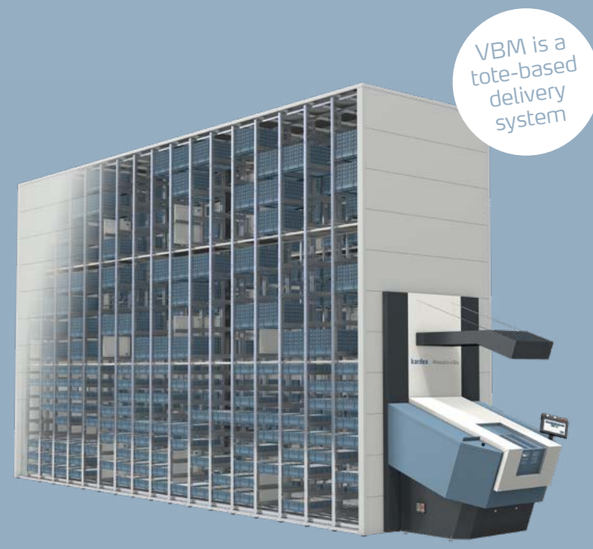
VLM vs. VBM

Both Vertical Lift Modules and Vertical Buffer Modules are designed to reduce floor space, increase productivity, inventory control, accuracy and ergonomics. They usually cost justify in roughly 18 months because of these efficiency gains. This section of the guide will help you understand the specific difference, benefits and best uses for the two types of technologies.

Vertical Lift Modules

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

Vertical Buffer Modules



A Vertical Buffer Module (VBMs) 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.

How do they measure up?

Footprints

A standard VLM unit is roughly 1.6 to 4.4 m wide by 2.3 to 3 m deep. Standard trays storing the inventory range from 1.3 to just over 4 m wide by 0.6 to 0.9 m deep, with a maximum product height of just over 0.72 m.

(Ergonomics: You don`t want the trays to be too deep or the operators won't be able to reach the items with minimal effort.) VLMs can save up to 85% of previously wasted floor space, which opens possibilities for other revenue generating activities to be added.

In comparison, the picking station, also known as the turntable, on the front of a VBM is 1.8 m wide whereas the unit reaches a width of 2.4 m as standard. These units only handle two tote/bin sizes, 600 × 400 mm or 640 × 440 mm. The VBM can span up to 10.5 m long.

The VLM will maximize density in the smallest footprint.

Height

VLMs are built to take advantage of the vertical height in a facility. They start at 2.6 m tall but can reach up to 30 m. However, the average height of a VLM is between 10 to 14 m tall. The machine height should be determined by your available ceiling height and storage and throughput requirements.

On the other hand, VBMs have a maximum ceiling height of 12 m, allowing most organizations to take advantage of their full ceiling height. The typical VBM is longer than it is tall, giving it a more rectangular shape.

When the ceiling height exceeds 12 m, or you want to expand the building exterior, VLMs reach up to 30 m tall.

Load capacities

VLMs can be outfitted with trays that handle up to 1,000 kg each. For applications with heavier loads, lift-assist equipment can be added to a VLM.

The VBM can handle 35 kg per tote. Therefore, if you're looking to store heavy loads, the VLM is going to be the better choice for you.

VLMs are ideal for maintenance and repair operations (MRO) because these items tend to be heavier.

Vertical Lift Modules Kardex Shuttle

Product mix

One of the main differences between these technologies is how they store items in trays versus totes. Therefore, the size and weight of the items you plan to store will often determine the machine which is best for you.

VLMs use a height sensor located at the back of the access opening which measures how tall the items placed in each storage tray are every time the tray is put away. Integrated software crunches those numbers, then directs the VLM to store the trays dynamically – as close as 25 mm apart – to maximize storage density. The machine prioritizes compressed storage to give you the highest storage density possible.

