

# Autopilot

Automated warehouse trucks for lean pallet handling





# SMARTER HANDLING

## WITH LEAN AUTOMATION

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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

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The Autopilot range supports our lean approach. These automated warehouse trucks 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 Autopilot 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 RAE160-250 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 RAE160-250, 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 trucks 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.

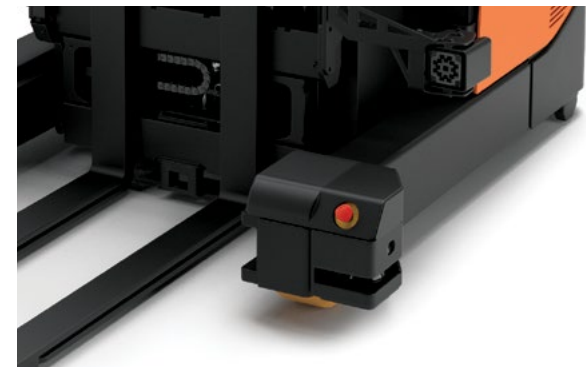
In addition to the fitted safety components, there is also an on-board monitoring system that carries out constant safety checks. This smart system will check component status and if the relationship between certain truck characteristics such as speed, force, position, load weight and lift height is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



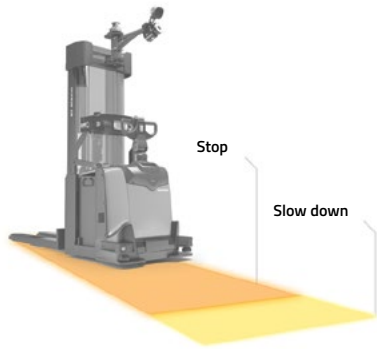
Mechanical fork bumpers for safety in narrow aisles



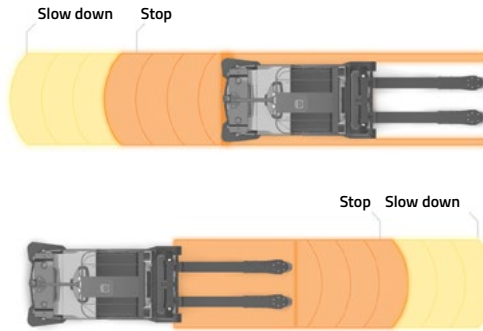
E-stop buttons easily reachable for operators in workplace



E-stop buttons on the support arms for increased safety



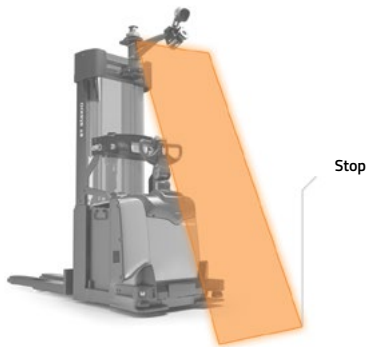
Side scanners for safe curves at optimum speed



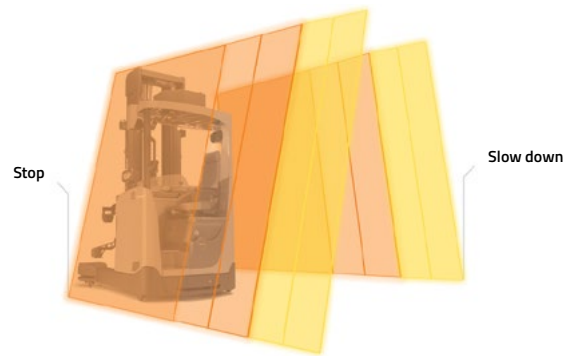
Front and rear scanners for safe transportation at rated speed



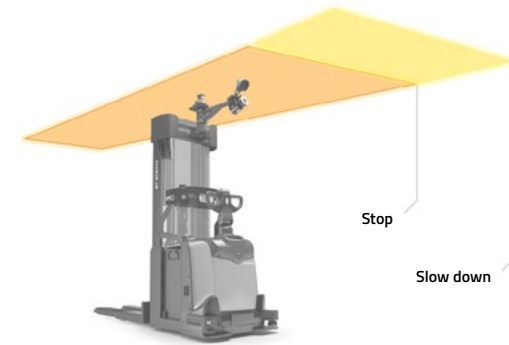
Blue LED light warning pedestrians and drivers when coming out of hidden areas



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

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Load handling involves different actions such as pick-up, transportation and drop-off. To make sure this happens safely and with exact precision, the Autopilot 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

