Your single source supplier of material storage and handling solutions

BITO LEO AGVs

Expert solutions for automated material handling.

BITO STORAGE SYSTEMS NORDIC

A **BIT OF** LEO.

LEO-TRANSPORTER.COM

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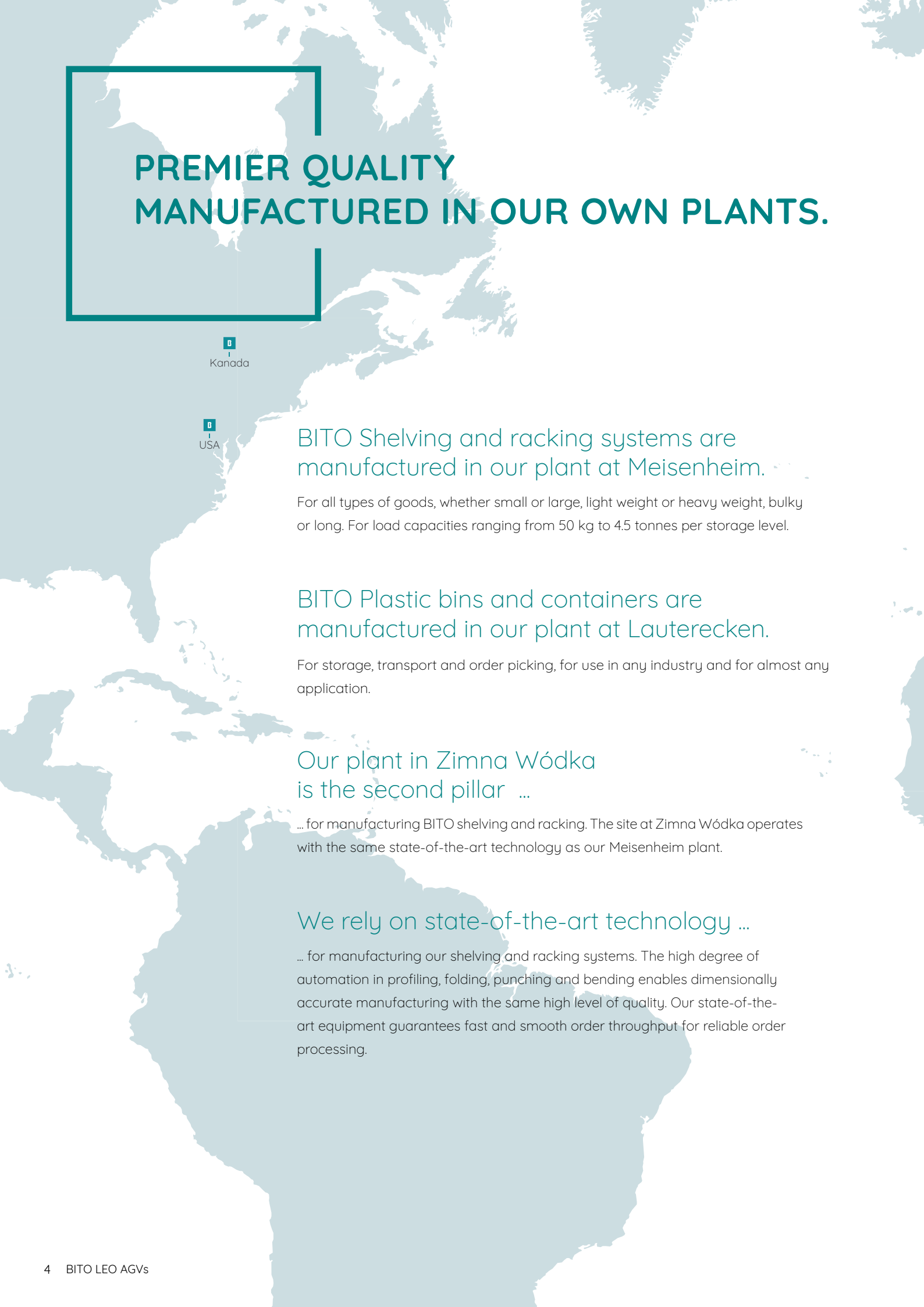
A **BIT O**F YOUR LIFE.

PREMIER QUALITY MANUFACTURED IN OUR OWN PLANTS.



BITO Shelving and racking systems are manufactured in our plant at Meisenheim.

For all types of goods, whether small or large, light weight or heavy weight, bulky or long. For load capacities ranging from 50 kg to 4.5 tonnes per storage level.

BITO Plastic bins and containers are manufactured in our plant at Lauterecken.

For storage, transport and order picking, for use in any industry and for almost any application.

Our plant in Zimna Wódka is the second pillar ...

... for manufacturing BITO shelving and racking. The site at Zimna Wódka operates with the same state-of-the-art technology as our Meisenheim plant.

We rely on state-of-the-art technology ...

... for manufacturing our shelving and racking systems. The high degree of automation in profiling, folding, punching and bending enables dimensionally accurate manufacturing with the same high level of quality. Our state-of-the-art equipment guarantees fast and smooth order throughput for reliable order processing.

Our subsidiaries

With our subsidiaries in Europe, Asia and North America as well as partnerships in many other countries, we are always close to our customers!

Customer specific demands ...

... are met by the BITO R&D department. Focusing on customer and application requirements is a top priority for our R&D engineers. They coordinate the introduction of a new bin from the first steps of development to the three-dimensional digital model and optimise prototypes until they are ready for serial production on high-performance, cutting-edge injection moulding machines. To meet special requirements, our plant in Lauterecken offers additional options. These include, for example, automatic barcode labelling or milling and drilling drainage holes to comply with fire protection regulations.

LEO Applications

From dock to stock

Workflow

Receiving > Sorting > Staging > Interim storage > Returning empty bins

Sample application / Considerations and challenges

A logistics service provider receives goods on pallets. The goods are removed from the pallets, sorted into bins and boxes and then taken to various staging areas/collection points. Unloading usually takes less time than transferring goods to the staging areas. For this reason, a buffer storage area is needed for decoupling the process. Once the goods have left the staging areas for further treatment, the now empty bins and boxes need to be returned to the goods-in area.

- Long walking distances
- Limited space
- Interim storage
- Process decoupling
- Cost of a conveyor system

The LEO Solution

Operators separate the delivered goods into totes or on trays and place them on gravity roller conveyors [A].

The last section of the gravity roller conveyor is fitted with an automated feeder that moves bins and boxes onto a LEO flow transporter which is fitted with a scissor lift.

Operators remove empty bins and boxes from the roller conveyor [D].

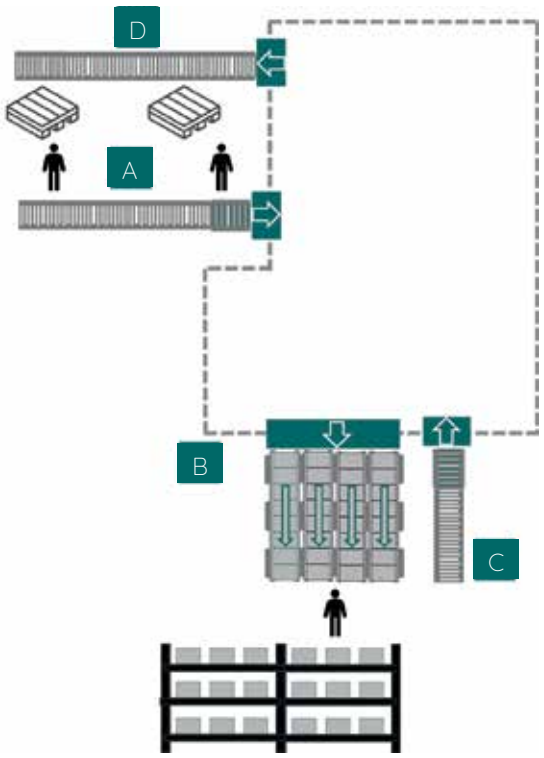
LEO flow takes the goods to the staging areas [B].

In the staging areas, the goods are placed into a LEO-serviced buffer stock consisting of several storage lanes, each 3 levels high and providing storage space for a total of 24 bins/boxes. This equals the loading volume of one Euro pallet.

The buffer stock decouples the receiving process from staging in terms of time.

Empty totes or boxes are placed on a roller conveyor [C] and returned to [D].

Optionally, operators can prioritise stock by sorting goods into specific lanes according to the point of further treatment.



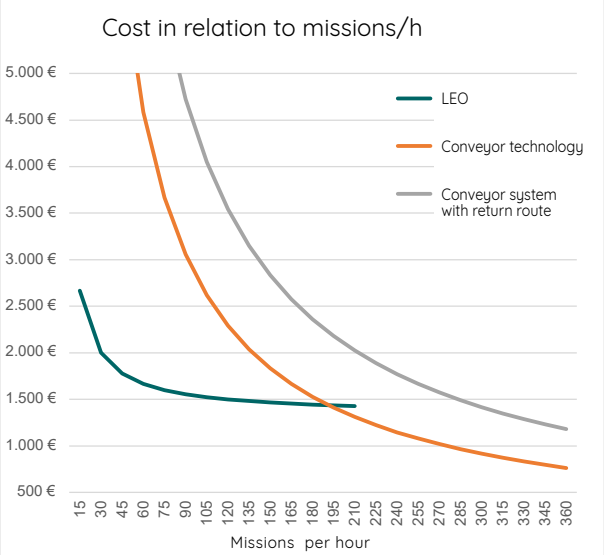
Performance parameters

Performance per LEO transporter on a 50-metre loop:
12-15 trips per hour per vehicle

Performance per LEO transporter on a 100-metre loop:
8-10 trips per hour per vehicle

Space needed for buffer lanes:
2.7m² for 24 bins sized 600x400 mm

Maximum scalability:
One LEO transporter can operate on a route as short as 5 metres.



The graph shows the investment costs for the number of trips per hour. It compares LEO costs with a one-way conveyor route and a conveyor system with a return route. LEO costs are constantly at a low level and only undercut by conveyor technology at high throughput rates. LEO applications with more than 200 missions are technically not feasible.

LEO Benefits compared to a conveyor system

Lower investment
The LEO system is significantly cheaper than conveyor technology for a low to medium number of missions (up to a maximum of 200 missions per hour).

Scalability
LEO grows at the same pace as your business does. As your operations expand, it is simple to phase in more LEO AGVs.

Low operating costs
A LEO system consumes less energy than a conveyor system and incurs lower maintenance costs.

Clear pathways & flexibility.
Compared to a conveyor system, pathways remain unobstructed and routes can be changed easily and without any assistance from specialist staff.

Greater availability
A LEO system has no "single point of failure". A defective vehicle can simply be removed and the system continues to run. There is nor need for expensive maintenance contracts with on-call service!

LEO Benefits compared to manual transport

- **Lower costs thanks to time savings**
  A LEO system saves your staff walking distances and hence valuable time. Even in single-shift operations, LEO achieves an ROI of less than 2 years!
- **Business growth without additional staff**
  LEO enables you to realise growth without employing additional staff.
- **More labour efficiency**
  Employees can focus on processes that generate more value for your company. If you compare opportunity costs with an investment in the LEO system, the payback period is even shorter!
- **AGVS help to increase the output of your workforce**
  In times when finding employees is becoming increasingly difficult, LEO AGVs free up human resources for more complex tasks.

Order picking by zones

Workflow

Storing > Order picking > Moving goods to dispatch > Order consolidation

Sample application / Considerations and challenges

Orders are picked simultaneously in several zones. Depending on the order situation or season, the picking volume grows or shrinks. The delivered goods are separated at a workstation and are then to be moved from here to different workstations, e.g. based on the chaotic principle, and stored there. The operator must handle both entry and exit orders in his zone. Picked orders must then be transported from various workstations to the packing and dispatch area.