Unlike a tray in a VLM which maximizes the cube, the tote-based VBM does not maximize space density in the same way. The VBM handles two standard two sizes, 600 × 400 mm and 640 × 440 mm, and they can't be used interchangeably within the same unit. The VLM can manage variable product sizes (height, length, width) within a tray versus the VBM which can only handle items sized to fit within the standard tote sizes.

Each tote in a VBM manages an individual SKU.

VLMs deliver a number of SKUs on a tray while VBMs deliver one tote a time.

VBMs offer discrete item handling for increased inventory control and security of high value or sensitive items.

How fast are they?

Compared to traditional methods, both machines yield high throughput. Operating on the goods-to-person principle, items directly move to the operator. The operator picks an item at an ergonomically positioned access point, either from the VLM's access opening or the VBM's turntable. While the operator picks an item, the next pick is being cued. This eliminates operator dwell time, increasing throughput.

While a VLM tray can mean higher density, your search time can be greater than the tote-based VBM. Searching a 2.4 m wide by 0.9 m deep tray delivered in a VLM to pick an item will take longer than a single SKU from a single tote delivered in a VBM.

Although a VLM can reach straight up to your ceiling, it sacrifices delivery speed when it does. The taller the VLM, the more time it takes to retrieve a tray for picking. The height of the unit should certainly be a consideration when determining the picking speed your operations require.

Reducing the distance between workstations can increase throughput by decreasing operator walking time. When you place VBMs next to each other in a pod or workstation, the center point between each pick station is 2.4 m. Therefore, if you set up a pod of three of these machines, your pick area is 4.9 m. Whereas three VLMs next to one another creates a 9.1 m pick area. The access points are a shorter distance in a pod of VBMs, reducing walk time between pick locations.

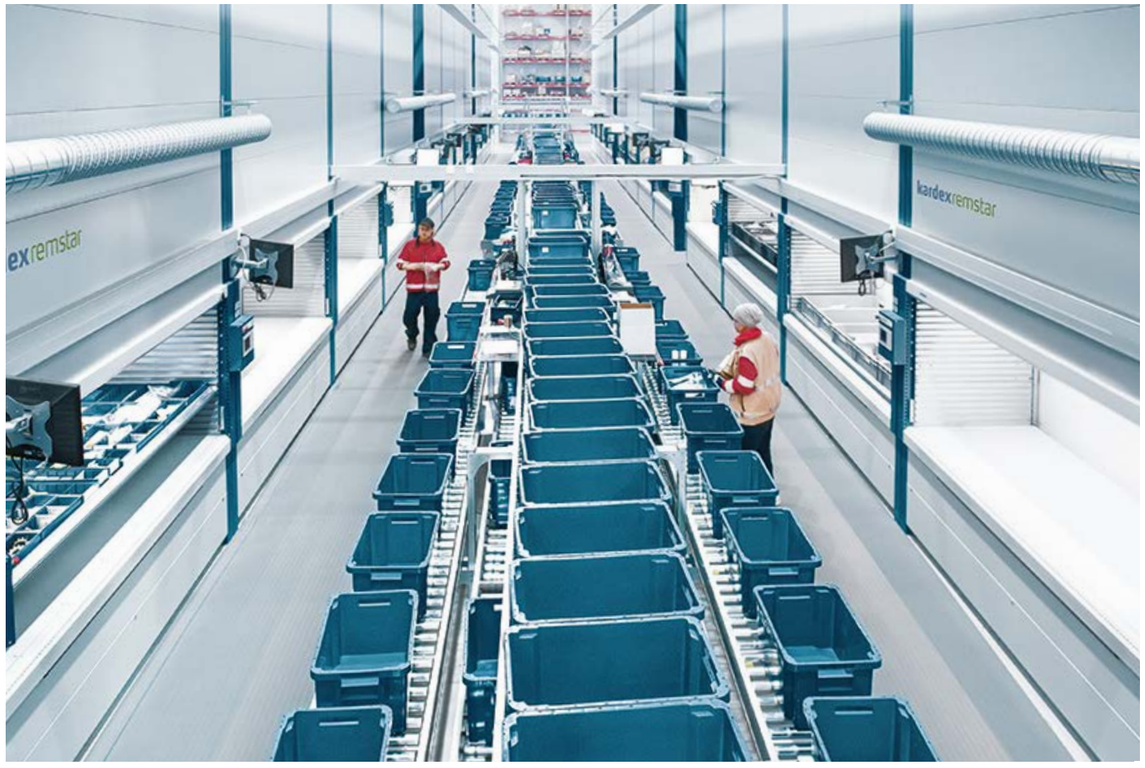
To reach top throughput speeds, outfit ASRS with light-directed picking technologies, and work in a pod utilizing a batch picking strategy.