## **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

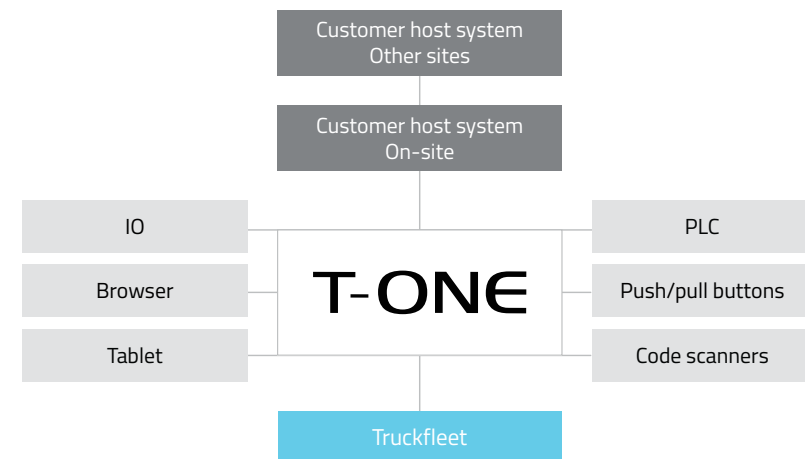
- reduces order processing time
- maintains continuous flow
- access to KPIs via a graphical user interface

## Navigate intelligently and quickly

- chooses the most ideal path for the AGVs, 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

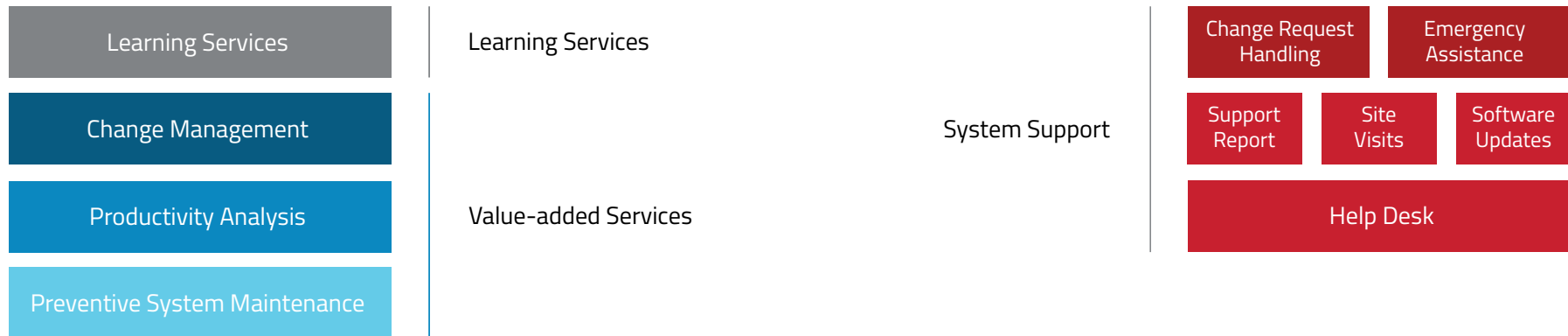
- delivers all loads when and where needed, accurately and efficiently
- provides a robust order execution
- communicates with other systems to guarantee a continuous flow



# 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 the Customer Support and Professional Services that ensures a maximised return on investment.

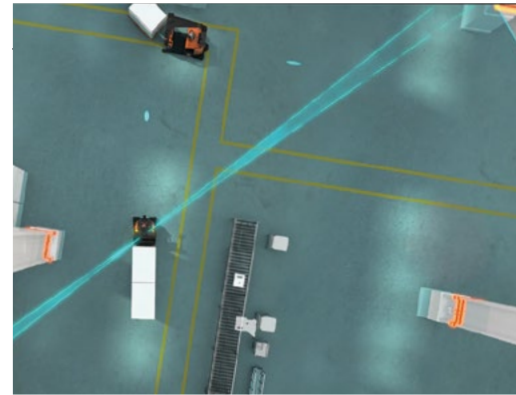
These services, ranging from reactive System Support to Change Request Handling and Preventive System Maintenance, are delivered by the engineers that developed and delivered your Autopilot System – a guarantee for access to the best possible expertise.



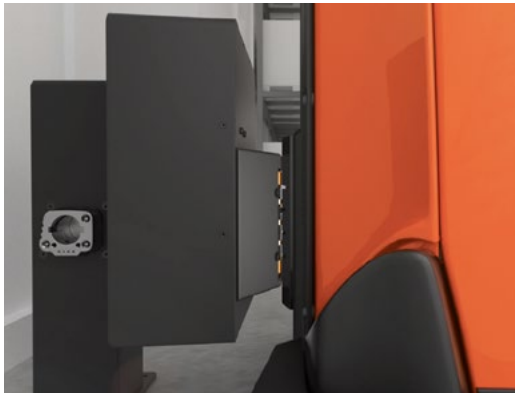
# SMART SOLUTIONS TO OPTIMISE EVEN FURTHER