- Long walking distances
- Varying capacity utilisation
- Zone picking
- Process merging
- Working at speed

LEO Solution A

A LEO carrier with four storage levels is used.
Each level is divided into two areas. This means that up to eight orders can be transported per vehicle.

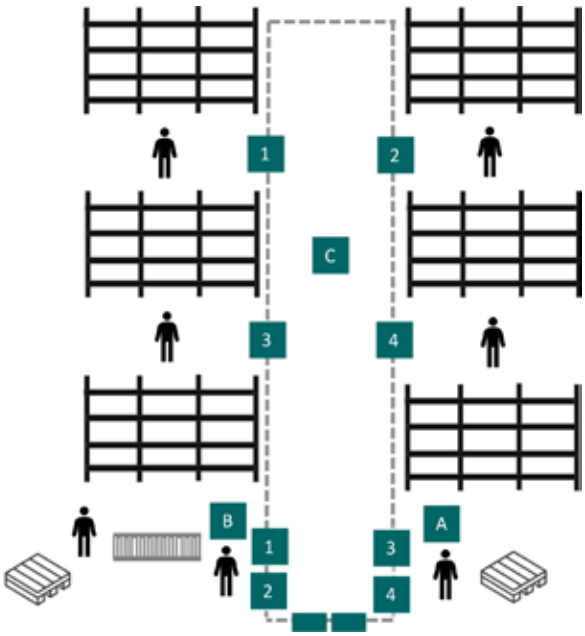
There is an inbound/storage area A, four picking stations and an outbound/order consolidation area B.

In area A, the LEO AGV is loaded with goods to be put into stock. The vehicle also receives the order list for inbound and outbound goods.

LEO then drives to the stops in picking zones 1-4. The operator removes goods for storage and retrieves goods according to the order list. Picked items are then placed in the free spaces on the vehicle. After completion, the operator will send LEO via tablet to the unloading area B.

Here, the vehicles are unloaded and sent on to area A. Depending on the order situation, A and B can be combined, zones can be added or enlarged.

Thanks to its scalability the system is extremely user-friendly. Another LEO carrier can be put on the track to double throughput.



LEO Solution B

As in solution A, a LEO carrier is used for the task.

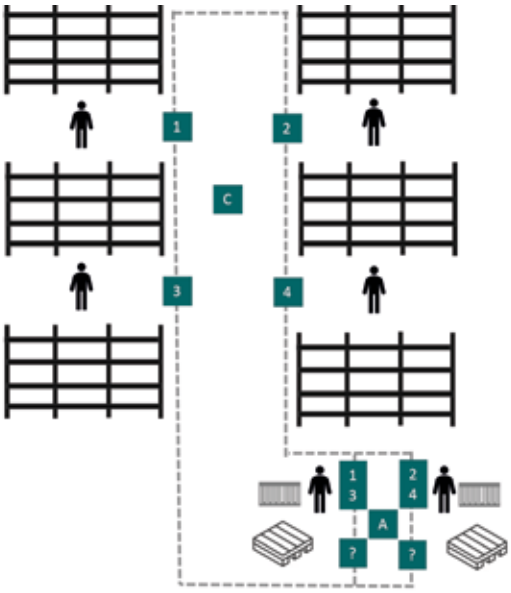
The difference is in the process. LEO carrier completes each order by picking items from different zones on a route with several stops.

Each rack level on the vehicle is assigned to an order. At least one item is loaded at each stop.

After completing a mission, the vehicle returns to its starting position. The goods can be packed and dispatched immediately without further consolidation.

The zones to be served are entered on the tablet. It is possible to define routes with several stops. LEO again manages this task without an interface to higher-level systems.

Transferring goods into stock works in the same way.



LEO Benefits

- **No IT support necessary**
  The system can be introduced without creating an IT project. Existing order slips or order lists can still be used.

- **Easy handling**
  The LEO carrier has two handles. The vehicle can be pulled into the racking rows required or simply pushed into an optimal position. Once the process is complete, LEO is simply placed back on track and drives on.

- **Flexible loading**
  Ordered goods can be stored individually on the storage rack of the transporter or in bulk in bins, boxes and cartons.

- **Fast implementation**
  For the above examples, the LEO system manages almost entirely without the need for stationary hardware. By eliminating the need for support of the IT department, such a system can be set up and started in just a few days

- **Rapid amortisation**
  The payback period compared to manual handling or conveyor technology solutions is often one year or less.

- **No need for external assistance**
  The system can be adapted easily, quickly and by yourself. This enables you to react quickly to seasonal fluctuations. In the event your warehouse is reorganised, there are only minor costs for changing the LEO routes.

From order picking to consolidation

Workflow

Order picking > Order consolidation > Shipping

Sample application / Considerations and challenges

In this case study, shipping orders are picked in various warehouses from shelving, pallet racking and multi-tier systems for B- and C-items. There are pick zones with carton live storage and lean-lift vertical storage for A-items. Goods from multiple storage locations must be collated to complete a customer order and prepare it for shipment. The task is to keep order consolidation as efficient as possible. Empty bins must be returned to the warehouse after consolidation.

- Long walking distances
- Staff shortage
- High level of efficiency required
- Limited space
- Cost of a conveyor system

LEO Solution A

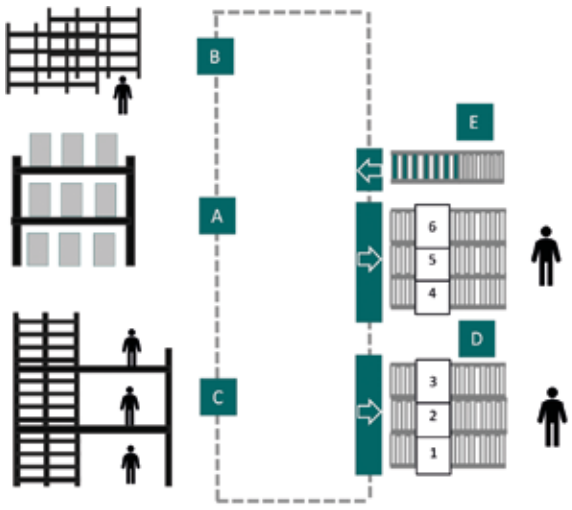
A shipping order consists of several items. These items are stored in different warehouses and shelving and racking systems.

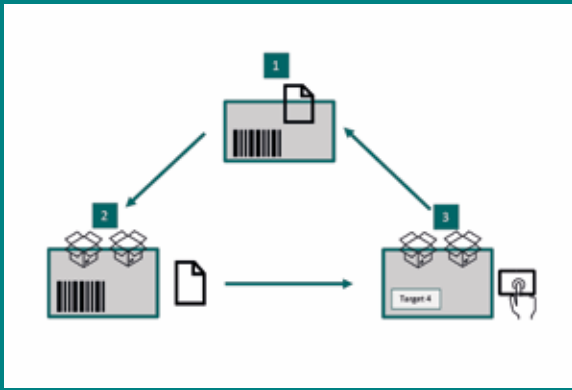
A-items are picked directly off the pallet and stored in pallet racking [A]. B-items are stored in a shelving [B] and C-items in a multi-tier system.

All items from the same storage area are picked into the same bin. LEO flow collects these bins from a conveyor station and takes them to the consolidation area [D].

This area is equipped with six roller conveyor lanes. Correct order consolidation is ensured by assigning orders to different lanes.

Another conveyor line [E] is used to collect empty bins for return transportation to the picking areas.





Simple and accurate navigation

The process described in this example can be mapped without additional IT interfaces.

(1) Each bin is identified with a specific barcode and is thus permanently allocated to a picking zone.

In the simplest case, the picking order is recorded on a paper print-out.

(2) The picking order is retrieved and the goods are placed in a bin.

(3) The operator reads the target lane in the consolidation area from the picking order and enters it on the tablet. LEO then takes this bin to the right lane.

Alternatively, the bin has a second barcode on the other side, which defines a fixed drop-off lane for the bin.

LEO Solution B

Employees pick goods on three levels of a BITO multi-tier system. The multi-tier system is equipped with a lift or a bin chute.

As a rule, A-items are stored on the floor level, whereas B-items are kept on the first tier and C-items on the second tier.

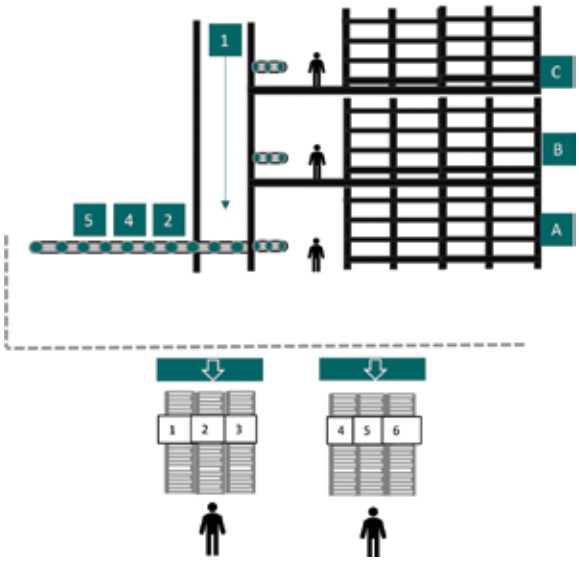
A dispatch order can include items from all tiers of a storage facility.

The operator picks all items related to that order into a bin or a box according to a packing list sent to him on a hand-held device, for example.

When the bin is delivered to the conveyor system in front of the lift or the product chute, the operator specifies the destination lane in the consolidation area using a LEO tablet.

Upon arrival at the floor level, the bin is picked up by a LEO flow AGV and moved to the consolidation area on roller conveyors.

The advantage is that LEO can cover very long distances cost-efficiently.



Sorting orders by destination for dispatch

Workflow

Order picking > Packing > Shipping

Sample application / Considerations and challenges

The picked goods must be packed, sorted by destination and buffered prior to being shipped. This involves sorting by country and postcode within a country. Alternatively, the goods could sorted by shipping company.

- Long walking distances
- Sorting by destination
- Goods-out buffer storage
- Flexible solution
- Costs of a conveyor system

LEO Solution A

The operator packs the order.

He places the consignment on a roller conveyor.

The last section of the roller conveyor is fitted with a powered feeder that moves bins and boxes onto a LEO flow transporter.

LEO flow transports the consignment to roller conveyors in the goods-out area.

Each roller conveyor lane has its own destination, which corresponds to a delivery country or zip code.

The operator determines the target lane by scanning the order or entering the target on a tablet.

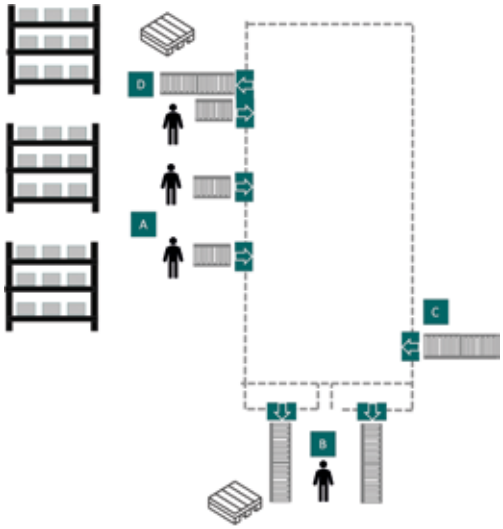
The buffer lanes are designed as roller conveyors. Alternatively, goods could also be buffered in LEO-serviced buffer racking with several levels.

LEO Solution B

In contrast to solution A, consignments are to be sorted for two destinations only, f. ex. domestic / international or freight forwarder A and B.

At the same time, empty bins are to be returned. A LEO locative AGV is used for this task. The transfer stations allow loads to be picked up and dropped off easily without stopping. The buffer tracks mounted in cross direction provide a sufficient buffer volume.

The operator simply enters the destinations on his tablet.

