Original instructions

Automatic Pallet Stacker

AXV 12 iGo



first in intralogistics

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1

Introduction

The driverless truck

Overall operation of the driverless truck

Driverless trucks are industrial material handling machines without an operator that move and manoeuvre automatically.

They allow logistics units to move independently on a route defined during installation. This can be redefined later.

Driverless trucks can transport and stack defined loads (weight, dimensions) on this guidepath.

The maximum characteristics of the logistics units are indicated near the capacity plate of the truck. They are agreed upon the time of purchase.

The centre of gravity should be as close as possible to the middle of the load.

Logistics units used for manoeuvres must be stable. The logistics unit must be able to withstand the requirements related to its transport (vibrations, turns, repeated emergency braking). No quality control of the logistics unit will be carried out by the driverless truck.

Each driverless truck is equipped with an onboard computer and controlled via navigation software.

It is possible to use several driverless trucks at the same site. Fleet management software is needed in this case.

Technical Description

The driverless truck AXV 12 iGo is a compact stacker and is used to transport and stack loads on designated routes without the need for forklift operator intervention. The truck is compact in size but high in operating efficiency, with a 1.5 kW AC drive motor that achieves a top speed of 2m/s under full load.

The nominal loading capacity is 1.2 t. This type of truck is suitable for use inside buildings and is equipped with additional devices to travel safely and independently along the route. The truck is designed to meet smaller aisle requirements, as well as horizontal transfer, line-side distribution, conveyor line connection, etc.

Operation

The driverless truck can be operated in maintenance mode or by the autonomous system. The truck receives commands from the dispatch system via Wi-Fi connection or from the control screen while in automatic mode. The MCU (manual control unit) is for maintenance mode only.

Battery

The driverless truck supports lithium-ion battery technology and is charged in an automatic charging process.

Navigation

The driverless truck is monitored by software. In automatic mode, the route is stored in the truck's memory. Therefore, the truck must be able to determine its position on the route at any time using the navigation laser scanner and the reflectors along the route.

The navigation laser is installed on the driverless truck, while the reflectors are installed at various locations within the facility for the truck to identify its position, to ensure safe navigation.

Conformity marking

The conformity marking is used to document the conformity of the driverless truck with the relevant directives at the time of placing on the market:

- CE: In the European Union (EU)
- UKCA: in the United Kingdom (UK)
- EAC: in the Eurasian Economic Union

The conformity marking is applied to the information plate. A declaration of conformity is issued for the EU and UK markets.



conformity symbols

Your driverless truck

Your driverless truck offers the best in economy and safety. However, it is up to the operator, to preserve these qualities for a long time to come and to make full use of their benefits on the job.

Additional information on the driverless truck may be provided at the time of delivery. These instructions are complementary and must not be separated. The site manager must ensure that all documentation is available at all times. If the documentation is incomplete, please contact your service partner. Do not use the truck if this documentation is incomplete.

All instructions supplied with the truck must be provided to the persons concerned (e.g. those operating the truck in automatic mode, those responsible for switching the unit on/off, and supervisors).

Operators must undergo training on how to use the driverless truck before carrying out any operations. The employer must ensure that all operating safety information relating to the driverless truck is properly understood by operators.

Regularly and promptly complete the maintenance checklists in accordance with the truck operating instructions and use the specified tools, cleaning products etc.

In order to maintain valid warranty service for your truck keep and save a complete, detailed record of the maintenance process. All servicing procedures must be recorded to ensure warranty.

Servicing work must only be carried out by specialists.

Modification to the driverless truck is permitted only with the manufacturer's approval.

CE declaration of conformity statement

Declaration that reflects the content of the declaration of conformity

Declaration

Name of manufacturer
Address of manufacturer
Address of manufacturer

We declare that the specified machine conforms to the most recent valid version of the directives specified below:

Industrial truck type **corresponding to these operating instructions**
Model **corresponding to these operating instructions**

Machinery Directive 2006/42/EC

Personnel authorized to compile the technical documents:

See declaration of conformity

KION Group NV

To sell driverless trucks in the European Union, the supplier must provide a declaration of conformity document with the truck. The supplier is listed in the Preface.

The declaration explains the conformity with the provisions of the EC Machinery Directive.

An unauthorized structural change or addition to the driverless truck can compromise safety, thus invalidating the declaration of conformity.

The declaration of conformity must be carefully stored and made available to the responsible authorities if necessary.

It must also be handed over to the new owner if the industrial truck is sold on.

Application conditions

Intended use of the driverless truck

The driverless truck is designed to move and maneuver automatically without a human driver. Its intended use includes the following tasks:

- Stacking loads on the floor or in elevated racking
- Transporting loads with the rated load capacity
- Transporting loads with the designated load dimensions
- Transporting loads within a specified guidepath
- Driverless trucks are used as part of a system that is controlled by fleet management software

To ensure the intended use of the trucks, it's expected that:

- The instructions for operation and maintenance are followed as described in this documentation.
- The safety precautions in this document are followed
- Only trained persons are allowed to operate and maintain the truck

⚠ DANGER

Only persons fully aware of how to work with the truck and the possible dangers of the truck are authorized to operate and maintain it.

Permitted container sizes

⚠ DANGER

Risk of loss of control

Never use containers that do not conform to the permitted and agreed dimensions.

Never transport loads that exceed the authorised weight agreed upon during commissioning.

The load must be stable on the truck.

The center of gravity should be as close as possible to the middle of the load.

Consult the capacity plate of the truck for the maximum permissible load depending on the use. The capacity plate is located at the rear of the truck.

Description of use and climatic conditions

The driverless truck can only be operated under the following conditions:

- It can only be used inside buildings.
- Average ambient temperature for continuous duty: 25℃.
- Maximum ambient temperature, short term (up to 1 hour): 40℃.
- Lowest ambient temperature: 5℃.
- Floor surface must be clean, flat, stable, dry and not slippery. The gradient and inclination must meet the given floor condition specifications (1% by default and up to actual situation).
- There must be no obstructions in the movement path of the driverless truck.

Information about the operating instructions

Documentation

Each truck comes with the following technical documents:

- Operating instructions for the truck
- Spare parts catalog
- Operating instructions for the attachments (only applies to trucks delivered from the factory with attachments)
- Declaration of conformity

Certain items of special equipment have their own operating instructions, which are supplied along with these devices, such as the battery.

These operating instructions and included documentations describe all measures necessary for the safe operation and proper service of the truck.

The persons responsible for operation of the truck and servicing work on the truck must be familiar with the operating instructions. The operating instructions must be accessible to the operators and operating company at all times.

If the operating instructions are lost, the operating company must obtain a replacement immediately from the authorized dealer. The operating company can obtain the operating instructions in digital form.

The complete documentation must be stored carefully. The documentation must be handed over to the next operating company if the truck is transferred or sold.

Copyright

These operating instructions must not be reproduced, translated or made accessible to third parties, even in part, except with the express written approval of the manufacturer.

Symbols used

This manual uses terms such as "Danger", "Warning", "Caution", "Note", and "Environmental Note" to alert users of important information.

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTE

Identifies technical information that requires special attention.

ENVIRONMENT NOTE

Identifies information that must be adhered to prevent environmental damage.

Decommissioning and disposal

The truck must be decommissioned and appropriately disposed of when it reaches the end of its service life.

The truck is composed of different materials. If components or batteries need to be replaced and disposed of, the national regulations must be observed with regard to:

- Disposal
- Handling
- Recycling

All power lines and control cables must be disconnected from the motor and controller in order to ensure that the equipment cannot start up. All components must be removed from the chassis and all liquid discharged before the chassis is disassembled.

ENVIRONMENT NOTE

Use environmentally friendly methods to dispose of all components and liquids. We recommend working with a waste management company for disposal requirements.

The truck's battery contains harmful substances and must be disposed of in an environmentally friendly manner. Please contact your local battery recycling/disposal centre and abide by relevant local and national regulations.

NOTE

The documentation provided by the battery manufacturer must be observed when disposing of batteries.

2

Safety

Purpose of this chapter

This chapter covers the safety measures that are necessary when working with driverless trucks. Driverless trucks transport loads within a facility without the need for human operation. It is crucial to ensure a safe working environment to prevent accidents and damage from occurring. The safety information provided in this chapter gives guidance on effectively managing potential risks associated with driverless trucks.

