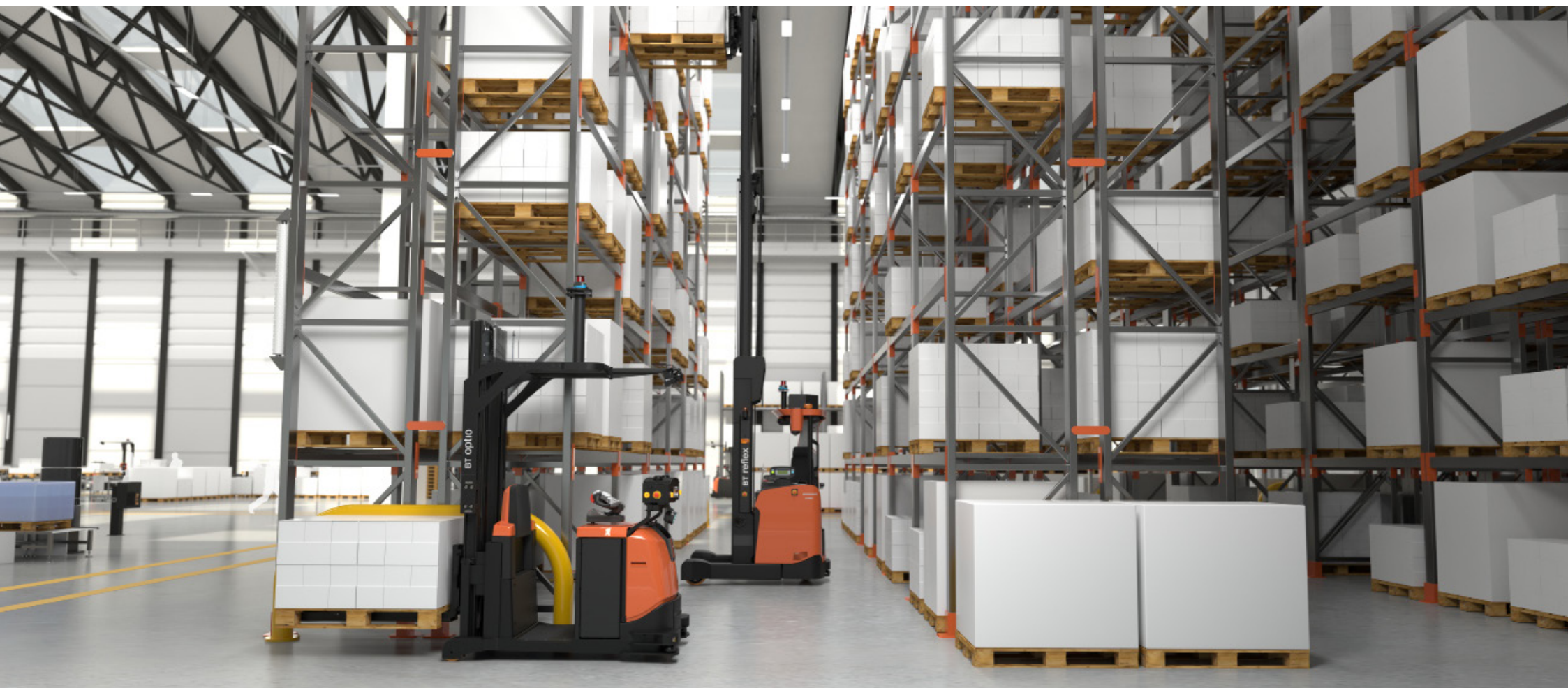


Autopilot

Automated vehicles for lean material handling



SMARTER HANDLING

WITH LEAN AUTOMATION

Toyota has a long history in material handling: in the very beginning by establishing the Toyota Production System, and continuing to innovate over the years, leading to Toyota's expertise in lean manufacturing today. We continually look to optimise our customers' warehouse operations with a wide range of products and solutions to increase productivity, efficiency and safety.