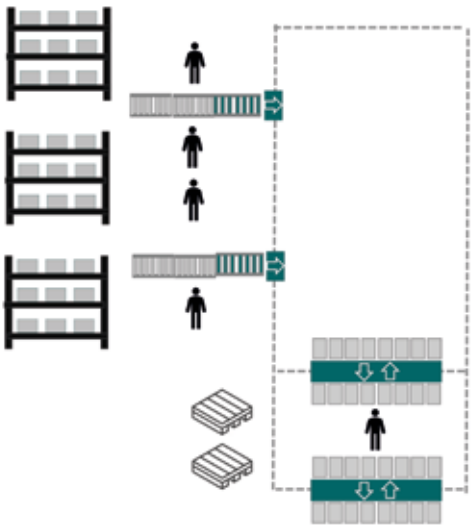


LEO Solution C

In contrast to solution A, the consignments are not directed to destination specific roller conveyor lanes. Instead, the consignments are sorted directly into bins, cartons, mesh boxes or mesh trolleys.

A LEO flow vehicle drives through an aisle between two roller conveyor blocks. The aisle is only approx. 50 mm wider than the LEO flow vehicle itself. The LEO AGV, which is fitted with a LEO Smartbox, will stop with an accuracy of a few millimetres based on its target information, With the ability to convey to the left or right side, LEO is extremely space-efficient.

The solution can be quickly adapted, expanded and downsized.



Automated supply of staging areas

Workflow

Replenishment stock > Staging area > Order picking

Sample application / Considerations and challenges

Products are stored in a BITO carton live storage system in a staging area. The system enables high pick rates by minimising walking distances and access times for the order picker. All lanes must be replenished regularly. For this purpose, the replenishment stock is buffered for example in BITO multi-tier shelving. The replenishment bins are to be filled automatically to reduce the number of personnel required. Empty bins must be returned to the replenishment area.

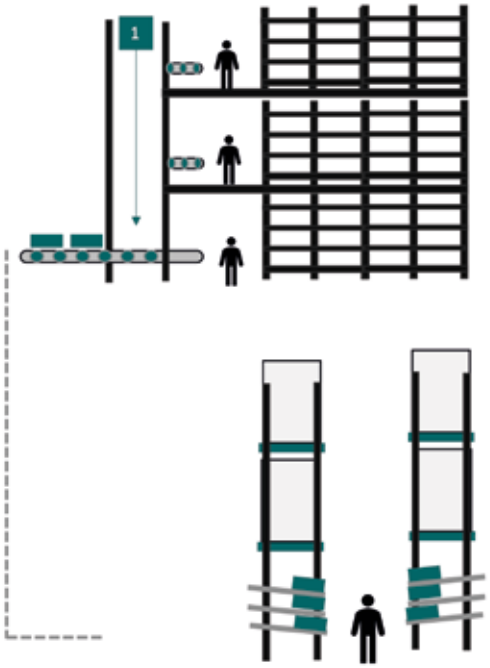
- Long walking distances
- Staff shortage
- On-time replenishment
- Operational efficiency
- Expensive conventional solutions

LEO Solution A

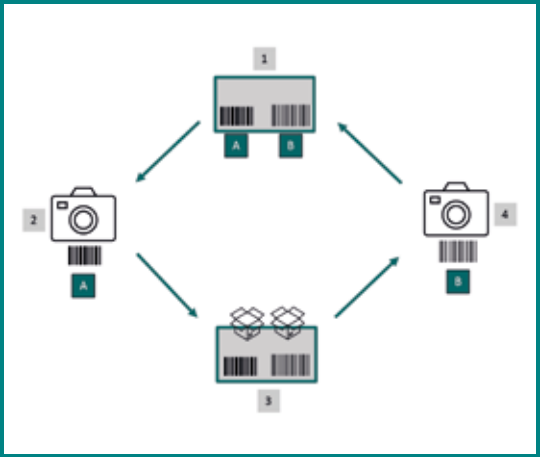
A LEO flow transporter with an automated lifting platform is used to transport empty bins from a return lane to the replenishment store. LEO signals which lane is to be refilled.

LEO flow picks up a previously picked order and moves it straight to the target lane.

The lift function is activated, LEO releases the bin into the correct lane and drives to the return lane.



Order picking area featuring BITO carton live storage for fast order picking. A powered conveyor line mounted on the racking short side passes empty containers to a LEO flow vehicle. It is also possible to use the conveyor line to move finished orders to dispatch.



Easy replenishment

(1) The operator places an empty container on the return lane where it is picked up by a LEO flow transporter.

(2) Upon arrival at the replenishment store, code A containing the product information is scanned.

(3) The picking process is started, the container is refilled and placed on a conveyor line.

(4) This is where code B is scanned. It contains all target info: racking run, bay, compartment, level. The LEO Smartbox is connected to the scanner and informs LEO about the destination.

Sample application / Considerations and challenges

Replenishment stock > Staging area > Order picking

Several assembly stations need to be replenished regularly. Goods are stored in containers.
The assembly station is equipped with a supply rack. Empty containers must be returned to the supermarket.

LEO Solution B

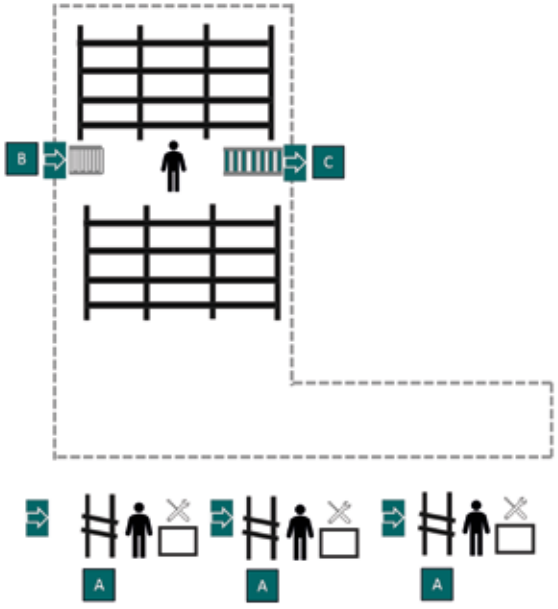
A LEO flow transporter with an automated lifting platform is used.

Empty containers are picked up at the assembly stations [A] in the same way as described in the replenishment process above. Return containers can be handled either manually or with a conveyor belt. The operator orders a LEO AGV via tablet. LEO will stop in an ergonomic position at the assembly station.

In the supermarket, LEO flow passes the empty container to a gravity roller conveyor [B]. An operator scans the container and refills it.

The conveyor lane [C] is fitted with an integrated scanner to scan the coded target coordinates.

At [A], the containers are fed into the correct storage lanes.



Small parts production

Workflow

Raw materials store / small parts store > Production > Finished goods store

Sample application / Considerations and challenges

At varying intervals, production machines require raw materials and semi-finished products. At the same time, semi-finished and finished goods have to be moved away. Until now, pallets with replenishment stock were deposited at each machine. Forklift traffic is to be eliminated and buffer stocks are to be reduced. The company operates in shifts.

- Long walking distances
- Limited space
- Pallets occupying production space
- Shift operation
- Cost pressure Globalisation

LEO Solution A

The LEO locative system offers the optimal solution.

Two production machines each share a LEO locative twin station [B]. In addition, buffer lanes with a length of 1.2 metres have been installed for bin pick-up and drop-off.

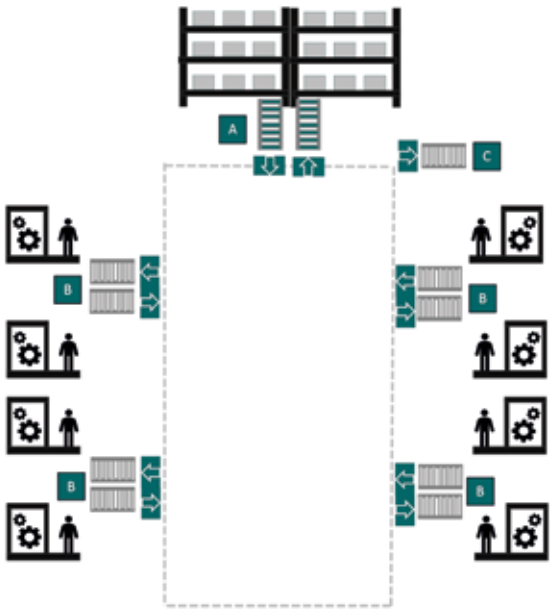
Another LEO locative twin station has been installed in front of the automated small parts store (BITO type AKL) [A] to which two short conveyor lanes have been added. They are used to transport goods from the store to the station and return goods back to the store.

A LEO Smartbox is linked to the miniload warehouse management system which sends transport orders straight to LEO.

A barcode scanner at the pick-up and drop-off points of the miniload system registers incoming and outgoing goods.

The LEO system is programmed in such a way that only 50% of the LEO locative transporters are waiting for orders in front of the miniload system. The other vehicles are actively searching for finished goods.

There is a conveyor line for empty containers close to the miniload system. [C]. To return the containers from the production machines [B], the operator can either select the miniload system, the empty container return line or another target on his tablet.



LEO Benefits

- **AGV routes can easily be modified**
  Vehicle routes and stops can be adapted at any time by your own staff.
- **Reduced space requirement for product buffering**
  Pallet loads of production/assembly materials for workstations take up a lot of space which is freed up by using LEO AGVs. On-time delivery by a LEO transporter also reduces the amount of material that needs to be kept at the workplace.
- **Improved safety**
  No or significantly fewer forklift trucks are needed in production. This improves safety.
- **Clearly defined processes**
  The LEO system helps to establish standardised processes which are transparent and easy to understand.
- **Easy handling**
  Tablet control is intuitive and simple.
- **All-in-one solution**
  The BITO LEO system provides a comprehensive solution and not just an AGV.
- **No or only simple IT interfaces**
  A LEO project can be managed completely without an IT interface. If an interface is required, e.g. to a WMS, it is very simple. Only a few commands are required to control LEO.

LEO Solution B

In this case, a LEO carrier is the ideal solution.
A supermarket warehouse [A] serves as the central distribution hub. This is where the LEOs are loaded manually for the various production machines.

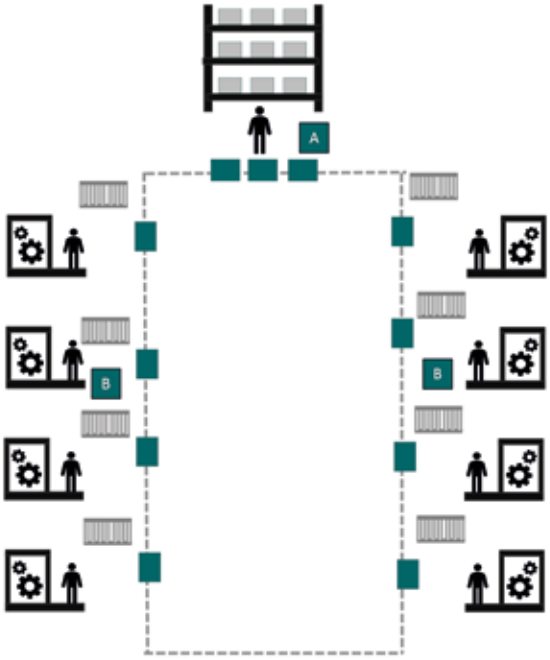
They are loaded with tools, raw materials, drawings or packaging materials. Finished goods are also returned to the supermarket warehouse. LEO is given directions by selecting the target station on the tablet. It is also possible to select a number of destinations in order to process several orders in a single journey.

Only a small clear area is required at the workstations [B]. LEO stops here. Thanks to the mounted handles, LEO can simply be pulled off the track for retrieving materials and loading finished goods. Upon completion, LEO can be placed back on the track. LEO will drive off autonomously. If no destination has been defined, the “home base function” automatically navigates LEO back to the supermarket warehouse.