Product handling and transportation

Product handling for both the VLM and VBM can be managed in a variety of ways. Both machines can be operated by a person in a straightforward, semi-automated way where the operator interacts with the storage unit. An operator takes product out of the unit via the access opening or turntable and distributes the items into order totes or onto a conveyor manually.

Both machines can be used for automated product handling by integrating robots. With this automated integration, a robotic arm picks items out of the tray or tote and distributes the items accordingly.

For more advanced automated product handling, the VBM can be equipped with automatic conveyor connections as standard. This means totes can flow in and out of the unit automatically with no human intervention. VBMs are ideal in both order consolidation and order fulfillment operations. Totes can enter the unit automatically, stay in the VBM as buffer storage until the order is complete and leave automatically on the conveyor to the consolidation area. Totes can also flow out of the VBM from pick station to pick station, completely unmanned, increasing throughput.



Vertical Lift Modules Kardex Shuttle

Vertical Buffer Module Kardex Miniload-in-a-Box* with automated conveyor connection

* formerly Kardex Compact Buffer

VLM vs. VCM

Now that you've learned about the differences between VLMs and VBMs, there is another vertical storage solution to consider. Vertical Carousel Modules (VCMs) are also an option.

This section of the guide will help you understand the differences between two commonly considered ASRS – the Vertical Lift Module and the Vertical Carousel Module.

What are the benefits of VCMs and VLMs?

As two types of goods-to-person automated storage and retrieval systems, VCMs and VLMs offer:

- **High-density storage of slow- to medium-velocity items** (a 6 m tall machine can provide anywhere from 5,000 to 7,000 locations [each roughly 150 mm × 150 mm × 100 mm]).
- Automatic delivery of required items to a waist-high window for **ergonomic, high-throughput picking** in just a few steps.
- Full enclosures and **lockable access for security**.
- **Maximized storage in a compact footprint** by leveraging a facility's overhead space.

Vertical Lift Modules

Vertical Carousel Modules

How do they store items?

Vertical Lift Modules

Vertical Lift Modules consist of two columns of trays with a mechanical inserter/extractor positioned in the center. The inserter/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.

Vertical Carousel Modules

Vertical Carousel Modules are built with a series of carriers attached in fixed locations to a chain drive. Movement is powered by a motor which sends the carriers in a vertical loop around a track in both forward and reverse directions.

How do they measure up?

Footprints

Both technologies span roughly the same range of widths, not much of a differentiator. When it comes to depths, VLMs can be about twice as deep as VCMs – giving VCMs an overall narrower footprint.

A standard VLM unit is roughly 1.6 m – 4.4 m wide by 2.3 – 3.1 m deep. Standard trays that store inventory range from 1.3 m to just over 4 m wide by 0.6 – 0.9 m deep, with a maximum product height of just over 0.72 m. (Ergonomics: You don't want the trays to be too deep or the operator won't be able to reach items with minimal effort.)

In comparison, standard VCMs range from 1.9 m to 3.9 m wide by 1.3 to just over 1.5 m deep. Designed for smaller product sizes, the carriers that store the inventory measure from 1.3 to almost 3.3 m wide by 0.43 to 0.63 m deep, with a product height up to 0.56 m.