Foreseeable misuse

Inappropriate use (misuse) of a driverless truck includes:

- Operating the driverless truck before it has been commissioned for the first time
- Allowing persons to carry people on the forks or to ride on the truck
- Exceeding the maximum load capacity of the truck
- Using pallets/containers that haven't been authorized for use with the driverless truck
- Removing or modify any of the equipment of the driverless truck
- Performing any operations other than transporting approved loads
- Using the truck in a way that deviates from or goes beyond its intended use
- Failing to comply with safety instructions
- Failing to immediately eliminate faults that may impair safety
- Manipulating the truck in a way that affects its functioning, use, or safety
- Manually handling loads on the forks while the truck is in automatic mode
- Operating the driverless truck without proper training and without having read the instructions for use as described in the documentation
- Allowing other trucks to operate in manual mode near the driverless truck during stacking/unstacking operations in automatic mode. If there are manual trucks present, routes must be organized to avoid affecting service levels
- Using non-approved spare parts and/or accessories
- Manual charging the truck in the automatic mode

NOTE

Inappropriate use (misuse) exempts the manufacturer from any liability.

Preventing unauthorized use

Take the following measures to prevent unauthorized use of the driverless truck:

- Keys should only be given to authorized personnel. The key should be removed from the truck when it isn't in use
- Access to the truck software password should only be given to authorized personnel

Truck software security

Operators and maintenance personnel can use the truck computer to access the truck software. The software's security level requires a verification password to maintain security by preventing unauthorized access. Only users with an appropriate access level can view this screen and make changes.

General safety guidelines

Situational awareness

Driverless trucks are programmed to move and transport materials without human intervention. However, they can be dangerous if workers aren't aware of their movements and fail to take necessary precautions. Persons in the driverless truck environment must follow all safety guidelines, such as wearing appropriate personal protective equipment, observing warning signs, labels and signals, as well as maintaining situational awareness of truck movements.

⚠ WARNING

Driverless trucks are moving autonomously on the guidepath. Persons should stay on designated walking paths and away from the driverless truck operating areas.

⚠ WARNING

When interacting with driverless trucks, stay alert and maintain an awareness of truck movements and their loads.

Safety responsibilities

Individual

It's the responsibility of each person (employee or visitor) to follow safe practices when working with or around trucks and/or moving through an area where trucks are present.

- If you are in an area with truck operations, STAY ALERT, look and listen. Trucks use flashing lights and horn sounds to signal their presence.
- If you are in an area with truck operations, obey all floor markings, facility signage, and warning labels.
- If you work around driverless trucks (operator, specialist), per the operating company policy, you must wear appropriate clothing and footwear, remove jewelry or wrist watches, and keep long hair up and confined.
- Driverless trucks always have the right-of-way. Never enter the guidepath perpendicular to (or moving opposite to) the truck's direction of travel to avoid serious injury and/or death.
- Report damage or other malfunction on the truck to supervisory personnel immediately.

  In the event of a malfunction, the truck must be located in a safe place and surrounded by traffic cones.

Operating company / customer responsibilities

The operating company or customer is responsible for ensuring that:

- All visitors and personnel are escorted.
- Regular safety checks are conducted.
- The driverless trucks are being used as intended and in accordance with the safety guidelines outlined in the operating instructions.
- If any damage occurs or if any defect is found, the operating company/customer must report this to the driverless truck manufacturer.

Training personnel

Visitor

Visitors should receive "Site Safety Induction" training upon entering the premises. Before arriving, they should be told what type of PPE to wear. For example, safety toe footwear and high-visibility vests. They should be escorted around the facility by a trained person.

Personnel/staff

Personnel/staff must receive driverless truck training by the operating company. While personnel/staff aren't responsible for operating trucks, they must be aware of the safety environment where the driverless trucks operate. Personnel/staff training must contain basic information on truck safety as contained in this manual.

Operator

Persons operating driverless trucks must receive training by the operating company. Operator training must contain comprehensive information on truck safety as contained in this manual..

Site manager

The site manager must ensure that their personnel are trained regularly on how to stay safe around driverless trucks, prevent accidents, and protect the environment.

The site manager needs to receive personnel/staff safety training as well as operator training.

Specialist

The specialist is an employee of the manufacturer or the local service supplier. Specialist personnel must have experience and technical training in driverless trucks and their associated systems. Specialist personnel must be competent to carry out all required tasks safely.

Operating company/customer

The operating company/customer needs to ensure that all personnel are trained regularly on how to stay safe around driverless trucks, prevent accidents, and protect the environment. The employer is responsible for ensuring that staff have properly understood all of the safety information provided in this manual.

Safety-related parts of control systems

The manufacturer has implemented safety measures, referred to as safety functions, to mitigate the risk of hazards. The parts of the control systems that are designed to implement the safety functions are called the safety-related parts of the control systems (SRP/CS). The SRP/CS consists of the hardware and software on the driverless truck which ensures the safe operation of all aspects of the truck operation. There are several groups of safety functions on the driverless truck (for example, mode control, starting and stopping, speed, steering and lift control, vehicle stability, load handling, automatic battery charging, obstacle avoidance, PDM muting, warning systems and emergency functions). Daily checks ensure the correct operation of the SRP/CS and driverless truck's safety functions.

Truck safety devices

Overview

Protective devices are installed to protect workers and prevent accidents when interacting with driverless trucks. These devices include warning lights, audible signals, safety laser scanners, guards, and emergency stop buttons.

⚠ WARNING

It's essential to check regularly all protective devices to ensure they're functioning correctly. Reference the routine checks section of this manual for further information.

Warning lights

Warning lights on driverless trucks are safety devices that alert workers and other people in the area of the vehicle's operation or approach.

They are mounted on the top or sides of the AGV and are designed to be visible from a distance. They provide visual signals about the vehicle's status and direction of movement. Visual signals help personnel to take the necessary safety precautions when the truck is in operation.

See ⇒Chapter "Audible and visual warnings", Page 28 for more information.

Audible warning signals

Audible warning signals on driverless trucks are safety features that alert workers and other people in the area of the vehicle's operation or approach.

The buzzers or horns emit a sound that emit a sound when the driverless truck is in motion. These sounds alert personnel to the presence of the truck and indicate that it is in motion, so they can take appropriate safety precautions.

NOTE

Beep patterns are project specific and depend on the traffic and the environment in which the trucks operate.

See ⇒Chapter "Audible and visual warnings", Page 28 for more information.

Safety laser scanner

Driverless trucks are equipped with safety laser scanners that are placed at the lower front and rear for 360–degree protection around the chassis. The scanners emit a horizontal beam that runs parallel to the ground. The safety laser scanners are designed to detect people and objects within the safety field that varies in size and shape. The safety fields are programmed to expand as the truck's speed and steering increases and reduce in size as the speed and steering decreases.

When the safety laser scanners detect an object, the driverless truck will slow down and stop. However, the truck requires enough distance to come to a complete stop. It's important to note that if a person or object enters the scanner's detection field directly from the side, a collision may occur. For more information on safety laser scanners, see ⇒Chapter "Front and rear safety laser scanners", Page 30 .

⚠ WARNING

The driverless trucks may not detect equipment with overhang or parts above/below the safety laser scanner's horizontal scanning plane. Attach skirting material (to manual trucks, scissor lifts, etc.) to increase visibility of the safety laser scanners and avoid equipment damage.

⚠ WARNING

The safety laser scanners on driverless trucks may not detect open doors from machines or electrical cabinets. To prevent collisions, always use traffic cones to block any potential hazards that may not be detected by the safety laser scanners.

Guards

Physical guards are installed on the AGV to prevent persons from unintentionally accessing hazardous areas on the truck. For example, there are guards to prevent unintentional access to the mast/chain rotation and the mast/chain up and down movement. Physical guards maybe removed for service or maintenance, but they must be reinstalled for truck operation.

⚠ WARNING

Missing guarding can expose operators to hazards. Do not operate the driverless truck without the guards in place.

Emergency stop devices

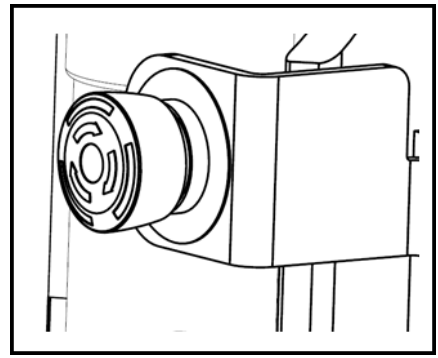
Emergency stop devices are safety mechanisms that allow for an immediate and complete stop of the truck in the event of an emergency. These devices are designed to protect workers, equipment, and the environment in case of unforeseen circumstances such as a collision, a malfunction, or a hazardous situation. Emergency stop devices for driverless trucks are a red mushroom-type button that can be pressed to immediately halt the AGV, and are located in easy-to-reach areas around the truck.