A LEO vehicle can be requested by pressing a button on the machine. The nearest available LEO will stop.

In addition to finished goods, empty containers can be returned or orders for material replenishment can be initialised.

It is also possible to send goods from one machine to another or to integrate a quality inspection station.



Metal casting / injection moulding

Workflow

Empty container buffering > Production > Finished goods store > Palletising

Sample application / Considerations and challenges

Small parts are produced by injection moulding. Production runs around the clock and, depending on capacity utilisation, five to seven days a week. It is becoming increasingly difficult to recruit staff for shift work. The aim is therefore to be able to realise as many shifts as possible with little or no staff. This requires a large empty container buffer. Finished goods must be stored according to type. As soon as 24 containers are filled, the goods are palletised and put into stock or dispatched to the customer. Produced parts are fed into containers. "Sprues" must also be removed for disposal.

- Staff shortage
- Large buffer stock for empty containers
- Single-reference storage
- Shift operation
- Manless factory

LEO Solution A

A LEO flow AGV with automatic lifting platform is used.

It picks up empty containers from the multi-tier buffer store at [A]. The vehicle now waits at [B]. The Smartbox sends LEO to the target machine.

The empty container is delivered at [C]. LEO now reverses, turns 90° on the spot and moves to position [D].

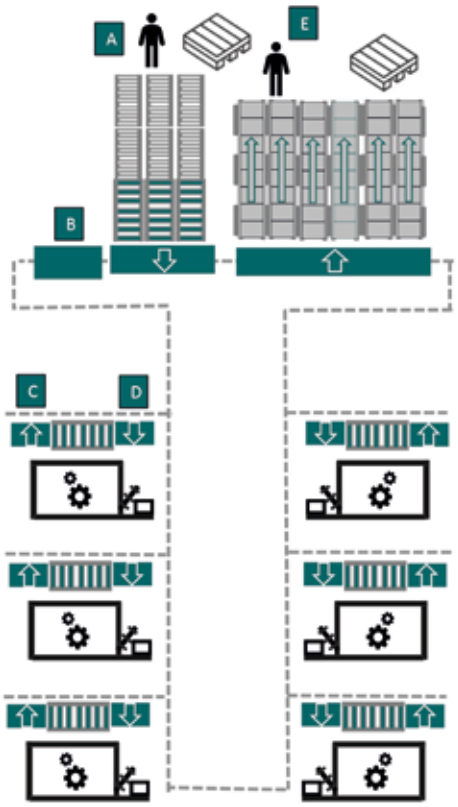
LEO flow picks up a full container and travels to the buffer store [E].

Each machine has an assigned storage lane. This is where the container is delivered.

As soon as a lane is full, the containers are unloaded manually and stacked on a pallet.

Each machine and the adjacent conveyor line is connected to a Smartbox. A LEO gateway centralises all information.

Sprues can be carried off in the same way.



Empty container buffering

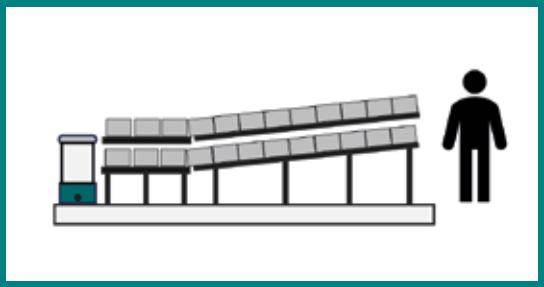
Having a sufficiently large stock of empty containers helps to minimise manual intervention.

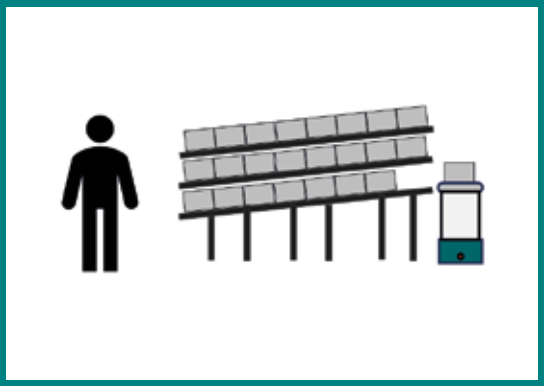
This challenge can be met with a combination of gravity-driven and powered roller conveyors.

Several buffer levels can be serviced with LEO flow to increase space efficiency.

LEO can service three levels if containers are up to 170 mm high. Two levels can be serviced if containers have a height of up to 450 mm.

Space occupation with two levels is only 0.18 m² for 600 x 400 mm containers. If three levels are serviced, space occupation is as low as 0.12 m² for 600 x 400 mm containers.





Finished goods buffering

Single-reference storage of finished products prior to palletising is crucial in an autonomous operation.

Containers with a height of up to 270 mm and a maximum payload of 15 kg can be stored three levels high. Space occupation is as low as 0.12 m² if 600x400 mm containers are stored on three levels.

This calculation example follows the principle of BITO carton live storage.

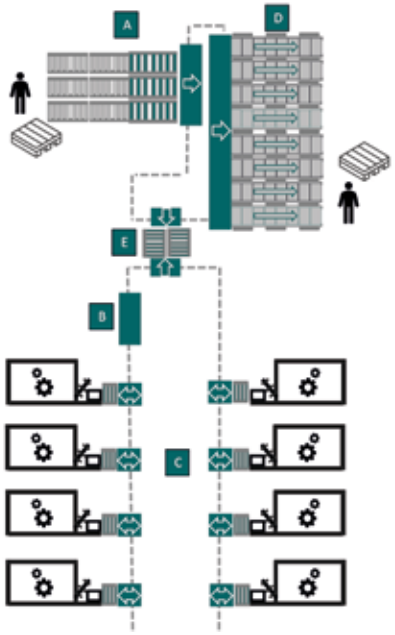
LEO Solution B

A LEO flow AGV with an automatic lifting platform is used in areas [A], [D] and [E]. In addition, a LEO flow DL vehicle without automatic lift function, however with two conveyor belts, is used in areas B, C and E where the double top is important for the process.

LEO flow DL picks up an empty container at [E] and travels to [B] where it receives the travel command to a target machine [C]. The machine is connected to a roller conveyor at the short side.

LEO picks up the full container, places it on the empty conveyor side, then travels approximately 500 mm and delivers the empty
container. LEO returns the container to [E], delivers the full container and picks up an empty one.

The LEO flow AGV with automatic lift system picks up the full container and deposits it in the specified lane.
It then moves an empty container to the conveyor line at [E].

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Benefits of the LEO system

LEO Benefits compared to manual transport

Cost-efficient operation
The LEO system stands out for its efficiency and achieves rapid amortisation, often in less than a year.

Example: With an investment of EUR 20,000, a LEO transporter works 300 working days per year and 20 hours per day. The cost per day is as low as 6 € for a travel route of up to 50 kilometres per day.

Reduced risk of site downtime
LEO convinces with simplicity of use and an efficient design. This translates to very little downtime!

LEO will not get sick, does not take holidays and does not need days off for training.

Well-structured and optimised processes
Routes and journey times can be calculated precisely from start to finish. LEO reliably travels the defined routes over and over again with the same precision.

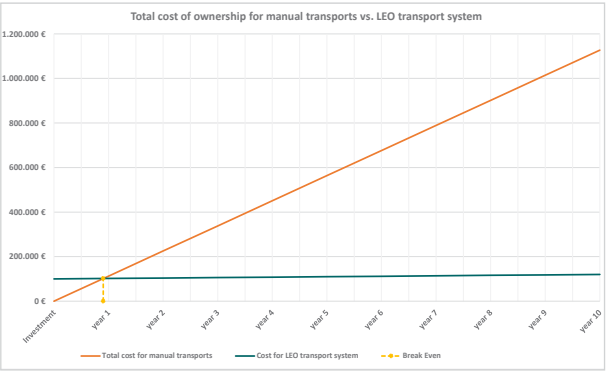
While on its way to the next destination, LEO assumes the task of a buffer store. Manually serviced storage areas at workstations can be reduced to a minimum.

Efficient deployment of your skilled workers
Employees can focus on value-adding activities while being reliably supplied with goods. At the same time, finished goods are being transported off.

Payback calculation of the LEO transport system

LEO costs vs. costs for manual transport by staff

Distance between source and destination in one direction	25	m
Number of bins or cartons per transport mission	10	pieces
Number of trips per operator and hour	4	per hour
Time needed for manual loading/unloading	15	seconds
Average walking speed	1	m/s
Time required per mission	350	seconds
Time / capacity needed	0,39	per hour
Transported quantity	40	pieces
Labour costs per hour	35	EURO
Daily working hours	24	hours per day
Working days per year	300	days per year
Personal need allowances and rest breaks	15	%
Required staff working time per year	2800	hours per year
Total time required (incl. personal need allowance) per year	3220	hours per year
Personnel costs for transports per year	112.700 €	EURO per year
Equivalent to number of full-time employees (FTE)	2,0	employees per year
One-off investment into LEO system	100.000 €	EURO
Annual operating costs LEO system (electricity, maintenance)	2	%
Annual operating costs LEO system	2.000 €	EURO per year
Payback time	**0,90**	**years**
Return on Investment (ROI)	**110,70**	**%**



Advantages of the LEO system over other AGV systems

Low initial cost
The costs of a LEO system are often 50% lower than those of alternative solutions. The LEO system requires no investment in WLAN infrastructure. As the vehicles are kept simple, running costs in terms of power consumption and maintenance are also very low.

Greater efficiency
LEO requires significantly less time for automated product loading and unloading. The LEO locative system can carry out a double swap without stopping, and is therefore particularly efficient. The LEO flow system is also capable of swapping containers in less than 15 seconds which includes correct vehicle positioning.

Excellent performance in narrow driving spaces
LEO performs particularly well in narrow spaces. At reduced speed, LEO can drive through aisles that are only a few centimetres wider than the vehicle itself.

Transparency and quick route adjustments
The clearly visible routing shows the operator where vehicles are travelling and where loads must not be parked.

Routes can be changed quickly and easily without external support. In most cases, this can be done by your staff!

LEO Benefits compared to conventional conveyor systems

Lower investment
The LEO system is significantly cheaper than conveyor technology in the case of low and medium mission numbers (up to a maximum of 200 missions/h).

Scalability
LEO grows with your system. Investments only need to be made as and when your business grows.

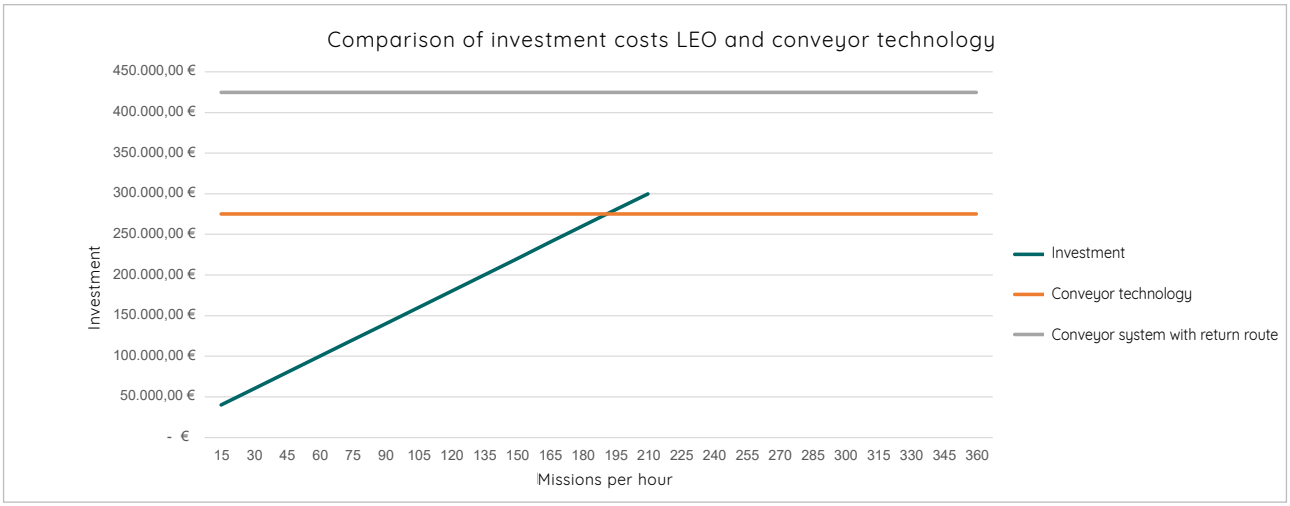
Unobstructed pathways
The LEO solution does not block routes. You can continue to cross the routes as you wish. Traffic light switching for forklift traffic is also possible.