Our approach to automated material handling supports our lean thinking. Today we are already working on the future of logistics, namely Industry 4.0, by creating a connected world thanks to telematics, automated vehicles and remote-controlled machines. We can offer a new dimension of productivity by providing solutions for automated processes in existing as well as new environments – with a step-by-step approach or a complete system conversion. This way we can move together towards smart factories that offer faster production, less waste, and more sustainable material handling.

SMARTER HANDLING

WITH AUTOPILOT

The Autopilot range supports our lean approach. These automated guided vehicles (AGVs) not only guarantee an optimised flow of goods by delivering the right load just in time but they also decrease waste and costs in terms of

Driving:

-The main cost in traditional material handling is attributed by the driver. Automation leads to a significant decrease in human involvement, only requiring people to supervise the system. Eventually saving up to 70% of the total operational cost.

Servicing:

-The Autopilot trucks always drive in the most efficient way, keeping wear and required maintenance to its components to a minimum, and achieving a lifecycle of about 10-15 years.

Safety

-The Autopilots are equipped with state-of-the-art safety laser scanners and additional features to secure a safe working environment, even when working closely to humans.

Damage

-While material handling may occasionally cause damage cost, the AGVs will cause virtually no damage to goods or infrastructure.

Energy

-Thanks to smooth driving behaviour and efficient transport, automated trucks contribute to energy efficiency. Charging can even be done automatically with Lithium-Ion batteries, that save 30% more energy and eliminate the need for specific charging rooms. Electricity and heating bills can also be reduced as the trucks can operate in total darkness.

The complete Autopilot system is earned back typically within 1-3 years:
75% of Autopilot installations have a payback time of approximately 2 years.



FOR EVERY PART OF YOUR OPERATION

The Autopilot is designed to automate repetitive pallet handling. It is based on the industry-proven Toyota warehouse truck range which makes it easy to automate existing manual processes.



Pallet transport

- Our Autopilot range guarantees fast, smooth and safe horizontal transport of pallets. The compact powered pallet truck LAE250 with 2400 mm forks handling 2 pallets at the same time is particularly suited for long-distance transport of heavy loads.



Block stacking

- Storing pallets on the floor, stacked in deep lanes or block buffers, is easy to manage with the Autopilot range. Our SAE160 stacker with lift heights up to 4,7m, a compact chassis and accurate load support ensure optimised storage in tight lanes.



Mixed pallet handling

- Our Autopilot trucks are ideal for repetitive tasks such as bringing finished goods to a wrapper, placing pallets on conveyors or block stacking. The OAE120CB counterbalanced truck has no support arms, making it a flexible tool to handle any pallet whether from the long or short side or bottom-boarded pallets.

Whether you're converting part of an existing flow or installing an entire new plant, Toyota provides all necessary components to set up a system that fulfills your new productivity goal.



High-level storage

- The Autopilot can store and retrieve goods safely and accurately in the racking. The powerful RAE 160-250 reach truck range, equipped with vision-aided load support, can smoothly lift up to 10 m, ensuring high productivity in a reliable manner.



Item towing

- Item handling and just-in-time delivery are key for manufacturing sites. With the towing truck TAE500 you can organise "milk runs" in the production area. It can automatically hook and unhook the tow train at pre-defined work stations, scheduled or on request.



Shuttle handling

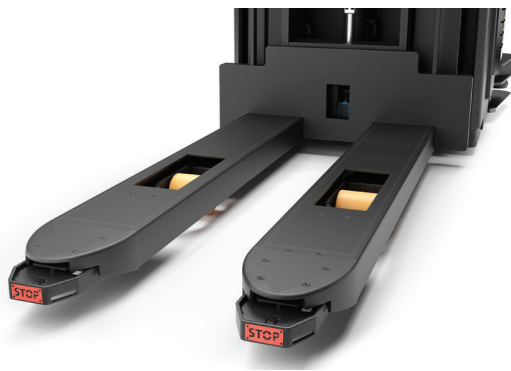
- Shuttle solutions allow for more storage capacity and can run on their own in the racking tunnel. The RAE can handle pallets as well as shuttles and move the shuttles between tunnels to get an optimised tunnel/shuttle ratio. In combination with the Autopilot RAE 160-250, you can run a fully automated high-density storage operation.