For additional information, see ⇒Chapter "Emergency stop buttons", Page 29 .

⚠ WARNING

Emergency stop buttons are to be used in case of an emergency. They do not remove all power from the driverless truck. When working on driverless trucks, lockout/tagout must be used to isolate and remove power.

▷



BlueSpot™ description

A BlueSpot device is mounted on the driverless truck. It projects a bright blue spot on the ground behind or in front of the truck to alert operators of its presence. The BlueSpot device is a visual warning signal that allows for early detection of driverless trucks in areas with poor visibility (for example, traffic routes and high shelves), as well as at blind junctions.

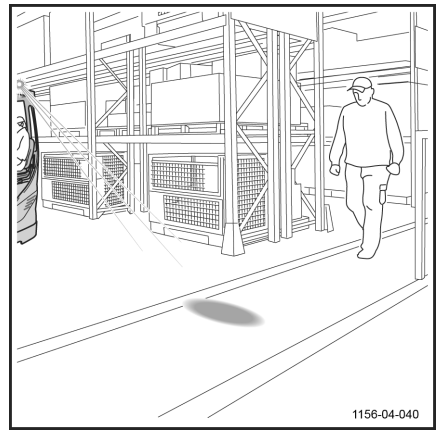
⚠ WARNING

Looking directly at BlueSpot may cause eye damage.

Do not look directly at BlueSpot.

For additional information on where this device is located on the truck, see ⇒Chapter "BlueSpot™ (optional)", Page 31 .

▷



Safety controller

The safety controllers on a driverless truck performs logic to ensure the safe operation of

the vehicle. The safety controller, along with its inputs and outputs, monitors the environment around the driverless truck and executes software to safely control the truck thus minimizing the risk of accidents or injuries.

Lockout/tagout (LOTO)

Lockout/tagout (LOTO) is the required procedure to disable machinery or equipment, which prevents the release of hazardous energy while a trained person performs servicing or maintenance activities.

Lockout/tagout requires the use of:

- An energy isolating device that can be locked out
- A lockout device to hold the energy isolating device in a secure position, and
- A tag to be placed on the energy isolating device with a warning indicating that the equipment being controlled may not be operated until the tagout device is removed

⚠ DANGER

Do not perform adjustments, maintenance, or any other work on this equipment unless you're competent in carrying out the lockout/tagout procedure as required by national or local authorities.

⚠ WARNING

Only trained personnel may perform the lockout/tagout procedure.

Residual risks

What Is a residual risk

Residual risk is the risk that remains after all protective measures have been implemented. The operating company/end-user must be informed and trained on all remaining residual risks that are listed in this manual. This manual also provides recommendations to mitigate the residual risks, such as personal protective equipment, additional safeguards, administrative procedures, etc.

Driverless truck operation

- **Braking distance**: The braking distance can be affected or increased due to the floor being damaged, dirty, wet or otherwise slippery. Floors must be kept clean and dry.
- **Moving objects**: If moving objects cross the path of an oncoming truck, this may result in insufficient braking distance and the truck's inability to stop and prevent a collision.

  It's prohibited to drive in front of, or step in front, of a moving driverless truck.
- **Unstable loads**: There's a risk of unstable loads falling from the truck forks.

  All loads must be stable and conform to the load specifications in the operator manual to prevent falls.
- **Shifting loads**: There's a risk of the load falling if the load is shifting on the forks.

  All loads must be stable and conform to the load specifications in the operator manual. Loads must be correctly placed on the pallets to avoid loads shifting.

Personnel detection means

- **Low-height objects**: Low-height objects (for example, objects lower than 200 mm) won't be detected by the safety laser scanners (installed approximately 200 mm above the floor).

  Traffic cones must be placed in front of low-height objects to ensure detection.
- **Objects not touching the ground**: Objects that aren't touching the ground (for example, boom lifts, etc.) won't be detected by the safety laser scanners (installed approximately 200 mm above the floor).

  Traffic cones must be placed in front of objects that aren't touching the ground to ensure detection.
- **Low reflectivity objects**: Objects with low reflectivity won't be detected by the safety laser scanners.

  Traffic cones must be placed in front of objects with low reflectivity to ensure detection.
- **Operator interaction**: There's no guarantee that the truck will stop prior to contact if the operator walks towards the truck or suddenly jumps in the truck's path.

  Operators should only approach a stopped vehicle.
- **Load capacity - Dimensions**: If transporting a load with dimensions greater than those indicated on the information plate, the safety fields will no longer be suitable and there's no longer a guarantee that the truck will stop.

  Driverless trucks must only transport loads that conform to the dimensions specified on the information plate.
- **Load capacity - Weight**: If transporting a load weighing more than the weight indicated on the information plate, the safety fields will no longer be suitable and there's no longer a guarantee that the truck will stop without contact.

  Driverless trucks shall only pick loads with weights per the information plate.

Picking/Dropping

- **Deactivation of the rear safety laser scanners**: The rear safety laser scanners can be deactivated when the driverless truck approaches the picking/dropping areas.

  To mitigate this risk, these areas must be marked as danger or restricted areas depending on the configuration of the site and the associated risks to warn operators of hazard locations.

  The audible signals and the warning lights will indicate when the safety laser scanners are deactivated. When the safety laser scanners are deactivated, care must be taken. Do not approach the truck or walk in the truck's path as personal detection is not guaranteed.
- **Risk of falling loads**: The areas at the bottom of the racks where the truck operates must be marked as danger areas. The risk of a falling load cannot be completely eliminated.

  Operators in the zones where automated trucks are maneuvering or loading/unloading is prohibited.

Path of travel

- **Insufficient aisle width**: Without the required aisle width, the driverless truck will have insufficient space for movement and may collide with objects in the guidepath along the guidepath. Adequate aisle space must be maintained at all times. To mitigate this risk, aisles must always be clean and free of obstacles.
- **Insufficient turning space**: Without the required aisle width, the driverless truck will have insufficient space for turning and may collide with objects in the turning path.

  To mitigate this risk, adequate aisle and turning space must be maintained at all times. Aisles must always be clean and free of obstacles.

Safety checks/Routine maintenance

- **Crushing hazard**: A crushing hazard can occur if a person or object is caught between the driverless truck and a fixed object, such as a wall or another vehicle, due to poor visibility, inadequate warning signals, or equipment malfunctions.

  Daily safety checks must be performed to sure all protective devices are properly installed and functioning.
- **Shearing hazard**: A shearing hazard can occur if a person or object is caught between moving or rotating parts, such as the driverless truck's lifting or chain mechanisms.

  Daily safety checks must be performed to ensure all guards and protective devices are properly installed and functioning.

Service

- **Electrical hazards**: When working on electrical components, personnel may be at risk of electrical hazards that could lead to electric shock or electrocution.

  Whenever working with exposed conductors or removed covers, the trained person must lockout/tagout to isolate energy before maintenance or service is performed.
- **Mechanical hazards**: When working on mechanical equipment, persons may be at risk of unintended movements, which can lead to injury from moving parts.

When performing maintenance or service tasks that involve removing guards or covers, a trained person must perform the lock-out/tagout procedures to isolate energy during maintenance or service.

Personal protective equipment

Personal protective equipment (PPE) for driverless trucks is the gear that workers must wear when operating or working close to driverless trucks. PPE is designed to protect workers from hazards such as collisions, falls, and other accidents that can occur when working with or around driverless trucks and their loads. When working near driverless trucks, safety toe footwear is mandatory. Depending on the type of truck and the work environment, additional PPE and training may be required. This may include safety glasses, high visibility vests, hearing protection, hard hats, gloves, etc.

Areas in a driverless truck environment

To ensure the safety of people and property, designated zones or areas are established within a facility where driverless trucks are allowed to operate.

Confined zones

A confined zone is an area where personnel detection means are turned off while the truck is operating, allowing any speed to be used. This zone is surrounded by perimeter guarding and access is only available through an interlocked guard door. A clear and visible marking on the floor or ground is necessary to indicate the boundaries of the zone where access is allowed. Additionally, access for a confined zone should be equipped with a warning that is either in the language of the user or in symbols.

