



BITO LEO AGV - Navigation & Control

The BITO LEO AGV product family including LEO locative and LEO custom is characterised by a unique navigation and control solution.

This enables us to offer you a simple, cost-effective solution that you can implement and adapt on an ongoing basis. In addition, the project realisation times are reduced to a few weeks including delivery times.

LEO Navigation

The LEO-AGV family navigates optically. Camera sensors in the LEO transporter thus detect its travel paths directly on the floor. This means that a warehouse or production hall does not have to be extensively surveyed or the surrounding area to the left and right of the travel paths provided with additional path markings.

The optical track is a 19mm wide colour strip. This can be applied to the floor using different adhesive tape solutions or coloured varnish. The track colours blue and green are available.

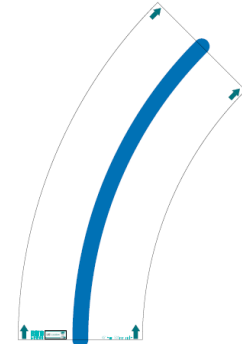
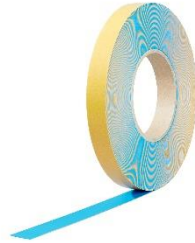
The track represents the road for LEO. LEO markers take on the roles of road & traffic signs. The data matrix codes on the markers regulate speeds and right-of-way at intersections. They also mark the position of targets and regulate the behaviour at points.

Why optical tracking:

- Simplicity:** Defining the AGV road network could not be easier. The tape is applied to the floor, the LEO Transporter is switched on, placed on the track and the system is up and running!
- Costs:** Other types of navigation such as inductive or free navigation (SLAM) cause significantly higher costs. Inductive navigation requires intensive processing of the existing ground. Free navigation requires additional sensors and software in the AGV. This increases the costs of a system at least by threefold!
- High flexibility:** The easier the system can be implemented, the higher the flexibility. In addition, the floor is not permanently damaged and needs to be repaired!
- Safety:** A visual track is very visible to people and therefore the routes of the AGVs are also recognisable to everyone!
- Availability:** Driveways can be easily kept clear due to their transparency. Damage can be detected and repaired by any employee.

LEO track guidance

We offer the following solutions as standard. All solutions can be combined:



Track tape FLEX:

Simplest and cheapest form of lane marking. Suitable for less busy environments or to test new courses quickly.

Track tape ROBUST:

Standard tape for most applications. Robust against normal loads, easy to apply and remove.

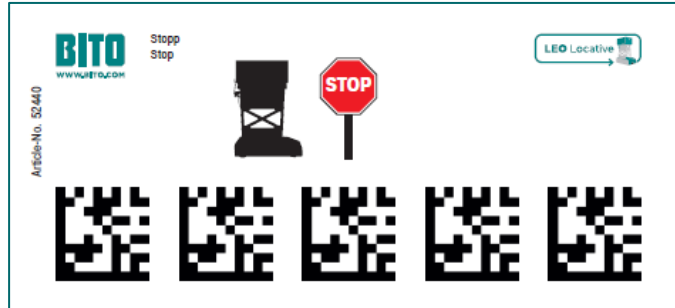
TRACK TAPE ULTRA:

Ideal for old, porous floors with changing surfaces. The 150mm wide tape always ensures the optimum contrast between floor and track.

Lacquering:

The solution for durable, highly stressed areas. The track also withstands e.g. forklift traffic for a longer period of time and reduces the maintenance effort.

LEO marker



LEO markers are simply applied next to the lane. Five identical data matrix codes are read by the LEO Transporter and then commands are executed.

Markers serve as traffic & road signs. The commands are static.

Markers are used individually or in combination. This enables thousands of possible combinations to programme your layout precisely to your needs.

Examples of traffic sign function:

Stop

If unloaded, stop

Hold for 30 seconds

Drive speed "snail" (slow)

Examples of street sign function:

If destination 5, then turn right

Transfer station to the right of the bypass with destination ID 5

If destination between < ID 10 then turn right

If destination between 5 and 10 then turn right

LEO custom marker

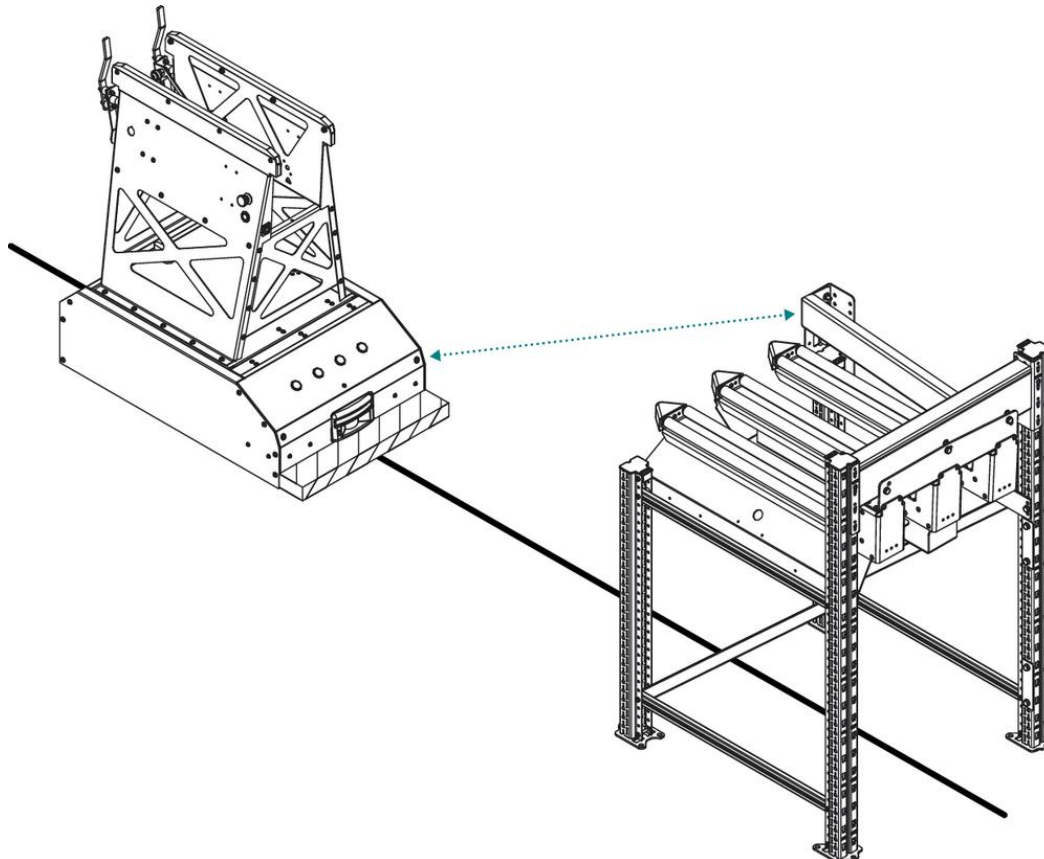
Longer marker combinations can be individually reduced to one marker. This is an optional service reducing space requirements.

LEO Control Smart Box

There are other ways to control the LEO system besides the LEO markers.

Infrared receiver/transmitter:

Each LEO transporter has two infrared receivers on the front. These are primarily used to receive signals from a LEO locative transfer station.



Smart Box - Decentralised control

The Smart Box is a decentralised control system specially developed for the LEO system. Since 2021 two versions are available, a lite and a pro variant.

Until 2020, there was only one variant, the Smart Box. Increasingly complex requirements have led to the split into two variants.

Both systems are equipped with ZigBee, Bluetooth, and a 25-pin Sub-D connector.

Smart Box lite: Reducing space requirement for a LEO locative station entrance.

Smart Box pro: Controller to enable the LEO system to fulfil complex tasks.

Comparison of the control variants

	Infrared	Smart Box lite	Smart Box pro
Integration of fire protection gates	X	X	X
Doors opening specifically for LEO.	X	X	X
Entry into stations with approx. 2m distance and direct line of sight	X	X	X
Entry into stations without line of sight within a radius of 5-10m		X	X
Straight section before entering station.	2.200mm	1.200mm	1.200mm
Empty vans can enter stations even if the drop-off places are occupied.		X	X
Only one LEO is called to the station to avoid unnecessary journeys.		X	X
LEOs only drive to stations when needed and save themselves longer journeys.		X	X
Adjustable number of transporters in the queue before station			New
Waiting directly in front of the station		X	X
Destination entry via tablet			X
Destination entry via barcode reader			X
Destination entry via keypad			X
Traffic light function			New
Roundabout function			New
Serial interface to PLC, LVS, ERP systems & machine controls (RS232/RS485)			X
Call Function Transmitter / Receiver			New
Call function repeater		New	New

Communication of the Smart Box

The Smart Box is the interface between the LEO Transporter and other systems. These other systems can be LEO transfer stations, tablet as an operating option or even a warehouse management system.