ONE PURPOSE, NUMEROUS FEATURES

Just like other material handling solutions from Toyota, the Autopilot range contributes to a safe workplace. The automated vehicles are equipped with multiple components and software to ensure a safe driverless operation. The core part is the Personal Protection System (PPS), that ensures the vehicle detects, slows down and stops for floor-based obstacles on its travel path. The PPS is designed with the highest level of safety and can be omnidirectional to enable rated speed in any direction.

There are also a number of sophisticated sensors standard and optionally available such as: obstacle detection sensors to detect and stop for non-floor based obstacles as well as different stop devices and alarm functions.

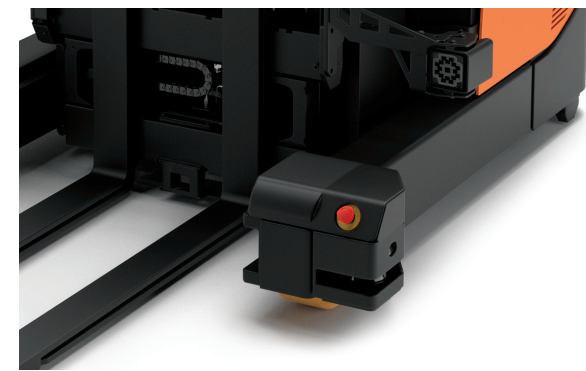
In addition to the fitted safety components, there is also an on-board monitoring system that carries out constant safety checks. This smart system will check component status and if the relationship between certain truck characteristics such as speed, force, position, load weight and lift height is safe.



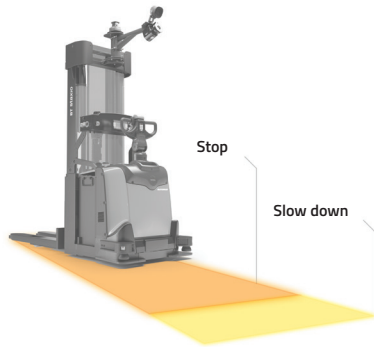
Mechanical fork bumpers for safety in narrow aisles



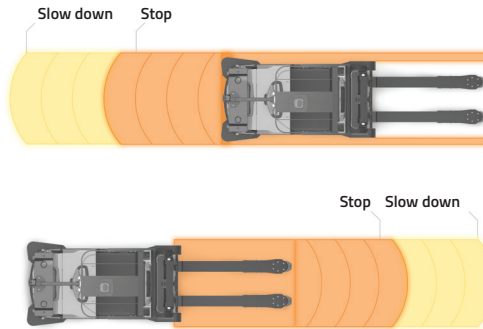
E-stop buttons easily reachable for operators in workplace



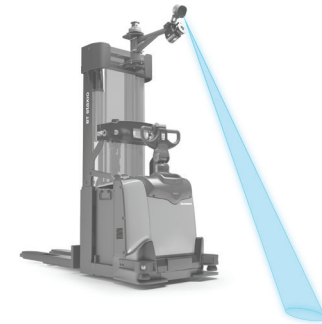
E-stop buttons on the support arms for increased safety



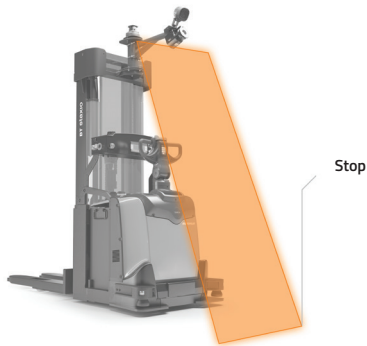
Side scanners for safe curves at optimum speed