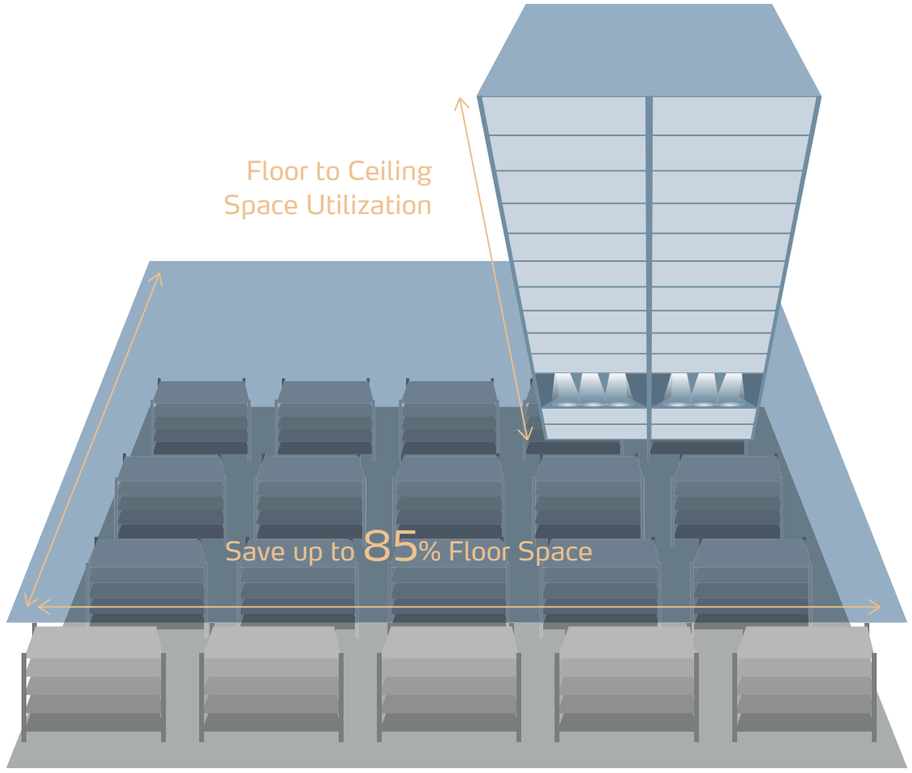
The VLM maximizes density in the smallest footprint.

Height

VLMs start at 2.6 m tall and can be installed up to 30 m high. In contrast, VCMs start a little shorter, at just over 2.2 m and can reach up to 10 m tall.

Although both machines can reach straight up to your ceiling, it doesn't mean they always should. Often, the taller the machine, the slower the throughput. It's really up to you to determine the machine height which gives you the perfect mix of space savings and throughput. There are plenty of experts in the material handling field who can help you figure out the throughput rates of different-sized machines.

To determine the perfect height, find the best mix of space savings and throughput.



Load capacities

VCMs can handle up to 650 kg per carrier. VLMs can be outfitted with trays that handle up to 1,000 kg each. For applications with heavier loads, lift-assist equipment can be added to a VLM as well. This is a major difference between the two machines: VCMs are difficult to fit with ergonomic lifts and cranes – so if it's heavy loads you're looking to store, the VLM is probably the choice for you.

VLMs can manage heavier loads by integrating ergonomic lifts and cranes.

How fast are they?

Throughput rates in VLMs and VCMs are application dependent. Depending on an individual machine's configuration (mostly unit height), customer's order profile (single line vs. multi), single order or batch picking, etc. both units can perform at very similar throughput rates. VLMs can deliver throughput up to 350 items per hour while VCMs can reach up to 400 items per hour.

To reach those top throughput speeds, both types of machines need to be outfitted with light-directed picking technologies, such as pick-to-light. Located within the access window, these devices illuminate to show the operator where within the tray or carrier the required item is stored to eliminate search time.