Buffer function for containers
Thanks to its automatic lifting platform, LEO flow can be used to deposit containers on several levels at their destination. In this way, processes can be decoupled in a space-saving and cost-efficient way.

High degree of flexibility
LEO routes can be modified and extended easily, quickly and cost-effectively.

Operational availability
The LEO system does not have a "single point of failure". If a vehicle fails, the entire transport route does not fail.

Low operating costs
A LEO vehicle requires around 200 kwH of electricity per year on 300 working days with approx. 20 hours of vehicle time per day.
No need for maintenance contracts with expensive on-call service for short response times.



Example calculation

Goods are to be deposited at several points along a route of 100 metres. In our first planning variant, goods are only conveyed in one direction. For example, from the picking zones to the consolidation area.

In a second planning variant, empty containers are to be returned. The investment in conveyor technology is independent of the throughput. The LEO performance, on the other hand, can be scaled.

Nor does LEO incur any additional costs when returning empty containers.

The initial investment in a LEO system reaches the break-even point at a transport volume of around 175 containers per hour. If empty containers are returned, the break-even point is reached at almost 300 missions per hour.

Energy consumption

Assuming a conveyor system runs for approx. 16 hours a day for 300 days a year. Each metre of conveyor technology consumes approx. 250 Wh. For a one-way route, the electricity consumption per year totals approx. 12,000 kWh, for a return route twice that amount, i.e. 24,000 kWh.

With 175 missions per hour, 12 LEO vehicles are required, which together consume 2,400 kWh per year.

At 0.20 EUR/kWh, this results in savings of 1,920 EUR per year.

With 300 missions per hour, 21 vehicles require 4,200 kWh per year.

At 0.20 EUR/kWh, this results in savings of 3,960 EUR per year.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Reference projects

BASF, Frankenthal, Germany

Places of use

- Production
- Warehouse

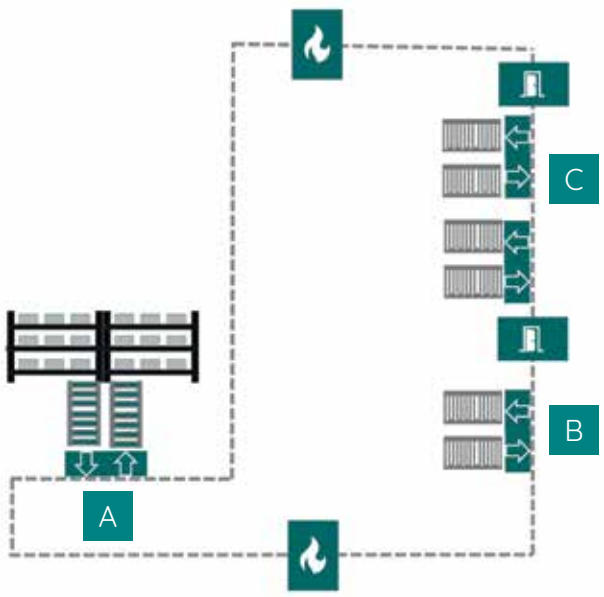
Specifics

- Automated storage environment
- Centralised control
- Fire protection doors
- High-speed doors

Industry

- Electrical engineering and process technology
- Pipework technology
- Machine components
- Laboratory equipment

Layout



Scope of delivery

- 4 LEO locative transporters
- 4 twin stations with buffer lanes
- 3 Smartboxes
- 1 tablet

Added value for the customer

- Savings of 22 km/day for forklift drivers
- Increased safety due to reduced forklift traffic
- No WLAN or IT integration required for the BITO LEO system
- ROI within the first year of operation

How LEO is used at the customer's site

As per order, the pickers retrieve goods from the Autostore totes and pick them into BITO KLT plastic containers. After all ordered goods have been picked, the containers are moved on roller conveyors from the workstations to an upstream LEO locative twin station.

This is where the LEO transporter picks up the containers and takes them to the shipping area. The driverless transport system delivers the containers to a LEO twin station installed in the dispatch area, where they are collected by the freight shipping service and prepared for dispatch.

After the goods have been taken out, the empty containers are returned on a roller conveyor to the LEO station, where they are picked up by the LEO AGV and moved to the LEO twin station in the picking area for a refill.


AS PORT 1
BASF
We create chemistry

SKF, Berlin-Marienfelde, Germany

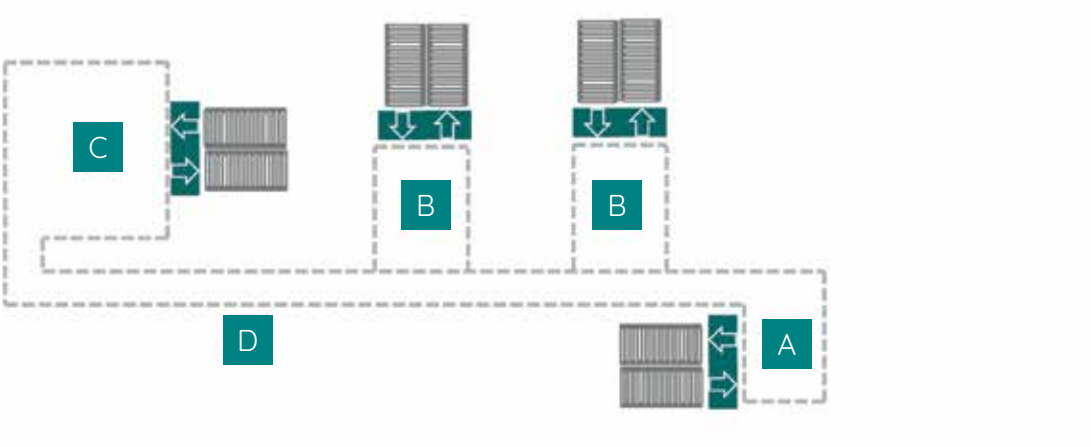
Places of use

- Production
- Warehouse

Specifics

- Central lubrication systems

Layout



Scope of delivery

- 2 LEO locative transporters
- 4 LEO locative transfer stations

Added value for the customer

- Drastic time savings
- Short travel routes, reduced downtimes
- Quick and easy supply of assembly stations

How LEO is used at the customer's site

In the past, incoming parts were grouped in the goods-in area (A) and packed onto pallets. The parts were only delivered to the assembly stations (B) when a pallet was fully loaded, which is why the pallets were left waiting in the goods-in area for a very long time.

The objectives of this project were to improve value-adding processes by automating internal transport and to reduce transport times and downtimes.

LEO locative transports the parts from the incoming goods department to the assembly stations and also transports fully assembled components - depending on their status - to warehouse (C) or to dispatch (D). Before using LEO locative transporters, the staff had to walk these distances and move goods with a hand pallet truck.
Two LEO transporters are now used in the assembly area to connect all workstations with each other.


SKF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Achtung
maximale
Tragkraft:
20

Versandmanufaktur, Witten, Germany

Places of use

- LEO connects picking stations
- Picked goods are moved

Specifics

- Orders are picked with MPA scanners

Industry

- Logistics
- E-commerce

Scope of delivery

- 5 LEO locative transporters
- 6 twin stations

Added value for the customer

- Improved workplace ergonomics
- Equalised and automated structures in the material flow process
- Maintaining high standards in the heterogeneous environment of e-commerce

How LEO is used at the customer's site

The aim of the shipping company was to reduce error rates and thus optimise processes. The material flow was therefore to be automated using BITO LEO transporters. Previously, the products were placed one by one in a KLT container divided by hanging racks and moved on trolleys by the staff.

These long distances are now covered by five LEO locative transporters, which pick up the goods at the LEO locative stations in front of the shelving and transport the goods to the assembly and dispatch stations. The automated guided vehicles thus save employees a large proportion of the walking distances between picking, goods receipt and dispatch. Staff pick the goods from the shelving first and then place them in containers by the staff. Picking is paperless with MPA scanners based on the multi-order picking method. The filled containers are placed on the LEO locative stations. LEO picks up the containers and transports them onwards.

The operator send their goods with LEO locative from the starting point to a destination of their choice, which is specified beforehand using an input medium, in this case a tablet permanently mounted in the goods receiving area. There is also a LEO station installed at the incoming goods area. The tablet sends the destination information via Bluetooth technology to a Smartbox, which is attached to the LEO station serving as a container transfer point (the destination). There are six destinations for the six stations to choose from on the display, each of which is shown with its own symbol.


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MEWA, Weil im Schönbuch, Germany

Places of use

• Production

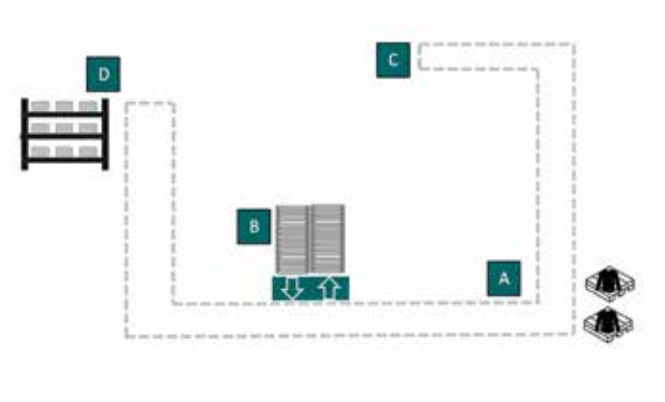
Specifics

• Lean Lift

Industry

• Textile industry

Layout



Scope of delivery

- LEO covers a route of some 200 m
- 2 LEO locative transporters
- 1 LEO twin station
- 2 tablets for entering destinations
- Assembly and start-up service

Added value for the customer

- Return on investment in less than 10 months
- Flexible automation
- Scalable solution

How LEO is used at the customer's site

Customers deliver dirty laundry in batches every day. The laundry is first stored in the incoming goods department (A) where it must be registered, checked and sorted (B). At this point, it must also be decided, for example, whether the laundry needs to be prewashed at station (C) before proceeding to the main wash. In other cases, the goods must be customised at station (D) with an emblem, a barcode or a number and stored in a lean lift. The LEO locative system is a flexible and cost-effective solution for automating these processes.

The batches are delivered from Monday to Saturday. Between 50 and 100 BITO EQ containers with dirty laundry are delivered per batch.