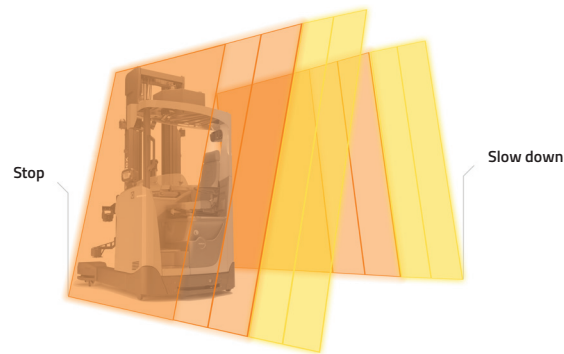
Front and rear scanners for safe transportation at rated speed



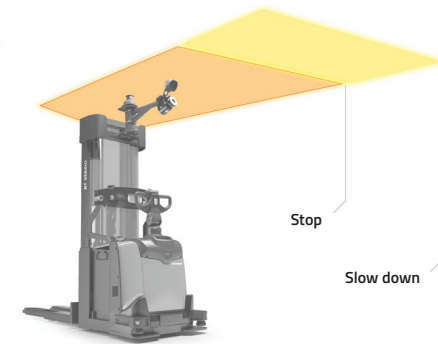
Blue LED light warning pedestrians and drivers when coming out of hidden areas



Front obstacle detection for obstacles above floor level



Side obstacle detection for obstacles entering the travel path from the side



Top obstacle detection for obstacles from above

LOAD ALWAYS IN FOCUS

Load handling involves different actions such as pick-up, transportation and drop-off. To make sure this happens safely and with exact precision, the AGV range is equipped with laser navigation, sensors, encoders and cameras. Even if the pallet is not exactly where expected, for example due to manual interference or incline in the rack, the combination of sophisticated features ensure safe and accurate load handling.

Horizontal transportation

Autopilot ensures:

- that the load is safely positioned on the forks and stationary during transport

Pick-up and drop-off in block stacking

Autopilot ensures:

- that the load is in place and pallet tunnels are clear at pick-up
- that the load is not stuck at pick-up
- that there is no other load on top of the load to be handled (MLD)
- that the station is clear at drop-off
- correct spacing in drop-off in flexible deep stack
- correct tracking of last load in flexible deep stack

Pick-up and drop-off of trolleys

Autopilot ensures:

- that automatic hooking of trolleys is performed correctly
- that trolley hook is in place

Pick-up and drop-off from stations or racking

Autopilot ensures:

- that the load is in place and pallet tunnels are clear at pick-up
- to check and correct forks at pick-up
- that the selected pallet location is clear at drop-off
- to check and correct forks at drop-off at high height



OPTIMISING THE FLOW IN YOUR OPERATION

Integrated automated solutions consist of hardware, our Autopilots, and software from Toyota, T-ONE (Optimise - Navigate - Execute)

T-ONE is installed as an integration layer communicating with the Toyota Autopilot automated guided vehicles (AGVs) and your existing systems such as warehouse management systems, goods identification and other material handling equipment.

The intelligent software offers operational robustness and flexibility for easy scaling of operations and quick commissioning. This makes it suitable for applications with a significant number of vehicles.

Optimise your flow and efficiency

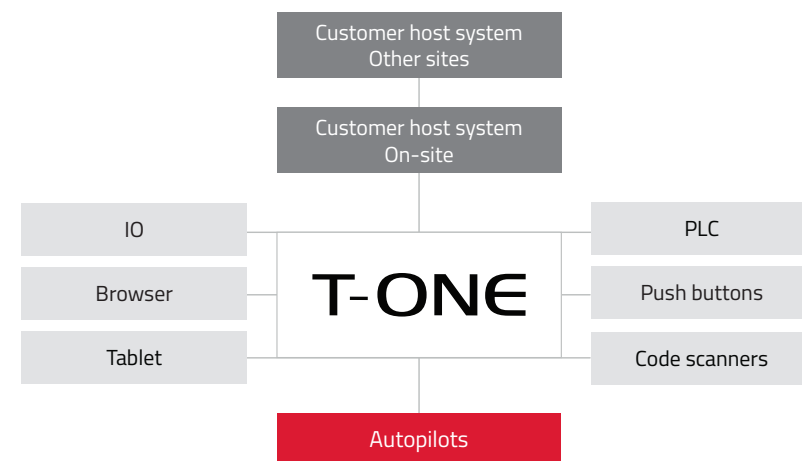
- reduces order processing time
- maintains continuous flow
- access to metrics via a graphical user interface