⚠ DANGER

Driverless trucks in the confined zone are operating without personnel detection means.

⚠ WARNING

The confined zone safeguarding must NOT be reset before all persons have left the zone.

Restricted zones

A restricted zone is a zone with limited space that can't be protected by personnel detection means (PDM). This zone is enclosed by a perimeter guard and can only be accessed through a movable guard door. Examples of restricted zones include block storage or very narrow aisles (VNA). A restricted zone must have clear and visible markings on the floor/ground at least at its boundaries where access is allowed. Any access point to a restricted zone must be clearly labeled with warning signs, using either the language of the user or symbols.

⚠ DANGER

Driverless trucks in the restricted zone are operating without personnel detection means.

⚠ WARNING

Access is restricted to authorized personnel who are trained on the specific hazards.

Operating hazard zones (ISO 3691-4:2023)

An operating hazard zone is a zone with limited space or clearance that can't be protected by personnel detection means. These zones can be found in load transfer areas or areas with inadequate clearances. Operating hazard zones do not have any guarding to prevent access, but they must be marked by clear and

visible floor/ground markings and/or appropriate signs to indicate the potential danger.

⚠ DANGER

Driverless trucks in the operating hazard zone can be operating without personnel detection means.

Operating zones (ISO 3691-4:2023)

An operating zone is a zone with enough space or clearance (at least 0.5 m on both sides of the path) to allow a driverless truck to operate safely. When the driverless truck is within the operating zone, its personnel detection means are activated to ensure safe operation.

⚠ WARNING

Driverless trucks are operating in the area. Follow the safety guidelines for entering the operating zone.

Non-operating zones

A non-operating zone is a zone where a driverless truck is brought for repairs, service, or maintenance. Examples of non-operating zones include storage areas, maintenance areas, or battery replacement areas. The driverless truck isn't in operation while it's located in a non-operating zone.

⚠ WARNING

Driverless trucks are located in the non-operating zone. Follow the safety guidelines for working in the non-operating zone.

Mixed traffic locations

Mixed traffic refers to the movement of different types of vehicles, such as driverless trucks, manual trucks, and pedestrian traffic within the same area. Mixed traffic can create a safety hazard if proper precautions are not taken. All personnel/staff must be aware of their surroundings and follow all safety guidelines and procedures to prevent accidents. To mitigate this risk, the customer must designate specific areas for certain types of vehicles and pedestrians, use clearly marked floor lanes and/or signs, and provide training to all personnel/staff.

Additional safeguards

In addition to the safeguards already present in driverless trucks customers may implement additional measures to ensure the safety of persons working around driverless trucks. These measures can include guards, safeguarding devices, and awareness devices such as signage or floor markings. All of these safeguards are designed to prevent exposure to hazards.

Warning signage

The purpose of warning signs for driverless truck operating zones is to ensure the safety of workers, pedestrians, and other personnel in the area. Warning signs alert people to the presence of driverless trucks and hazards and remind them to be aware of their surroundings and take appropriate precautions.

NOTE

See the requirements for warning signs based on the driverless truck operating zone or area.

Floor markings

To ensure uniformity across the company, it's recommended that floor markings remain consistent. However, in industrial environments, it's common to use standard floor markings with specific meanings.

- Red and white stripe - Areas that must remain clear for safety reasons, such as in front of safety equipment, fire-fighting equipment, and electrical panels
- Black and yellow stripe - Areas or zones that may expose persons to hazards, such as driverless truck hazard zones
- Yellow - Designated aisleways and traffic lanes, such as facility walkways for pedestrians

NOTE

See the requirements for floor markings based on the driverless truck operating zone or area.

Emergency situations

For emergency situations, it's important to know how to handle the driverless truck safely. Emergency situations can include equipment malfunctions or personnel injuries, and it's critical to be prepared to ensure the safety of all persons involved.

Ensure that your facility has policies in place for responding to different types of emergencies.

Fire

The facility should be equipped with the proper fire extinguishers for driverless trucks based on the fuel source or battery type. Fire extinguishers should be readily available in case of a driverless truck fire. If a fire occurs, ask someone to notify the fire department. If accessible, press the emergency stop button on the driverless truck. If trained to use a fire extinguisher, attempt to extinguish the fire. If necessary, evacuate the area. Any resulting fire damage can be hazardous. The incident and clean-up should be escalated to the proper authorities.

Collision

A collision maybe with another vehicle or with a person. In case of a collision, press the emergency stop button on the driverless truck and access the situation. Check for any injuries or damage and report it to the appropriate personnel. If trained, administer first aid and/or call emergency services for medical attention.

Fallen load

In case of a fallen load, press the emergency-stop button on the driverless truck and access the situation. Check for any injuries or damage and report the fallen load to the appropriate personnel. If trained, administer first aid and/or call emergency services for medical attention.

Non-moveable or stuck load

In the case of a non-movable or stuck load, press the emergency stop button on the driverless truck and place traffic cones around the AGV. Escalate the issue to skilled personnel to manage the load as well as for any repairs to the lifting mechanism and/or hydraulic system.

Malfunction or breakdown

If the driverless truck is non-functional or has no power, place traffic cones around the vehicle to avoid collisions. Contact persons who authorized to troubleshoot the vehicle or to remove the vehicle from the AGV guidepath for service.

Hydraulic fluid

If hydraulic fluid escapes under pressure, for example from a damaged pipe or through leaks in a component, it can easily penetrate the skin. Hydraulic fluid can poison the surrounding tissue and can cause the loss of the affected body part or even to death. Even if such injuries do not feel particularly painful or serious, immediate medical attention should be sought. The cause of the injury must be described accurately and the treatment started promptly.