Also, to achieve high throughput rates, regardless of how your VLM or VCM is configured, slotting is critical. Although the slotting process typically doesn't rank high on a warehouse manager's list of favorite things to do, committing to regularly reviewing inventory data – such as seasonality, how often an item is picked and replenished, which items are commonly picked together, and so on – then figuring out the most appropriate place to store each item in the machine goes a long way toward achieving maximum throughput. If it's throughput you're after, you might as well embrace slotting from the start.

A properly slotted machine will keep the most frequently picked (and co-picked) items stored together on the same tray or carrier. The more picks an operator can make on a level before the unit moves to the next level with picks (less travel time), the faster the picking. In a VLM, the items with the highest pick frequency are stored closest to the access window so the inserter/extractor doesn't have far to travel to retrieve them. In a VCM, the carriers with the highest pick frequencies are adjacent (or at least a carrier or two away) so the drive chain only travels a short distance most of the time.

For even more, learn more about cross picking to speed throughput beyond standard batch picking applications.

Product mix

Now that you've learned about the physical differences between Vertical Lift Modules and Vertical Carousel Modules, it's time to figure out which one is right for your operations.

The size and weight of the items you plan to store in the machine – and how frequently your product mix changes – are the key deciding factors when picking between a VLM and a VCM. This is because each system stores items differently.

More sophisticated than VCMs, VLMs use a height sensor that measures how tall the items placed in each storage tray are every time it's put away. Integrated software crunches those numbers, then directs the VLM to store the trays dynamically – as close as 25 mm apart – to maximize storage density.

VLM tray spacing allows dynamic storage

For example, if the tallest item you place on a tray measures 15 cm tall, the VLM will store it in a 17.5 cm space inside the machine. If that product is picked and the next tallest product remaining in the tray measures 9 cm tall, the VLM will automatically place the tray in a 11.5 cm tall location. The machine prioritizes compressed storage to give you the highest storage density possible.

Vertical Lift Module

Vertical Carousel Module

VCMs are ideal for similarly sized products

In VCMs, the carriers are spaced evenly in fixed positions. The shelf levels within the carrier can be adjusted up or down to compress the vertical space – but not automatically. Adjustment is manual. Nobody wants to pay to inventory air, so it's critical to know the heights of your stored items when specifying the machine in order to have the shelves as close together as possible.

This makes VCMs an ideal choice to store products that are similar in height (usually under 20 cm, and whose sizes do not often change. Every carrier in a VCM can be subdivided further (both vertically and horizontally) to maximize storage density. In fact, they are frequently divided into two or three shelves to separate items for slotting and organization.

Adjusting those dividers – while possible to do – is a tedious task which requires all the product to be removed first, then the dividers unbolted, moved and re-attached in a new position. If inventory changes frequently enough that a new carrier configuration is required often, a lot of labor hours will be spent maximizing the machine's storage density. That's why VCMs are a great choice if your product mix is pretty consistent in size.

VCMs contain evenly spaced carriers which can be subdivided for maximum storage density.

VCMs are ideal for storing products of similar size.

Which one do you need?

Because of their construction, operation and product handling differences, VBMs, VLMs and VCMs are ideal for different applications. When you're deciding which system is right for you, keep the following in mind...

Vertical Buffer Modules are ideal for:

- High density (up to 12 m tall)
- Small items fitting in a 640 × 440 mm tote
- Item weights up to 35 kg
- Automatic tray-based handling with conveyor connections
- Discrete item picking for increased inventory control (high value items)

Vertical Carousel Modules are ideal for:

- Ceiling heights under 7.5 m
- Stored parts sharing relatively similar dimensions
- Items that can be hand-picked without lift assistance

Vertical Lift Modules are ideal for:

- Maximum density in the smallest footprint (up to 30 m tall)
- 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

Contact a specialist