Navigate intelligently and quickly

- chooses the most ideal path for the Autopilots, reducing waiting time and travels without a load
- dynamically (re-)routes when needed by continuously scanning the system and adjusting
- allocates orders to the best-suited vehicle, taking the overall picture and delivery time into account

Execute safely and accurately

- delivers all loads when and where needed, accurately and efficiently
- provides a robust order execution
- communicates with other systems to guarantee a continuous flow



KEEPING YOUR AUTOMATED WAREHOUSE RUNNING

We have the hardware, the software, the know-how, and the experience to deliver high-quality solutions that match customer needs – in addition to this, we provide reliable system support from Toyota to maximise your Autopilot system’s uptime, ensuring stability and full return on your investment.

These services, ranging from reactive System Support to Change Request Handling and site visits, are delivered by the engineers that developed and delivered your Autopilot System – a guarantee for access to the best possible expertise.

Maximum uptime

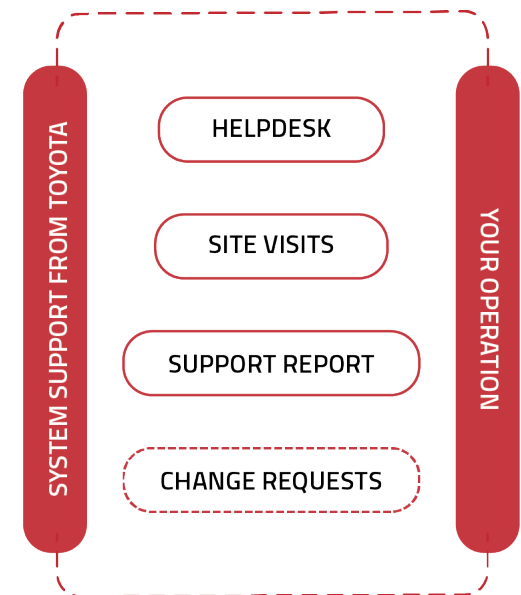
- The right support thanks to extensive knowledge from our local teams – supported by our central logistics solutions experts.
- Availability around the clock with remote and/or on-site system support.
- Quick problem solving by our help desk.

Ensured stability

- Continuous improvement and evolution of our processes and overall delivery.
- One-step-ahead-thinking that prevents problems before they occur.

Smooth evolution

- Regular site visits help us to learn about your system over time and suggest improvements.
- Our extensive knowledge about your installation, paired with our experience from similar Autopilot systems, updates and modifications in order to meet changes in your operations are performed in a cost-efficient way within agreed lead times.



SMART SOLUTIONS TO OPTIMISE EVEN FURTHER



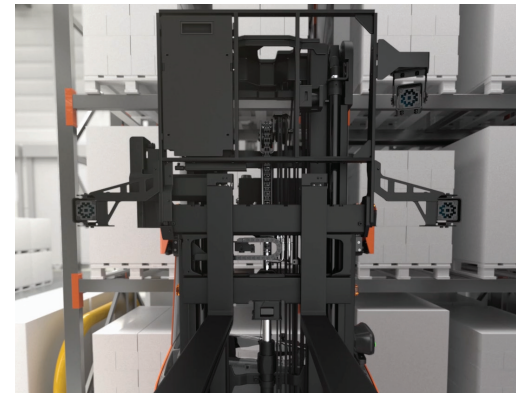
Reflector navigation is a navigation method in which consistent and high-contrast targets, reflectors, are added to the environment. The reflectors installed in the warehouse allow the scanner on the automated truck to define its position based on its distance to the reflectors. The characteristics of this technique guarantee robustness, high accuracy and long reach in most environments.