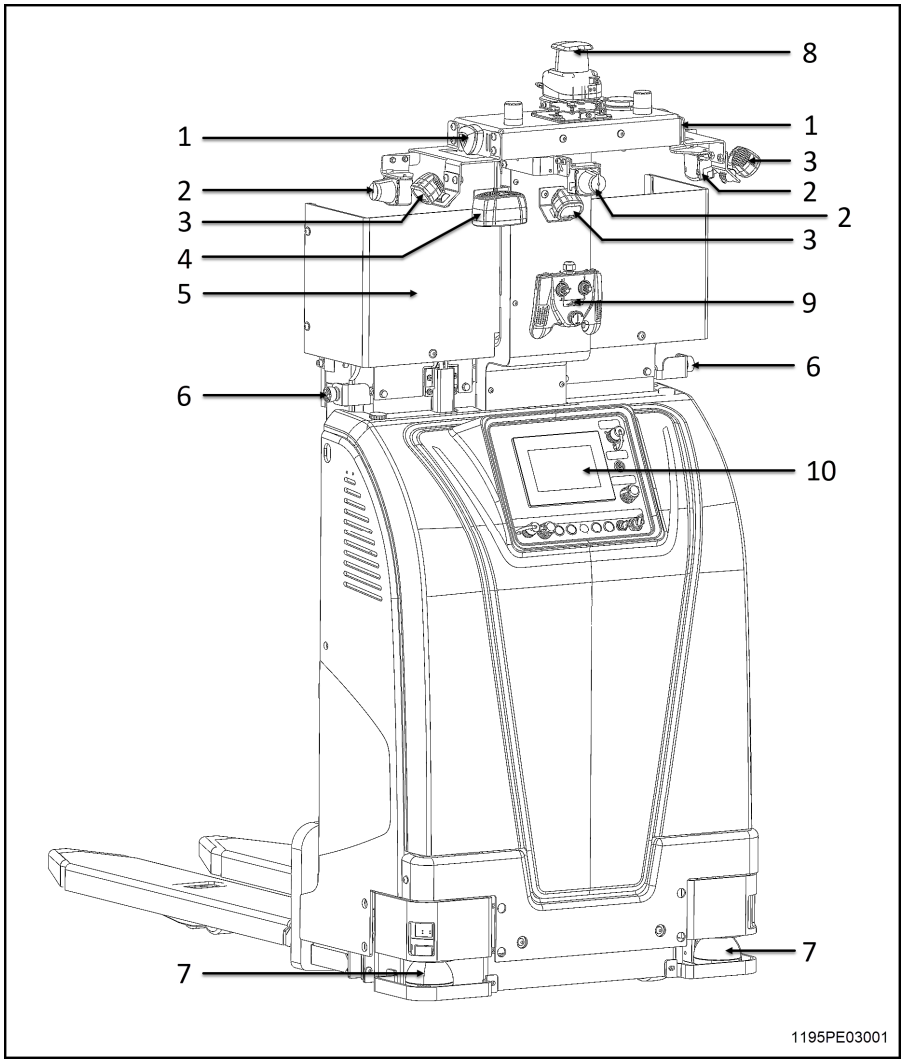
3

Truck overview

Truck overview

General view

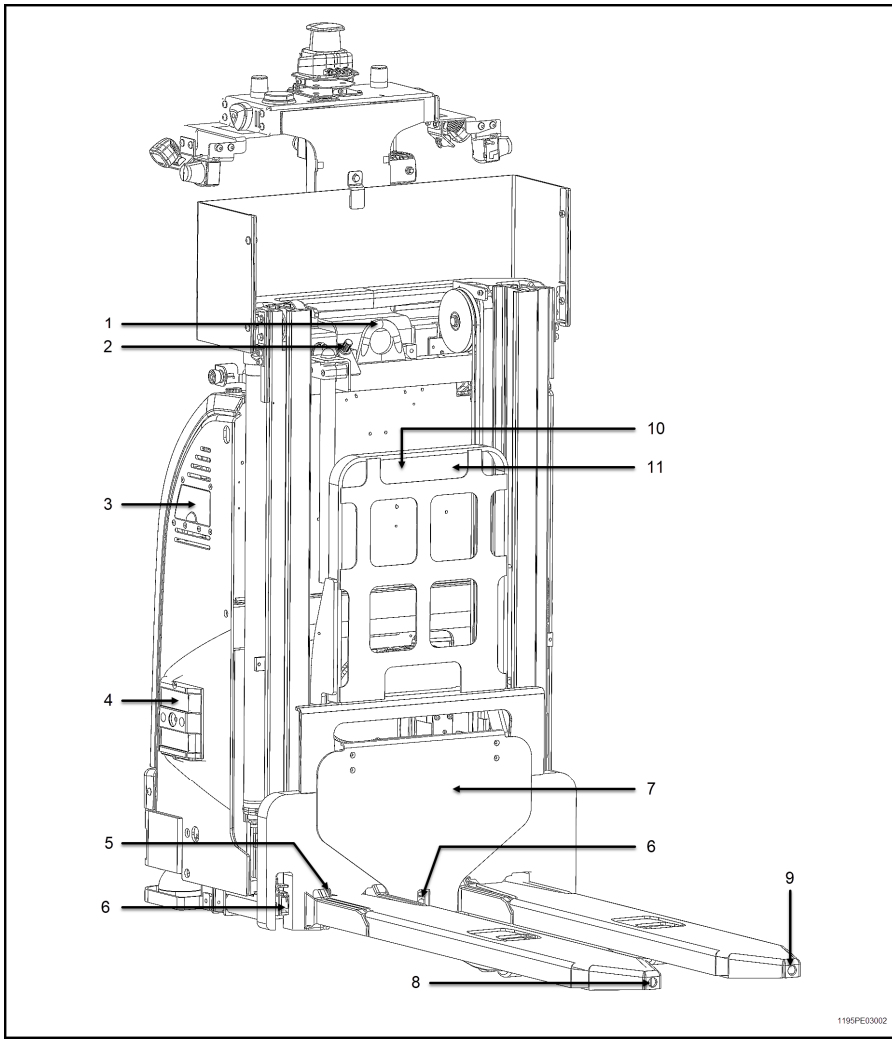
Main view



1 Warning light
2 Curtain scanner (series option)
3 Linear warning light (series option; depending on versions)
4 BlueSpot™ (series option; depending on versions)
5 Mast protection (polycarbonate)
6 Emergency stop button
7 Safety laser scanner (front)

8 Navigation laser scanner
9 MCU (Manual Control Unit)
10 HMI - Touchscreen

Rear view



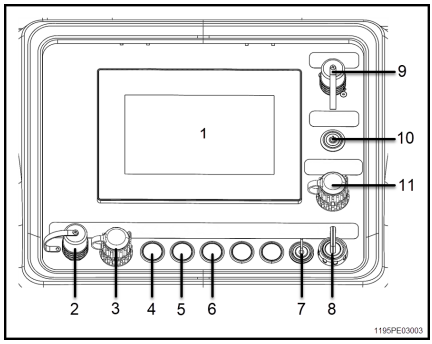
1 Sling ring
2 Second load detection sensor (series option; depending on versions)
3 Manual charging cover
4 Auto charging contacts
5 Fork free sensor
6 Push through sensor (the one on the side is a series option)
7 Load flap/load flap sensor
8 Fork tip sensor
9 Drop full sensor
10 Information plate
11 Rated capacity plate

HMI - Touchscreen

The HMI (Human Machine Interface) displays the on-board software and is connected to the server.

Virtual keyboard

Text can be entered using a USB keyboard or virtual keyboard. The virtual keyboard is displayed as soon as an input field (blinking text input cursor) has the focus.



1 Touchscreen

Control buttons, interfaces and switches

2 Ethernet plug
3 Diagnostic interface
4 Start button
5 Stop button
6 Reset button
7 Maintenance/Automatic mode keyswitch
8 On/Off Keyswitch
9 Handle (MCU) interface
10 Battery switch
11 Battery diagnostic interface

Navigation system

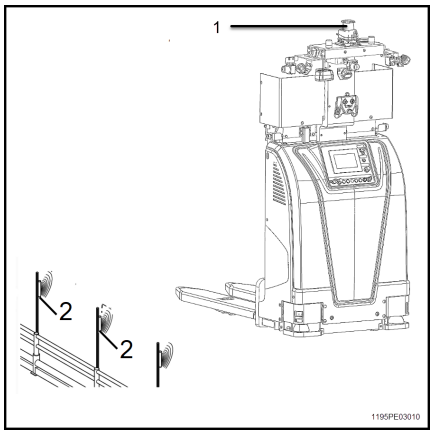
The navigation system consists of two basic elements:

- Navigation laser scanner (1) for scanning reflectors (2)
- Reflectors (2) positioned throughout the work environment

The navigation laser scanner (1) is mounted on top of the driverless truck. The reflectors (2) are positioned in the facility along the path of the truck. The navigation laser scanner and the reflectors allow the driverless truck to identify and communicate its position within the area.

The navigation laser scanner must have a very clear view of the reflectors. It can perform 360° scanning for reflectors. Reflectors are reflective markers that can be detected up to 30 metres away.

The navigation laser scanner works by sending out reflective light pulses. It determines an accurate distance measurement by measuring



the time between emitting the light pulse and receiving the light pulse when it is reflected back.

NOTE

The navigation laser scanner and reflectors must be cleaned regularly to ensure that the navigation system is functioning correctly.

Safety devices

Overview

The driverless truck is equipped with various safety devices.

The safety devices have been properly installed and commissioned, but require regular checking and maintenance to guarantee they are working as intended.

⚠ CAUTION

Risk of injury

If any damage to the safety devices or if a malfunction is found, stop operating the truck immediately and report the issues to the manufacturer or local supplier for maintenance or repair at once.

Audible and visual warnings ▷

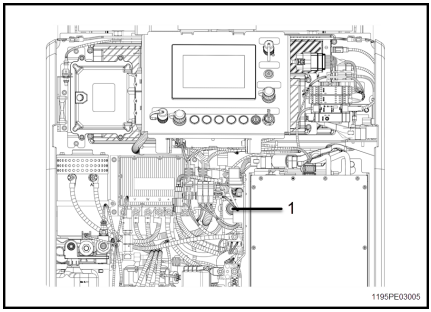
The driverless truck is equipped with a warning system consisting of:

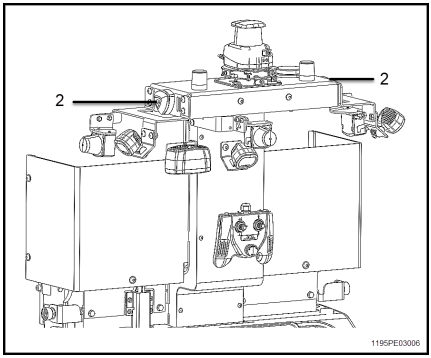
- A buzzer (1) mounted in the truck body
- Two warning lights (2) on either side of the truck body

The warning system indicates the presence of a driverless truck in motion when the driverless truck is operating in automatic mode.