Example communication:

By driving over a marker combination, the LEO Transporter starts communication with the Smart Box.

The Smart Box is optimised for operation with LEO transfer stations. It knows whether the intake and delivery side are filled or not.

The Smart Box communicates with a tablet via Bluetooth or the barcode reader is connected directly to it via a Sub-D connector.

The Smart Box and LEO pass on the target information fed in by the controls.

The information is confirmed, and LEO moves to the corresponding destination.

Operating options/ User interface options:

LEO tablet

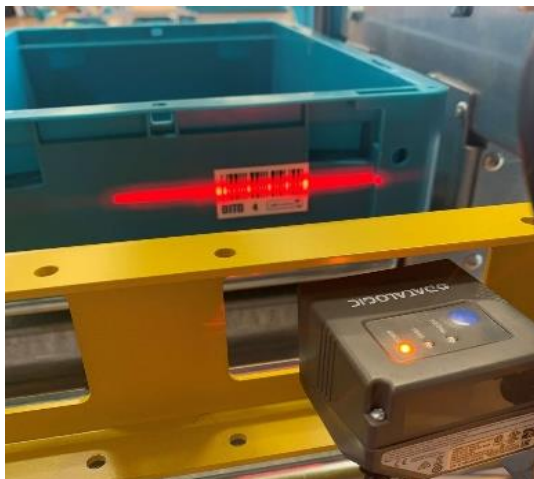


The LEO tablet enables comprehensive command inputs.

The operator simply selects the appropriate target, or a sequence of targets.

The app is optimised for operation with LEO locative transfer stations and gravity conveyors.

Barcode control



BITO provides both the barcodes and the reader.

This is connected to the Smart Box by means of a Sub D connector.

The barcodes correspond to the LEO destination ID.

After reading the barcode, the LEO transporter is informed of the corresponding destination.

Ideal for Kanban processes.

Keypad



The keypad is recommended for rough applications, e.g., when wearing gloves.

It is connected directly to the Smart Box.

Each button corresponds to a LEO target. 6-way keypads are the standard.

LEO can be sent to 6 different destinations.

Automation interface



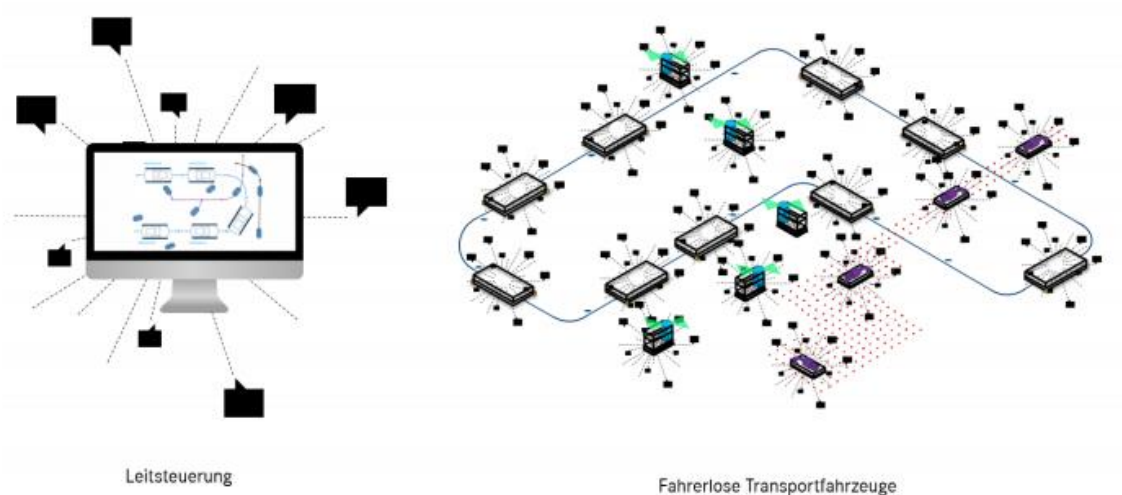
External systems can be connected directly to the Smart Box with a 25-pin sub-D connector.

The systems can then communicate via the RD232 or RS485 serial interfaces.

An open interface description defines the communication with the Smart Box pro.

Machines, PLCs, LVS or ERP systems, for example, can be integrated via the interface.

VDA 5050



The standardised interface between control systems and driverless transport systems, which has been available since the end of 2019, focuses on systems with WLAN connections and central controls.

Therefore, the interface is currently not supported. However, connection is possible in principle.

If you are interested in controlling LEO using the interface, please contact us directly.