Natural navigation is an alternative navigation technique for warehouses where the surroundings remain fairly constant. The truck can utilise the existing environment to navigate without reflectors, avoiding extra cost and additional equipment. A unique benefit from Toyota is the fact that the Autopilot can switch seamlessly between natural and reflector navigation depending on the area it's in - we call this dual navigation.



Lithium-Ion batteries have proven to be 30% more energy-efficient than lead-acid ones, significantly reducing CO2 emissions. The Autopilots with lithium-ion batteries can charge themselves whenever not assigned to a task. This opportunity charging ensures continuous operation and eliminates the need for specific charging rooms and manual work.



The sophisticated vision-aided load support on the Autopilot RAE ensures safe and accurate handling at high heights. This 3D vision technology in combination with side shift function corrects the forks position when needed. The vision algorithms recognise natural objects such as pallets and racking beams as well as artificial markers to ensure flexibility in different racking constellations.

A WIDE RANGE TO SUIT EVERY NEED

● standard ° option

Suitable application

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
Horizontal Transport	●	●	●	●	●
Stacking		●	●		●
Order Picking		●	●	●	
Towing				●	

Load carrier type

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
EURO pallet	●	●	●	● Depends on trolley	●
Bottom-boarded pallet			●	● Depends on trolley	●
Roll cage	● Depends on base beam	● Depends on base beam	● Depends on base beam	● Depends on trolley	● Depends on base beam
Trolley				●	
Shuttle					●

Racking type

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
Conventional		●	●		●
Gravity flow		● Special entry pocket	● Special entry pocket		●
High-density shuttle storage		○ On request	○ On request		●
Drive-in		○ On request	○ On request		

Specifications

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
Speed (m/s)	2.2	2.2	2.2	2.2	2.0
Load capacity (kg)	2500	1600	1200	5000	1600/2000/2500
Max lift height (m)	0.2	4.7	4.15		10

Navigation type

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
Reflectors	●	●	●	●	●
Natural landmarks	●	●	●	●	●

● standard ° option

Safety scanner

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
Front (Drive wheel direction)	●	●	●	●	●
Rear (Fork direction)	○	○	○	○	●
Side	●	●	●	●	●

Stop device

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
E-stop buttons	●	●	●	●	●
Mechanical fork bumpers	○	○	○		
E-buttons on support arms					○

Human alert device

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
Visual alert	●	●	●	●	●
Acoustics alert	●	●	●	●	●
Blue or Red LED warning light	○	○	○	○	○

Obstacle detection scanner

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
Top	○	○	○	○	○
Front	○	○	○	○	○
Side					○

Load support sensors

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
Load sensor	●	●	●		●
Fork tip sensor	●	●	●		●
Multi load detection (MLD)					○
Load cameras					○
Automatic tow device				○	
Barcode scanner	○	○	○		○

Energy system

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
Lead-acid	○	○	○	○	○
Li-Ion	○	○	○	○	○

Charging system

	BT Levio LAE250 Autopilot	BT Staxio SAE160 Autopilot	BT Optio OAE120CB Autopilot	Toyota Tracto TAE500 Autopilot	BT Reflex RAE160/200/250 Autopilot
Manual	●	●	●	●	●
Automatic*	○	○	○	○	○

* Requires Li-ion battery.

Toyota Material Handling in Europe

Total coverage

The Toyota Material Handling network extends to over 30 countries in Europe with more than 5000 mobile technicians.

Always local – with global support

Wherever you are located in Europe, we are always local, due to our extensive coverage, but with the stability and back-up of a worldwide organisation.

Made in Europe

Over 95% of trucks we sell are built in our own European factories, in Sweden, France and Italy – all to TPS quality standards. We employ over 3000 production staff in Europe and work with over 300 European suppliers.

Approximately 15% of our European production is exported to other parts of the world.