The lights (2) are positioned on either side of the truck to indicate the mode and condition of the truck.

The status of the truck as indicated by the warning lights:





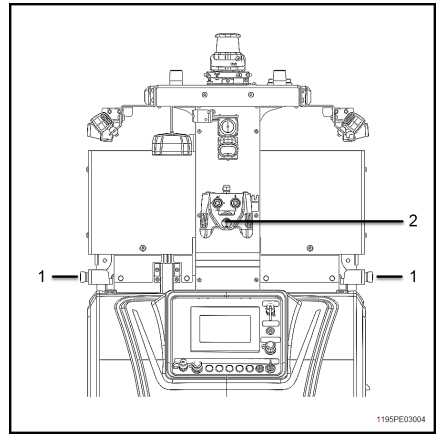
Warning light color	Meaning	Truck status
Red	Urgent	There is an error on the driverless truck and the warning light flashes. Immediate action is required (reset).
Yellow	Abnormal	The truck is at a standstill. It will restart in automatic mode.
White/Blue	Normal	The truck is moving in automatic mode.
White/Blue flashing	Normal	The truck is cornering in automatic mode.
Green	Normal	The truck is in automatic mode. No error code is detected.

Emergency stop buttons ▷

There are 3 emergency stop buttons on the driverless truck (1).

- Two on the either side of the truck body (1)
- One on the MCU (2)

The emergency stop buttons can be used in maintenance mode and automatic mode.



Stopping the truck in an emergency

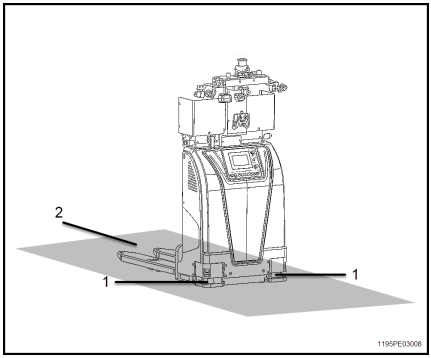
Press any of the emergency stop buttons. This will shut down the base truck's electrical system. The truck can still have a braking distance (up to operating speed and environment). Personnel must remain vigilant.

⚠ WARNING

Unintended truck movement

To switch off the power supply to the truck completely, the battery connector plug must be disconnected.

Front and rear safety laser scanners ▷



The driverless truck has three safety laser scanners

- Two front safety laser scanners covering zone (1).
- One rear safety laser scanner covering zone (2).

The height of the scanning field is 78.3 mm at the front and 142.2 mm at the rear.

The safety laser scanners detect objects greater than 70 mm in diameter.

The size of the area covered by these devices varies depending on the moving speed and the steering angle of the driverless truck.

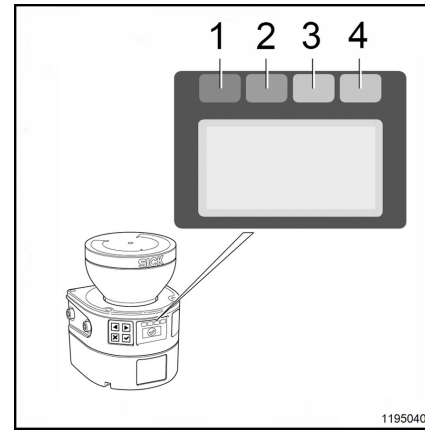
If an obstacle enters this field, the truck will first slow down. The truck will then stop if the obstacle remains within the horizontal scanning field of the laser safety scanners.

⚠ DANGER

Risk of eye injury

Do not look directly at the lasers. If a lens breaks, contact your authorised dealer for replacement.

Safety laser scanner LED status

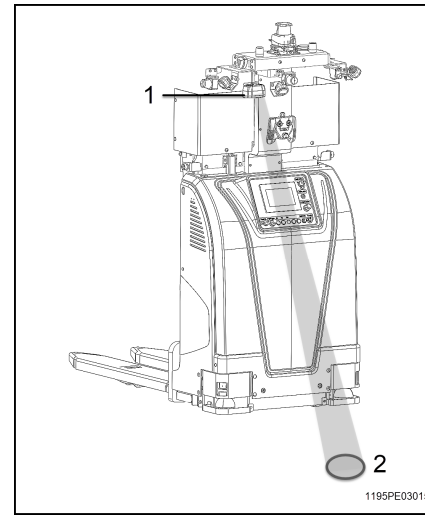


No.	Function	Color	Meaning
1	OFF state	Red	Illuminates red when at least one safety output is OFF.
2	ON state	Green	Illuminates green when at least one safety output is ON.
3	Warning zone	Yellow	Illuminates yellow when an object is detected in at least one of the warning zones
4	Restart interlock	Yellow	Configuration with reset: Flashes when restart interlock is triggered. Configuration with automatic delayed restart: Lights up for the configured time until restart.

BlueSpot™ (optional)

BlueSpot (1) is a safety device that allows you to see that the truck is approaching.

BlueSpot (1) projects a blue circle (2) on the ground in front of the truck. People in the immediate vicinity of the truck then know that the truck is approaching. This is particularly useful when the truck is cornering or hidden by a rack.

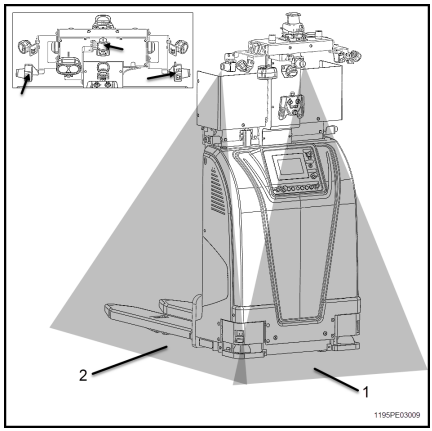


Curtain laser (optional)

The driverless truck can be equipped with three optional curtain lasers:

- The front curtain laser covers the slanted zone (1) in front of the driverless truck (distance depends on installation).
- The two side curtain lasers cover the slanted zones (2) on both sides of the driverless truck (distance depends on installation).

The curtain lasers can cause the driverless truck to stop. The truck will stop once it is confirmed that an obstacle is located in the slanted zones at the front or sides of the truck.



⚠ WARNING

The curtain laser scanners are not implemented for the protection of persons, they are implemented for object detection only.

⚠ DANGER

Risk of eye injury

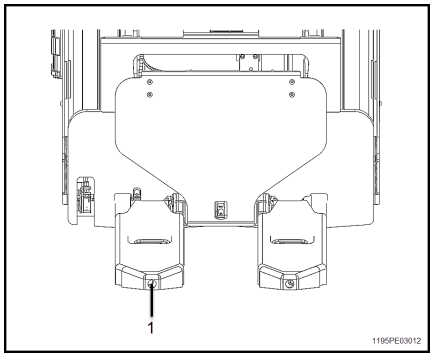
Do not look directly at the lasers. If a lens breaks, contact your authorised dealer for replacement.

Fork tip sensors

The driverless truck is equipped with a fork tip detection sensor (1). It is mounted on the inside the tip of the fork.

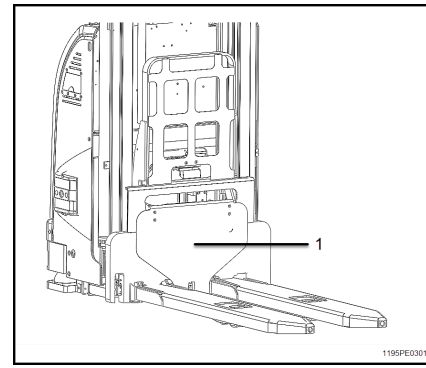
The fork tip sensor can help to ensure that the fork arms are correctly inserted into the pallet openings and to detect obstacles.

If an obstacle is detected, the driverless truck stops and needs to be manually restarted when the area is safe again. They play a key role in the load picking/dropping process.



Load flap/load flap sensor

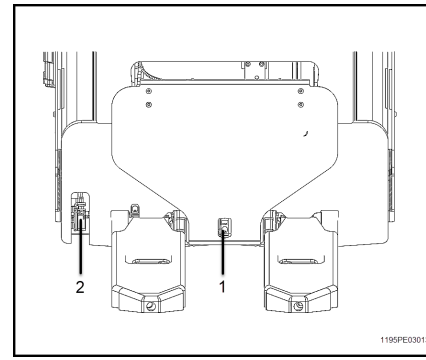
The driverless truck is also equipped with a load flap sensor (1). It is used to determine whether pallets are correctly positioned against the load backrest. The plate is spring-loaded so that when the load comes into contact with the plate, it will send a signal to the sensor indicating that the load is in place.