Two LEO locative transporters are used to automate manual handling. They transport the containers autonomously and save the staff 200 metres of walking distance.


mewa
#textilsharing
MEWA


mewa
MEWA

Carl Christensen, Denmark

Places of use

- Warehouse

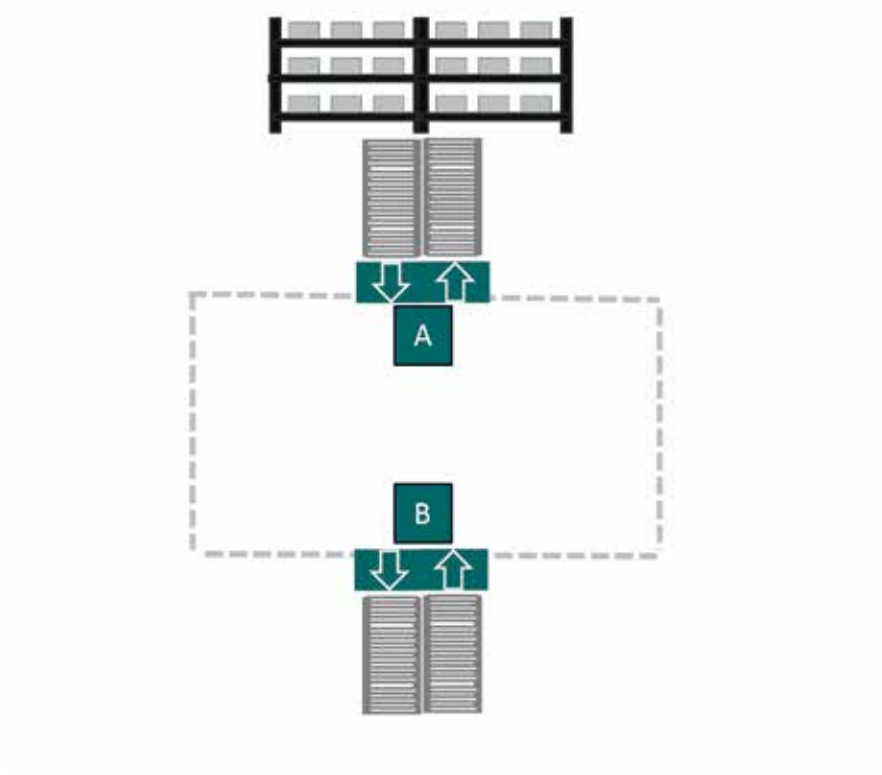
Specifics

- Automated warehouse

Industry

- Automotive industry

Layout



Scope of delivery

- 1 LEO locative transporter
- 2 twin stations with buffer storage lanes

Added value for the customer

- Optimisation of logistic processes
- Easy set-up and control of LEO transporters
- Direct connection from the AutoStore system to the shipping area without loss of space
- Low-cost alternative to conveyor technology

How LEO is used at the customer's site

At CAC, products are stored in an AutoStore system (A) and need to be transported to the shipping area (B).
The internal transport system was to be streamlined to ensure a continuous flow of goods.

The customer now benefits from a direct connection between the AutoStore system and the goods-out area with no floor space wasted. LEO takes care of transporting the bins, making expensive conveyor technology superfluous.

MAGNA, Czech Republic

Places of use

- Production
- Warehouse

Specifics

- Customised on-top racks
- Centralised control
- Vertical storage lift

Industry

- Automotive industry

Scope of delivery

- 100-150 m loop
- 200 LEO custom transporters for use at three locations

Added value for the customer

- Cost-effective solution for automated operations
- Optimal adaptation to customer requirements
- Efficient, automated transport of components
- In contrast to overhead conveyors, staff mobility along the conveyor route is not restricted.
- Safety technology prevents accidents involving pedestrians.

How LEO is used at the customer's site

Four bumpers are transported at the same time on a LEO transporter with a customised on-top rack. The bumpers are manually loaded and unloaded. At the push of a button, operators can enter different destinations to feed the lines of product variants. LEO accompanies the material flow between bumper production and metal painting.

The loop is 100 to 150 metres long, including one lift ride per loop. The LEO AGVs have a dual function. On the one hand, LEO serves as a mobile assembly line to bridge distances. At the same time, LEO also serves as a buffer store.


MAGNA


BITO
MAGNA

Brady Seton, France

Places of use

- Zone picking
- Order consolidation
- Packing

Specifics

- Multi-tier shelving
- Vertical storage lift
- Empty container cycle
- BITO MB containers

Industry

- E-commerce
- Operating supplies

Scope of delivery

- 4 LEO locative transporters
- 5 twin stations, each with a 2.4m long buffer lane
- 2 LEO tablets including a Smartbox for dynamic entry of the target data

Added value for the customer

The customer's aim was to automate the routes between the picking and packing stations.

A conveyor technology solution was considered as an alternative to the BITO LEO system.

The investment costs for the LEO system were significantly lower than for a conveyor system. The lower running costs and the fact that pathways remain clear have also helped to demonstrate that the LEO system is the more efficient system.

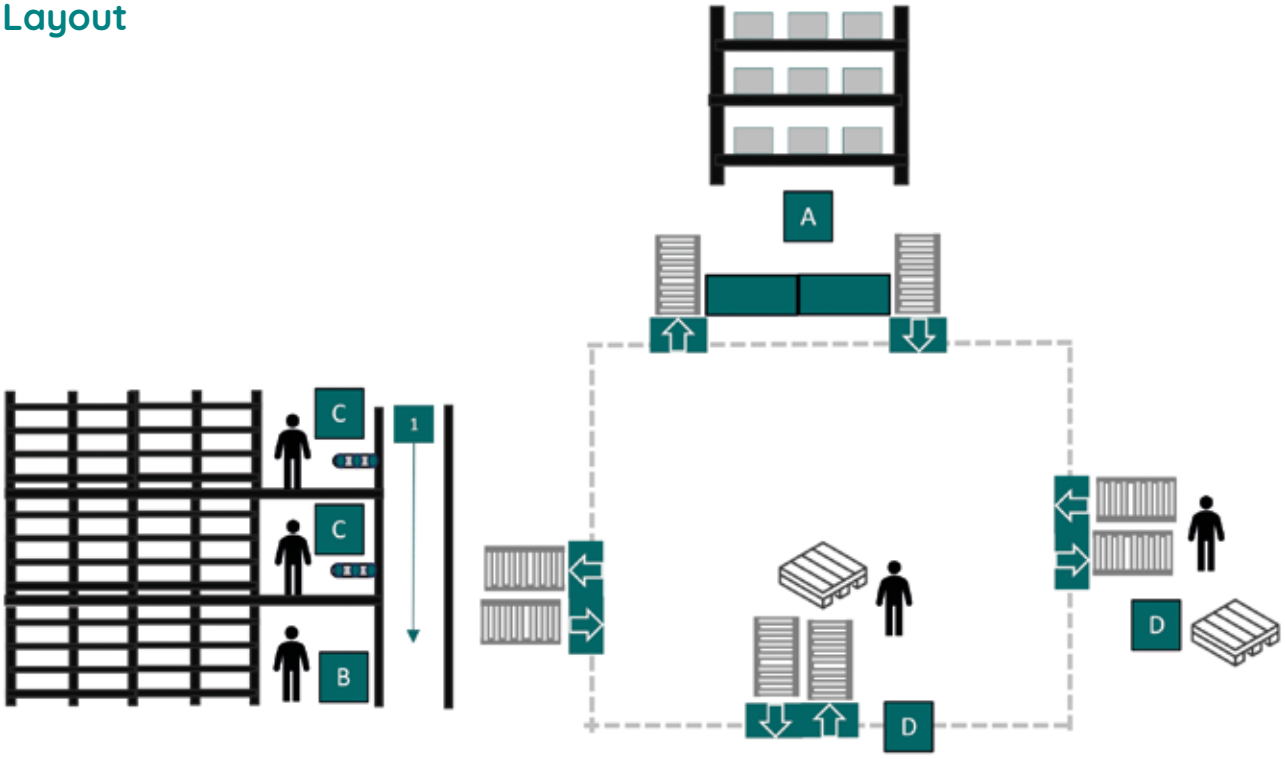
How LEO is used at the customer's site

The goods to be delivered are stored in a BITO multi-tier system and in a vertical storage lift. The A-items are stored in the vertical storage lift (A), the B-items on the lowest level of the multi-tier system (B) and C-items on the two levels above (C). A bin lift transports picked orders down to the lowest level. The warehouse is organised in such a way that A-items are also stored in the multi-tier system for orders with both A and B or C-items. LEO locative transfer stations are installed at several packing stations (D) with buffer lanes for loading and unloading.

Each order is picked into a BITO MB container. The container is placed on the LEO locative transfer station and automatically transported to the packing stations. There, the goods are packed and placed on a pallet. The buffer lanes ensure that a larger quantity of orders can be stored on site before they are packed.

The empty containers are sent to the buffer lanes at the multi-tier system or vertical storage lift. A closed container cycle is thus created.

Layout




LEGO
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LEO System

LEO carrier

Features
LEO carrier has four shelf levels, each measuring 625 x 425 mm, which can be used to store goods. By entering data on the permanently mounted tablet,
LEO can be directed to various destinations. Thanks to the handles at the front and the rear,
LEO can be lifted from its track and used as an order picking trolley.

- Ready for immediate use
- User-friendly operation
- All-in-one solution

Efficiency

Flexibility

Easy to use

Fact sheet

Maximum load capacity	50 kg
Shelf dimensions	700 x 425 mm
LEO vehicle dimensions (W x L x H)	700 x 500 x 1458 mm
Battery runtime	up to 16 hours

Applications

Order picking
LEO carrier can be used as a picking trolley to accompany the order picker during the process.

Picked goods are taken to the packing stations.

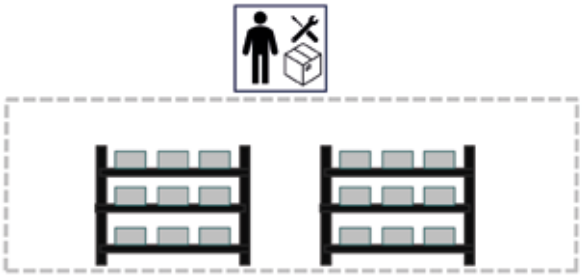
Express deliveries are loaded and transported straight to the packing station without any detours.

Allocation of incoming goods
Incoming goods are distributed to various positions in a bin storage facility/ASRS system.

With a WMS interface, storage positions can also be allocated automatically.

Supply for production lines
A LEO carrier is loaded at the materials supermarket. An operator directs the AGV to the desired destination using a tablet.

LEO is unloaded by another operator and placed back on its track.



Returns management
Operators place returned goods on the LEO shelves and send the transporter to the reworking stations. The goods are then transferred back to the warehouse.

Mobile buffer stock
Thanks to the shelving levels, LEO carrier offers sufficient space for a number of bins and boxes or for individual items. If the transporter is used between two production stations, it can be used as a mobile buffer store.

LEO locative

Features
LEO locative is an automated guided vehicle that will move bins, cartons and trays autonomously. The system does not require an IT connection and can be implemented and expanded by the customer without external support.

- Efficient
- Ergonomic
- Tried and tested

Efficiency

Flexibility

Easy to use

Fact sheet

Maximum load capacity	35 kg
LEO vehicle dimensions (W x L x H)	700 x 425 mm
Battery runtime	up to 16 hours
Weight incl. battery	35 kg
Voltage	24V
DC Power supply	40 W
IP code (Ingress Protection Code)	IP 21
Noise emission	<60 dB

LEO locative is a patented all-in-one system consisting of a transporter, a transfer station and a control system

A LEO transporter autonomously picks up or deposits containers and cartons at LEO transfer stations. Optionally, LEO can also be loaded and unloaded manually by an operator. Loads are transported at an ergonomic height and can be conveniently picked up from the vehicle or placed on it. Load collection and delivery at a transfer station is a fully automated process. If more space is needed for multiple container/carton handling, a buffer roller lane can be mounted to the transfer station providing enough room for LEO to deposit or collect several bins at the same station without the need for human intervention. The LEO locative package is a safe, CE-certified all-in-one solution.

Applications

- LEO connects manufacturing areas with order picking stations
- LEO is ideal for decentralised order picking
- LEO supplies raw materials/parts to production/assembly stations
- LEO returns empty bins
- LEO connects production stations with the packing/goods-out area

LEO locative transfer stations

LEO transfer stations are a central element of the LEO locative system. Loads can be delivered and picked up manually or in a fully automated process. At LEO twin stations, loads can be picked up and dropped off in one go. The transporter simply drives through the twin station. Light barriers on the stations recognise whether a container is on the station and whether it is positioned correctly. The LEO system also includes stations for pick-up and drop-off only.