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

|                              | BT Levio LAE250 Autopilot | BT Staxio SAE160 Autopilot | BT Optio OAE120CB Autopilot | Toyota Tracto TAE500 Autopilot | BT Reflex RAE160/200/250 Autopilot |
|------------------------------|---------------------------|----------------------------|-----------------------------|--------------------------------|------------------------------------|
| <b>Suitable application</b>  |                           |                            |                             |                                |                                    |
| Horizontal Transport         | ●                         | ●                          | ●                           | ●                              | ●                                  |
| Stacking                     |                           | ●                          | ●                           |                                | ●                                  |
| Order Picking                |                           | ●                          | ●                           | ●                              |                                    |
| Towing                       |                           |                            |                             | ●                              |                                    |
| <b>Load carrier type</b>     |                           |                            |                             |                                |                                    |
| EURO pallet                  | ●                         | ●                          | ●                           | ●<br>Depends on trolley        | ●                                  |
| Bottom-boarded pallet        |                           |                            | ●                           | ●<br>Depends on trolley        | ●                                  |
| Roll cage                    | ●<br>depends on base beam | ●<br>depends on base beam  | ●<br>depends on base beam   | ●<br>depends on trolley        | ●<br>depends on base beam          |
| Trolley                      |                           |                            |                             | ●                              |                                    |
| Shuttle                      |                           |                            |                             |                                | ●                                  |
| <b>Racking type</b>          |                           |                            |                             |                                |                                    |
| Conventional                 |                           | ●                          | ●                           |                                | ●                                  |
| Gravity flow                 |                           | ●<br>special entry pocket  | ●<br>special entry pocket   |                                | ●                                  |
| Push back                    |                           |                            |                             |                                | ○<br>On request                    |
| High-density shuttle storage |                           | ○<br>On request            | ●                           |                                | ●                                  |
| Drive-in                     |                           |                            | ○<br>On request             |                                |                                    |
| <b>Specifications</b>        |                           |                            |                             |                                |                                    |
| 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)          |                           | 4.7                        | 4.15                        |                                | 10                                 |
| <b>Navigation type</b>       |                           |                            |                             |                                |                                    |
| Reflectors                   | ●                         | ●                          | ●                           | ●                              | ●                                  |
| Natural landmarks            | ●                         | ●                          | ●                           | ●                              | ●                                  |

● standard ° option

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|-----------------------------------|---------------------------|----------------------------|-----------------------------|--------------------------------|------------------------------------|
| <b>Safety scanner</b>             |                           |                            |                             |                                |                                    |
| Front (Drive wheel direction)     | ●                         | ●                          | ●                           | ●                              | ●                                  |
| Rear (Fork direction)             | ○                         | ○                          | ○                           | ○                              | ●                                  |
| Side                              | ●                         | ●                          | ●                           | ●                              | ●                                  |
| <b>Stop device</b>                |                           |                            |                             |                                |                                    |
| E-stop buttons                    | ●                         | ●                          | ●                           | ●                              | ●                                  |
| Mechanical fork bumpers           | ○                         | ○                          | ○                           |                                |                                    |
| E-buttons on support arms         |                           |                            |                             |                                | ○                                  |
| <b>Human alert device</b>         |                           |                            |                             |                                |                                    |
| Visual alert                      | ●                         | ●                          | ●                           | ●                              | ●                                  |
| Acoustics alert                   | ●                         | ●                          | ●                           | ●                              | ●                                  |
| Blue LED warning light            | ○                         | ○                          | ○                           | ○                              | ○                                  |
| <b>Obstacle detection scanner</b> |                           |                            |                             |                                |                                    |
| Top                               | ○                         | ○                          | ○                           | ○                              | ○                                  |
| Front                             | ○                         | ○                          | ○                           | ○                              | ○                                  |
| Side                              |                           |                            |                             |                                | ○                                  |
| <b>Load support sensors</b>       |                           |                            |                             |                                |                                    |
| Load sensor                       | ●                         | ●                          | ●                           |                                | ●                                  |
| Fork tip sensor                   | ●                         | ●                          | ●                           |                                | ●                                  |
| Multi load detection (MLD)        |                           |                            |                             |                                | ○                                  |
| Load cameras                      |                           |                            |                             |                                | ○                                  |
| Tow sensor                        |                           |                            |                             | ○                              |                                    |
| <b>Energy system</b>              |                           |                            |                             |                                |                                    |
| Lead-acid                         | ○                         | ○                          | ○                           | ○                              | ○                                  |
| Li-Ion                            | ○                         | ○                          | ○                           | ○                              | ○                                  |
| <b>Charging system</b>            |                           |                            |                             |                                |                                    |
| Manual                            | ●                         | ●                          | ●                           | ●                              | ●                                  |
| Automatic                         | ○                         | ○                          | ○                           | ○                              | ○                                  |

# Solutions For Every Pallet®

Whether you own a single forklift or a fleet, we want to show you why Toyota Material Handling is the world's number one forklift company#.

We've got Australia's biggest range to provide you with the best possible material handling solutions, plus the service and replacement parts support you'd expect from the world leader.

The benefits of dealing with Toyota Material Handling include:

- Australia's biggest range of materials handling equipment
- No.1 counter-balance forklift consecutively since 1987\*
- Leading product, safety and environmental initiatives
- 100% Toyota owned branches
- Australia's largest rental fleet with over 35,000 units
- Forklift rentals from 1 day to 5 years with flexible finance options available
- 500+ service support staff & 300+ service vans



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