Push through sensor

The driverless truck can be equipped with two push through sensors (1) and (2; optional).

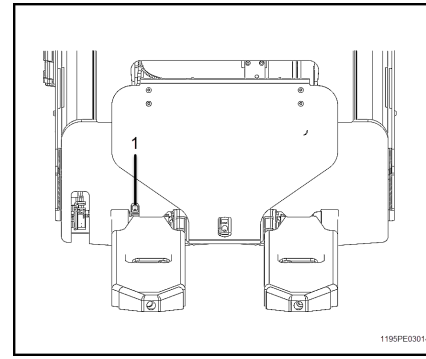
This sensor is used to detect the pallet movement relative to the AGV and prevent the pallets from being pushed or pulled out of position.



Fork free sensor

It is used to detect free space between the load and the fork during load dropping.

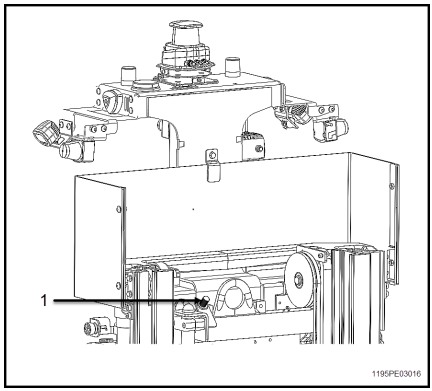
If the sensor does not detect free space before the truck starts to drive forward, it means that the load is still on the forks and the truck cannot move forward. In this case the truck will stop moving.



Second load detection sensor (optional)

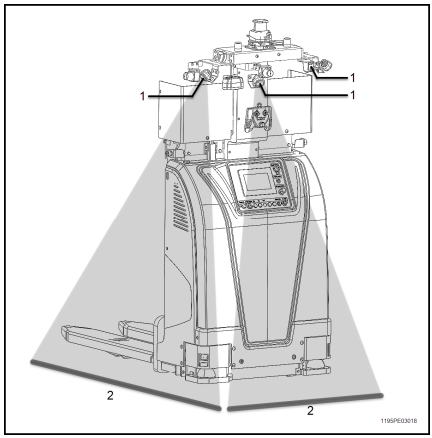
The driverless truck can be equipped with a second load detection sensor (1). ▷

This sensor is used to monitor if the position of the second load is in the intended load position. The truck will stop moving if the presence of the second load is expected but the sensor is not activated, or the presence of a second load is not expected but the sensor is activated.



Linear warning light (optional)

The driverless truck can be equipped with the linear warning lights (1), which will shed a line (2) on the floor when the truck is working and warn personnel to keep a proper distance. ▷

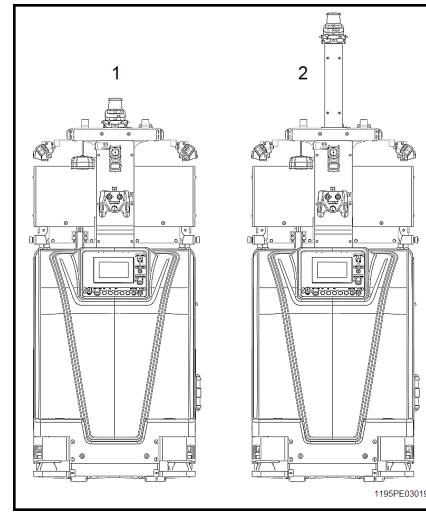


Other options

Options in height of navigation laser scanner

This series of driverless trucks is available with two options in the height of the navigation laser scanner:

- (1): The standard version (2m in height)
- (2): The height version (2.424m in height)



4

Operation

First commissioning of the driverless truck

Staff authorised by the supplier shall perform the first commissioning at the customer's site.

Staff authorised by the supplier are fully trained on the operation of the driverless truck as part of this commissioning.

⚠ DANGER

Risk of damage to the truck

As the driverless trucks arrive on site, all functionality and safety devices are verified during the commissioning process.

It is prohibited to operate the driverless truck before the commissioning phase and training are complete.

Daily pre-shift checks

Daily pre-shift check

Daily pre-shift checks must be performed before starting work. They must be performed at least once every 24 hours. These daily checks ensure that the truck is working correctly. Perform the checks with the truck in Maintenance mode. The battery must be charged to at least half its total capacity.

No.	Inspection item	Checks
1	Electrical system	1. Check the visible electrical components for abnormal mounting/appearance
		2. Check electrical components for cleanliness
2	Lifting system	1. Visually check the condition of the fork arms
		2. Visual check the condition of the mast chain
		3. Visually check the condition of the mast chain guide rails
		4. Visually check the condition of the protective guards
3	Hydraulic system	1. Check for oil leaks
		2. Visually check the condition of the seals on the hydraulic hoses and on the uncovered sections of hose
4	Warning lamp and buzzer	1. Check that warning lights are normal in Maintenance mode (and Automatic mode)
		2. Check that the buzzer is normal in Maintenance mode (and Automatic mode)
5	Blue light (if equipped)	1. Check the light beam coming from the blue light during operation in automatic mode, and confirm that it is functioning normally. Replace the light if necessary
		2. Check the installation and connections, and tighten if necessary
6	Emergency stop button	1. Visually inspect the emergency stop button. Ensure that the red cap and connection pad are fastened, and tighten if necessary.
		2. Testing the emergency stop function
7	Stop/start button	1. Visually inspect the stop/start button and ensure that the installation and connections are secure.
		2. Check whether the stop/start button is functioning normally in Automatic mode.
8	Reset button	1. Visually inspect the reset button and ensure that the installation and connections are secure.
		2. Check whether the reset button is functioning normally.
9	Front/rear laser scanners	1. Visually inspect the laser scanner lenses for dust and scratches. Clean if necessary.
		2. Check the scanner's mechanical fittings, ensuring that they are secure. Tighten if necessary.
		3. Place a traffic cone in a suitable location so as to interrupt the light coming from the laser scanners and test whether the scanner is functioning normally.

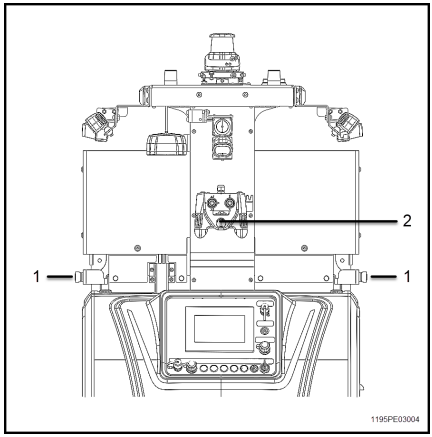
No.	Inspection item	Checks
10	Cleanliness of the floor and the driving route	1. The floor along the AGV's driving route should always be kept clean and dry.
		2. Do not place obstacles along the AGV's route. You should immediately remove obstacles when you find them (such as debris, hardware, tools and equipment).
		3. Objects that suddenly appear on the floor (such as dirt, dust, wires, water, oil and ice) must be cleaned away in a timely manner to prevent the truck from slipping, especially during emergency stopping.
		4. Do not use the truck on a non-predesigned floor.
		5. Keep markings (if any) on the floor (or in the working environment) clean and clearly visible.
11	Stickers and warning labels	1. Check the designation plate and labels, ensuring that all stickers and labels are safe, clear, and clean. Replace if necessary.

NOTE

The driverless truck can only be used after all checks have been carried out and passed. If any check is failed, contact your authorised dealer.

Checking the operation of the emergency stop buttons

The emergency stop buttons (two on either side of the truck body and one on the MCU) must be checked one at a time to ensure that they all work properly.



NOTE

The truck cannot be started if any of the emergency stop buttons are not working.

Procedure to check proper functioning of the emergency stop button

– Press the emergency stop button, the truck should stop moving immediately.

– Pull up the emergency stop button.

– The truck is ready for operation.