The various stations are operated either via mains voltage or with a LEO battery.

Dimensions

LEO station	Dimensions (W x L x H)
Pick-up/drop-off station	710 x 770 x 1107 mm
Twin station	710 x 1562 x 1107 mm

Buffer lanes, connection to conveyor systems and powered rollers

Buffer lanes
Buffer lanes of either 1.2 or 2.4 metres long can be added to LEO transfer stations. They extend the operating range of the station and decouple pick-up from drop-off. Up to seven containers can be dropped off at one time, which will be picked up one by one by the LEO transporter and taken to their destinations.

Connection to existing conveyor systems
LEO stations can be linked to existing conveyor systems. An application example would be a LEO route to and from an ASRS facility.

LEO station with a powered roller platform
The two middle rollers of the loading platform are replaced by two powered rollers. They ensure that loads weighing between 0 - 35 kg are safely moved on and off the roller platform. In addition, the roller platform can be adapted to the height of the conveyor system for a smooth load transfer. This option can be retro-fitted together with a Smartbox Pro.

LEO flow

Features
LEO flow is equipped with a belt conveyor top. Containers, cartons or small parts are picked up and discharged sideways to the direction of travel. Three reflective light barriers detect the position of the goods on the vehicle and ensure that the goods are centered before transport.

The LEO Smartbox communicates between vehicles and conveyor technology. The modular system has been designed for use with a standard LEO transporter. This means that LEO locative variants (built as of 2022) can be converted to a LEO flow system.

- LEO replaces a fixed conveyor line
- LEO also handles bulky goods of non-standard dimensions
- LEO perfectly integrates into existing operations

Fact sheet

LEO flow variants	600 x 400	400 x 600	400 x 600 DL	600 x 400 lifter	400 x 600 lifting
Maximum load capacity	35 kg	35 kg	Σ 25 kg	35 kg	35 kg
LEO vehicle dimensions (in mm, W x L)	550 x 830	650 x 830	650 x 900	500 / 580*	500 / 580*
Min. height (in mm)	450	450	450	1,150 / 1,600*	1.150 / 1.600*
Max. height (in mm)	900	900	750	550 x 830	650 x 830
Height adaptability	Fixed height	Fixed height	Fixed height	Automatic lifting	Automatic lifting
Vehicle weight incl. battery	35 kg	35 kg	60 kg	50 kg	50 kg
DC Power supply	24V / 40 W	24V / 40 W	24V / 40 W	24V / 55 W	24V / 55 W
Battery runtime	12-16h	12-16h	12-16h	10-14h	10-14h
Charging power 230V	230V/120 W	230V/120 W	230V/120 W	230V/120 W	230V/120 W
IP code (Ingress Protection Code)	IP 21	IP 21	IP 21	IP 21	IP 21
Noise emission	<60 dB	<60 dB	<60 dB	<60 dB	<60 dB
Battery runtime	12-16 h	12-16 h	12-16 h	10-14 h	10-14 h

*** Variant on request**

LEO flow variants

LEO flow 600 x 400 with and without automatic lifting mechanism for long-side on handling

Loads are conveyed at right angles to the direction of travel.

A 600 x 400 mm load is placed and moved long-side on at right angles to the conveying direction.

The transport height is determined individually for each customer for the variant with a fixed-height top belt conveyor. The height can be changed at a later date by adjusting the aluminum profiles.

Automatic lifting is enabled by a scissor lift system.
During travel, the belt conveyor unit is always lowered to the minimum height of 500 mm. It is only raised when loads are picked up or dropped off.

The LEO flow lifter receives the height coordinates from the LEO Smartbox.

A folding bellows prevents access to the scissor lift system and thus increases safety at work.

LEO flow 600 x 400 with and without automatic lifting mechanism for short-side on handling

Loads are conveyed at right angles to the direction of travel.

A 600 x 400 mm load is placed and moved short-side on at right angles to the conveying direction.

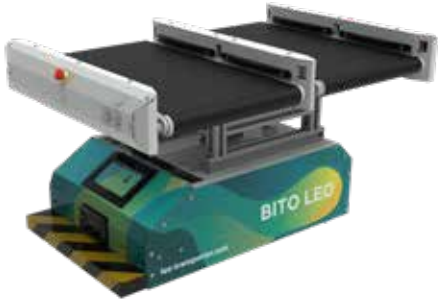
This variant is available with a fixed-height loading top or with a height adjustable top (“automatic lifter”).

LEO flow 400 x 600 DL with a fixed-height loading top

Two containers can be transported at the same time. Loads are moved at right angles to the direction of travel.

The system was designed for a quick and uncomplicated container exchange with one and the same vehicle. Empty containers are transported in the rear space. At workstations, the full container is picked up first and then the empty container is deposited.

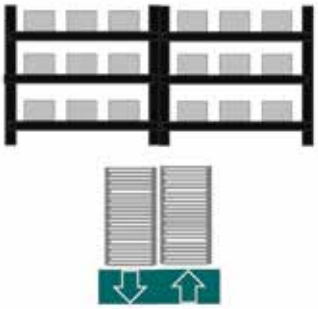
There is only one version with a fixed-height top available.



LEO flow applications

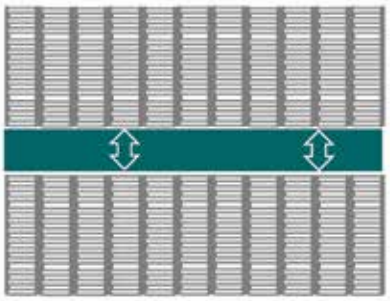
Receiving and delivering from and to conveyor systems
LEO is ideal for picking up and delivering goods from and to conveyor systems. The automatic lifting mechanism bridges the source and the sink of the conveyor system.

LEO flow can therefore be fed directly from an automated small parts warehouse and also transfer goods to an ASRS.



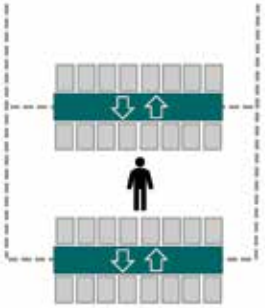
Delivering to gravity-driven roller conveyors
LEO flow can also deliver goods to gravity roller conveyors. LEO flow services individual lines, side-by-side roller convey- or lines or a "roller conveyor tunnel".

This allows space-efficient buffering and sorting of goods by delivery location, shipping service provider, finishing step or order.



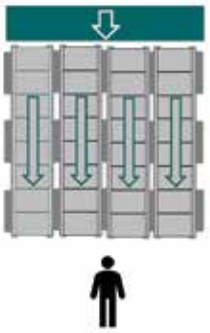
Delivering straight into containers/cartons
LEO can transfer goods or small cartons straight into plastic containers, mesh boxes or cartons.

Depending on the type of load, there is no need for manual packing or stacking.



Delivering to buffer racking
Buffer racking allows to decouple processes or to store pallets by product type. A storage bay may be reserved for a number of single-reference pallets, a storage lane for the production quantity of a production shift or for similar distinguishing criteria.

Pallets are stored automatically on several levels and removed manually.



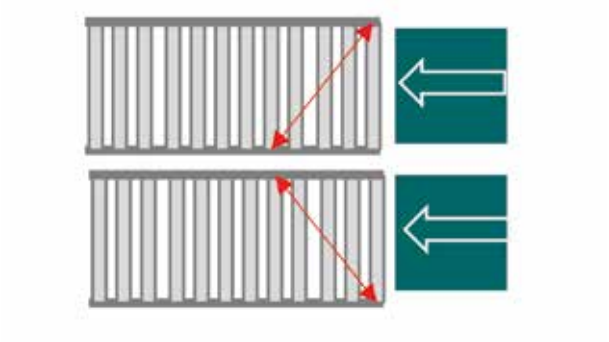
Delivering to production machinery
LEO flow can deliver raw materials to production machines and collect finished goods, both as individual item and boxed goods.

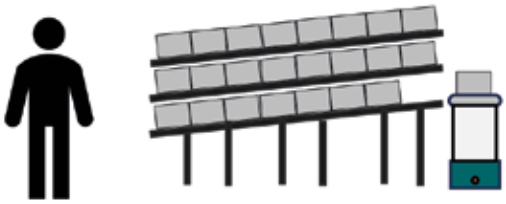
With the LEO flow 400 x 600 DL, a double exchange of full and empty containers/cartons can be realised in one go.

LEO flow case studies

Receiving and delivering from and to conveyor systems
A LEO set consists of a LEO Smartbox, a terminal box and retro-reflective photoelectric sensors.
The Smartbox provides the interface between LEO and the conveyor system. It detects whether a space is occupied. The Smartbox transmits the command to convey or pick up to both the conveyor system and the LEO flow vehicle.

It can be linked to all common conveyor systems.





Delivering to buffer lanes
Single-reference storage of finished products prior to palletising is crucial in an autonomous operation.

Containers with a height of up to 270 mm and a maximum payload of 15 kg can be stored three levels high. Space occupation is as low as 0.12 m² if 600x400 mm containers are stored on three levels.This calculation example follows the principle of BITO carton live storage.

This calculation example follows the principle of BITO carton live storage.

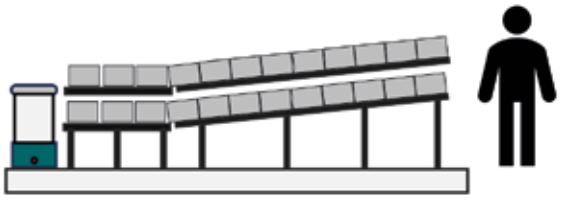
Returning empty containers
In order to operate as long as possible without manual intervention, empty containers must be buffered in sufficient quantities.

For this purpose, BITO relies on a combination of gravity roller conveyors and powered roller conveyors.

LEO flow can service several storage levels which improves space utilisation.

LEO can service three levels if containers are up to 170 mm high. Two levels can be serviced if containers have a height of up to 450 mm.

Space occupation with two levels is only 0.18 m² for 600 x 400 mm containers. If three levels are serviced, space occupation is as low as 0.12 m² for 600 x 400 mm containers.



LEO custom

Features
LEO custom was designed to accommodate customised add-ons for carrying application-specific items. Loading platforms or racks can be fitted onto the perforated mounting plate and adjusted in height for convenient and ergonomic load handling. LEO custom can also be designed as a tugger vehicle.

- Basic unit which can be adapted to customer-specific applications
- Integrate your own control panels and sensors
- Serial interface for custom solutions

Fact sheet

Maximum load capacity	55 kg
LEO vehicle dimensions (W x L x H)	500 x 830 x 280 mm
Battery runtime	up to 16 hours
Weight incl. battery	25 kg
Voltage	24 V
DC Power supply	40 W
IP code (Ingress Protection Code)	IP 21
Noise emission	<60 dB

LEO custom adapts to your application

LEO custom in operation at MAGNA

MAGNA


LEGO
LOCATIVE

Technical information

Battery and charging technology

- LEO rechargeable batteries have a runtime of 12 to 16 hours.
- Long service life thanks to lithium technology
- Three charging options

BITO opted for lithium batteries (LiFePo4)
BITO opted for a battery technology that is known for its high energy density, thermal and chemical stability and long service life. Compared to lithium-ion batteries, lithium batteries have a significantly lower fire risk.

In addition, lithium iron phosphate batteries can be stored for longer periods without intermediate charging. This facilitates spare parts storage and reduces the likelihood of batteries going into a deep discharge state.

Compared to conventional lead acid batteries, lithium batteries have a longer lifetime and increased performance. This outweighs the initially higher cost and provides a significantly higher price-performance ratio.

Fact sheet

- 12-16h runtime
- 1,000 to 5,000 charge cycles

Battery

Dimensions (W x L x H)	370 x 80 x 225 mm
Battery type	LiFePo4
Weight	7 kg
Rated capacity	20 Ah
Charging time	6-8h

Battery charger

Dimensions (W x L x H)	120 x 190 x 70 mm
Primary voltage	230 V / AC 50 Hz
Charging current	4 bis 5 A
IEC Protection class	III

There are three options for recharging LEO transporters:

Manual battery replacement
The most efficient way to ensure continuous operation is to manually replace batteries. Simply remove the battery from the transporter and swap it for a freshly charged battery. Connect the empty battery to the charger for 4-6 hours.

In this way, the AGV is ready for use again within a few minutes. There is no interruption in your operations, hence no loss in performance.

Manual charging via the battery terminal
For a daily operation of 12-16 hours, we recommend direct charging. The charger is connected directly to the LEO transporter inlet socket.

The vehicle is ready for use again
after 4-6 hours.

Automatic charging
Ideal for 24-hour applications in an automated process.

This optional, retrofittable system enables automatic charging of the lithium batteries. For this purpose, the LEO transporter is equipped with a charging rail. After 120 to 180 minutes of operation, the AGV automatically moves to a charging station for about 30 minutes.

Guidance and navigation

- Simple stand-alone solution
- No IT interfaces need for standard use
- No area-wide WLAN necessary
- The control system grows with your projects

Optical navigation
The LEO route is defined by a 19 mm wide blue or green track line which can be applied on the floor via adhesive tape or floor painting. BITO offers a range of solutions for flooring subject to different levels of wear.

Road and traffic signs to guide the vehicles are defined by "markers". Markers are printed QR codes that define destination points, the speed to be driven at, the start and end of traffic light control, charging points, lane colour, acoustic warning signals and much more.

Hence, LEO transporters do not need to be programmed to the layout of your premises.

Simple and moderately complex layouts can therefore be implemented by the user. As a rule, extensions can also be realised without any external assistance. Optical navigation eliminates the need for time-consuming measuring of your warehouse or production hall floor space. Also, no additional path markings are necessary. Another advantage is that the flooring of your building will not be damaged.

Navigation with a vehicle-mounted tablet
The LEO transporter is fitted with a tablet that is permanently connected with the vehicle by a USB-C cable. A specially developed app enables destinations to be entered, entire routes to be programmed and called up, charging processes to be triggered manually and the return to the home station.

This function is installed by default for the LEO carrier. and can be retrofitted as an option for LEO flow, LEO locative and LEO custom.

Navigation with a stationary tablet and a LEO Smartbox
For the LEO flow and LEO locative AGVs in particular, it is recommended to separate destination entry from the vehicle.

The delivery points of the goods to be transported are simply entered by an operator using a tablet. The tablet is connected to the Smartbox which reports the requirement to the nearest available vehicle which will carry out the order.

Navigation via barcodes
In this case, load carriers are identified with a barcode which has been assigned to a target.

The LEO barcode reader is available as a base-mounted device or as a hand-held scanner. Once the barcode has been scanned, the nearest available vehicle receives the destination command via the LEO Smartbox.

Navigation via customer-related barcodes
Customer barcodes can be entered in the LEO Smartbox in CSV file format and can be adapted at any time.

Navigation with a warehouse management system
The LEO Smartbox has an automation interface. An RS232/RS485 interface enables commands to be issued by external systems, such as a warehouse management system which allows LEO to be directed to the right destinations from one central point.

On returning to the source station, the vehicle provides information that can be called up via the interface, such as the unique serial number of the vehicle, the last destination reached and the load and battery status.

Control via Com-Server and job control
To map LEO in even more complex processes, it is recommended to provide each Smartbox with a Com-Server. This will make the system network-compatible.

In this way, a higher-level control system can manage and control all pick-up and drop-off points, charging stations or traffic control points in one system.

Such a job control system can also be obtained from BITO.

Driving manoeuvres

The BITO LEO system has been on the market since 2017. The vehicles with display delivered since 2022 enable a range of new driving manoeuvres.

This means that even complex situations in areas that are difficult to access can be solved in a space-efficient manner.

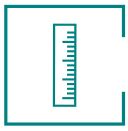
On-the-spot turning
LEO transporters can turn 180° or 90° on the spot.

This function is ideal for

- Navigating in narrow spaces that do not offer enough room for a 500 mm or 700 mm turning radius
- Layouts with an outward and a return journey without space for a U-turn
- Space-saving drive-in to a loading station or a transfer station

Reversing
LEO can reverse over short distances of three to five metres.
In order to maintain staff safety, this section of the route is travelled at a reduced speed.

With this feature, LEO adapts to the conditions of its surroundings and enables navigation in areas that are difficult to access and in confined spaces.



Trackless navigation
The BITO LEO system is a track-bound, optically navigating AGV.
Nevertheless, LEO transporters are capable of travelling up to 25 m in a straight line without lane-marking.

This avoids lane damage at junctions with frequent forklift traffic. In addition,
maintenance requirements for this section of the route are minimised.

This function is also suitable for applications in which LEO travels a long straight line alongside a pallet rack.
The benefit lies in saving material, time and effort for this section of the route.

High-precision travelling
Code tapes enable very precise driving. The Y-axis (in transverse direction to the vehicle) has already been defined very precisely with the 19 mm wide standard track tape. Code tapes also enable the X-axis to be defined accurately to the millimetre.

This technology is used for automatic loading stations and pick-up/drop-off points on conveyor systems in LEO flow applications.

Customised applications can also be implemented.

LEO Accessories, safety & service

Remote maintenance and real-time analysis with the LEO gateway

The LEO gateway is a useful optional addition to your LEO system. It is a device that records the communication within the LEO system and saves this data in the cloud database. For this purpose, the module is equipped with Ethernet, WLAN and LTE interfaces. The gateway is just as easy to operate via the integrated touch display.

The collected data is used for real-time analyses and remote maintenance in the event of problems. This means that our service staff can access your system quickly and from anywhere to reliably rectify faults.

In addition, the module can be connected directly to the LEO transporters and Smartboxes via cable. This ensures that the latest software is always installed automatically on the devices.

Remote maintenance

Data analysis

Cloud database

Automatic updates

Automatic opening and closing of high-speed doors

The LEO system is versatile and adapts seamlessly to your workplace environment. For example, it is possible to open gates and doors on demand via RF and close them again once the vehicles have passed through.

In addition to the automatic operation of high-speed doors, the closing position of doors is also monitored. This means that LEO is only granted passage through the area when the door is fully open. Furthermore, doors remain open until all transporters have left the monitored area.

Fire protection approval
Safety and fire protection play a major role in industrial environments. The LEO system adapts to your circumstances and can connect different fire protection zones.

This means that fire protection doors can be controlled via remote control to allow LEO to pass through these areas without any problems. This also prevents that fire protection doors are blocked by LEO vehicles. LEO will wait in front of the door until the vehicle has received clearance to pass through.

Door monitoring

No manual intervention

Safety

Fire protection

Traffic regulations

Although LEO transporters do not communicate directly with each other, several LEOs can navigate in one area without any problems

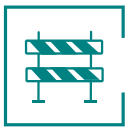
By setting up intersections, it is ensured that a LEO transporter which arrives at a certain point first has right of way over another LEO. To avoid collisions, LEOs wait for each other until they receive the signal to move on.

This function is not only limited to LEO transporters from their own fleet, but also to AGVs from other manufacturers. LEO checks an external release signal in a similar way as in the case of a fire protection door and only enters the defined area once the other AGV has left the monitored area.

This signal can also trigger virtual traffic lights or warning signals to alert other traffic participants to the LEO transporters. LEOs are also able to emit acoustic signals.

Nonetheless, LEO has a safety sensor that reliably prevents collisions with obstacles such as people, machines, walls and other AGVs.

Right of way control



Area closures

Safe

Interacting with elevators / product lifts

It is not unusual for production or storage areas to extend over several floors. These sub-areas can also be easily connected with LEO. The LEO system provides simple standard elements that enable LEO to interact with elevators and product lifts.

This means that LEO can call elevators via RF and an interface and travel autonomously to the target floor to pick up or drop off goods.

Elevator/Lift control

Scalable

Safety

Safety plays a key role when designing LEO transporters. Our LEO transporters are fitted with various sensors and safety features. LEO detects obstacles and automatically moves on once the obstacle has been removed. Acoustic and visual signals increase staff awareness even in noisy and dark working environments.

Transfer stations are also part of the safety concept: The transporters drive into a station at reduced speed to prevent injuries when containers or cartons are removed.

Permanent space monitoring of the load position ensures safe operation. Two-way communication between LEO and the transfer stations prevents LEO vehicles from entering a station that is already occupied.

The system was developed in close cooperation with the German Federal Institute for Occupational Safety and Health (BGHW)
and complies with ISO 2691-4:2020 for driverless transport systems. LEO transporters are certified in accordance with the Machinery Directive 2006/42/EC
.

Safe

Automatic vehicle stop

Obstacle detection

The LEO sensor system detects obstacles and brakes in good time. The environment perception fields are variable. The LEO transporter moves on automatically once the obstacle has been removed.

Foam shock absorber

Redundant collision safety for persons is ensured by a foam shock absorber.

Automatic stop if the optical lane is not detected

Another safety feature ensures that the vehicle stops automatically after a maximum of 0.5 m if the optical track is not detected.

Service

- Non-binding and flexible
- Discover the LEO variety
- Put LEO to the test for four weeks

Test out our LEO transporters and become familiar with all the components of the system. Experience the simplicity of the system by setting up your own system and find out how LEO works.

Buy LEO within six months and benefit from a 50% discount on the trial price.

What can be tested?

- LEO locative
- LEO custom
- LEO carrier
- LEO flow

System set-up & LEO operation

- Assembly and start-up
- Route (re-)configuration and extension
- Training of operators and service staff

Project planning

- CAD route planning
- Create flow logics
- Create a marker plan in CAD and a list of components

LEO Wiki

Our LEO Wiki provides more than just instructions on how to use our transporters. It is a tool that will keep you up to date at all times.
LEO Wiki offers updates for your transporter, Smartbox and tablet. In addition, you will find information on each transporter, a list of all markers including explanations of their respective functions, various layout examples and much more. Wiki is constantly updated and expanded. This means that you will receive updates for our products as soon as they are available.

Simply register on **www.leo-wiki.com**

Maintenance

The LEO Care service package includes an annual inspection of your system to ensure that everything continues to run smoothly. In addition, we offer follow-up training for your employees to keep them up to date. As both your requirements for the LEO system and the complexity of your working environment increase, we also carry out layout checks to make sure that the BITO LEO system remains efficient despite any subsequent layout adjustments.

Comprehensive LEO CARE service package
An all-inclusive time-based maintenance package can also be booked as an option. In addition to the benefits of the LEO Care service package, we offer a warranty for the entire contract period and optional replacement of wear and tear parts. On top of this, customers can also choose between a 24h or a 72h service option.


Remote maintenance


Data analysis


Automatic updates


Cloud database

Remote maintenance with the LEO gateway

- Faster error detection and correction
- Increased efficiency and availability of your LEO system
- Less time and effort required for system support by your staff
- Selective improvements to the system based on valid data from your operations

The LEO gateway serves as a module for data tracking and records the communication of your LEO transporters.
The LEO gateway also features a touch display to ensure easy operation.
Connecting the LEO gateway to a LEO transporter or Smartbox enables remote maintenance of your LEO fleet.
The data from your LEO transporters is analysed in real time.

Software updates can also be easily installed. Connecting the gateway to the LEO transporter or Smartbox guarantees that the latest software is automatically installed on your devices.
The LEO gateway collects data and uses it to analyse errors. This means that errors can be detected and corrected quickly.

You will also receive a six-monthly system performance report with information on the driving behaviour, loading performance and frequently occurring errors.

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