⚠ DANGER

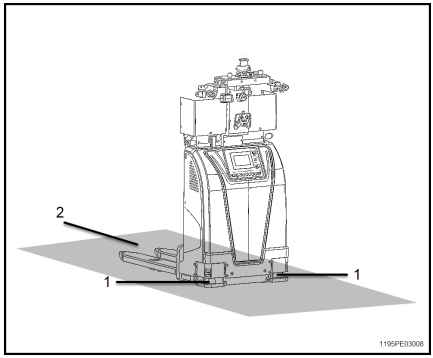
Risk of injury

– Do not use the driverless truck if an emergency stop button is defective.

– If any of the emergency stop buttons are defective, switch off the truck and contact your authorised dealer.

Checking the operation of safety laser scanners ▷

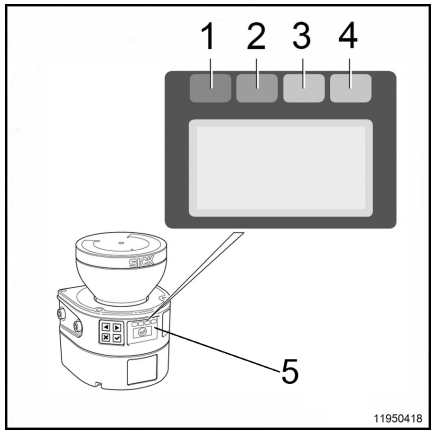
The truck is equipped with three safety laser scanners. There are two safety laser scanners in the front (1) covering the front zone and one safety laser scanner in the back covering the rear zone (2).



It is necessary to check the operation of safety laser scanners at the front and rear. To do so, each of the indicators (5) must be checked. ▷

On the safety laser scanner control screen (5), the green light (2) must be lit. The corresponding safety laser scanner is working.

If the light is red (1) or yellow (3), (4), it is necessary to check what is happening. Once the fault is repaired, the light returns to green (2).



Movement in automatic mode

Prerequisite conditions

At all points of entry into the truck's range of movement, the plant manager must affix warning signage indicating that the driverless truck is in operation.

Residual risks associated with the operation of the driverless truck must addressed by operating company. The operating company shall implement additional safeguards and/or administrative procedures for all residual risks. All personnel must be trained on the residual risks and the mitigation measures

The risks must be reported and communicated to:

- All persons involved
- Any external personnel brought into the operating environment of the driverless truck

To minimise these risks, the site supervisor must ensure that all safety guidelines are adhered to. These regulations apply when commissioning the driverless truck and when the driverless truck is operating and in use.

The site supervisor must:

- Identify work areas and lanes
- Identify danger areas
- Mark danger areas
- Develop and communicate traffic rules (directions, priorities, etc.)
- Train personnel who have reason to enter the operating zone of the truck. Personnel must be knowledgeable of all risks and safety guidelines.

⚠ WARNING

Risk of injury: Never approach the driverless truck or jumping/stepping into the path of travel without wearing appropriate personal protective equipment (PPE).

Personal protective equipment must be worn in the working environment of the driverless truck.

Standard safety distance

General guidelines

Before entering the driverless truck area, please familiarise yourself with all of the safety guidelines for this area.

Below are the safety guidelines outlined by the site manager along with a list of additional recommendations.

Anyone within the driverless truck area must:

- Use the pedestrian crossings
- Be particularly vigilant when turning

They must not:

- Move towards the driverless truck, even if it appears to have stopped
- Cross the path of the driverless truck
- Remain in a hazardous area or in any area where it is not possible to move out of the way

- Follow the driverless truck at the side or at the rear
- Assist with driverless truck manoeuvres, even if they need to observe the operation of the truck during work.

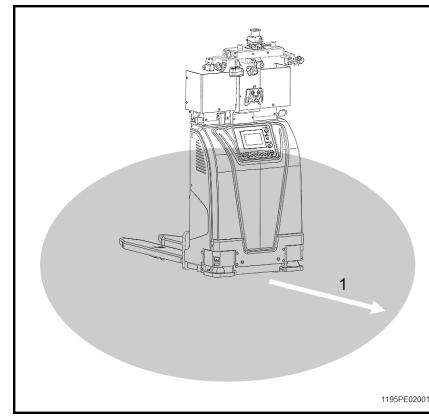
Standard safety distance ▷

⚠ DANGER

Risk of injury

When driving, stacking and unstacking, the standard safety distance (1) varies according to the application. It is set when the truck is first commissioned.

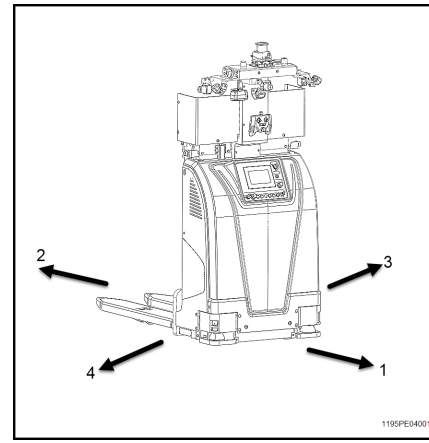
In certain situations (hazardous environment and high mast height), the safety distance (1) must be increased during commissioning.



Determining the direction of travel ▷

For the driverless truck, the conventional directions are:

- Forward (1)
- Reverse (2)
- Left (3)
- Right (4)



Operating in automatic mode

To switch on Automatic mode, the driverless truck must meet the following conditions:

- Truck is started.
- Daily checks have been performed.

- Truck is parked on the guidepath.
- Emergency stop buttons must not be activated (i.e. they cannot be pressed to start the truck).

NOTE

The driverless truck can only be used in Automatic mode by authorised personnel.

NOTE

When restarting the truck in Automatic mode, the operator is responsible for the interaction between the driverless truck and its environment. Check the driving route (floor surface conditions, presence of objects on the floor, condition of loads at loading and unloading points, presence of markings, etc.).

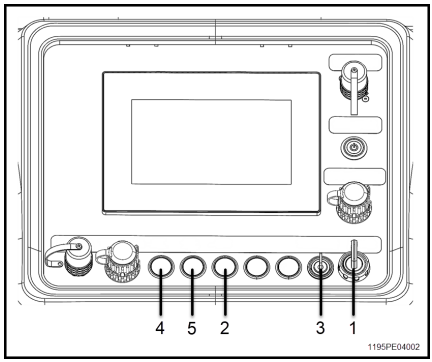
During normal operation, the driverless truck operates in Automatic mode. It receives instructions from the dispatch system over a Wi-Fi connection. It can also receive commands from the control screen.

NOTE

Always follow the safety guidelines and operating instructions before starting the driverless truck in the dispatch system. Only trained personnel may operate the truck in automatic mode.

To use the truck in Automatic mode, proceed as follows:

– Make sure the dispatch system is running. ▷



– Ensure that the battery is connected and press the battery switch.

– Release the emergency stop.

– Turn the key (1) on the control screen to start the truck.

– Select Maintenance mode and keep the key (3) in the upright position.

The control screen will start automatically and display the battery level, alarm information, operating mode, etc. on the screen. The user can view information via the screen.

– Press and hold the reset button (2) on the screen for at least one second.
– Tow the truck as close to the guidepath as possible using the MCU (initial position point).
– Turn the key (3) to Automatic mode.
– Press and hold the reset button (2) on the screen for at least one second.
– Push the start button (4).

The truck is ready for movement in Automatic mode. The truck waits for information from the dispatch system about a task for completion.

– Vacate the area around the truck.
– The truck will switch on as soon as it receives the task information from the dispatch system.
– Observe the truck for a few metres as it starts travelling.

NOTE

If you notice that the truck is operating incorrectly, press one of the emergency stop buttons to stop the truck and notify the appropriate personnel. Place traffic cones around the driverless truck.

NOTE

If an alert message appears, follow the instructions to view it on the control panel.

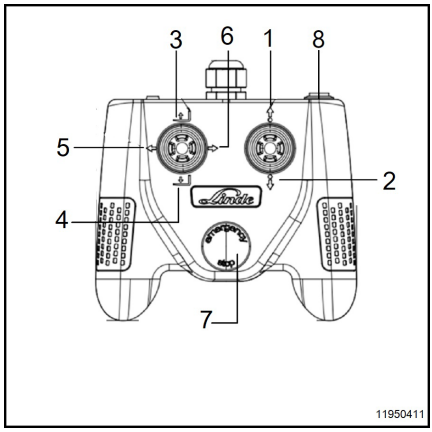
Manual Control Unit (MCU)

The manual control unit is only used for Maintenance mode.

Key features

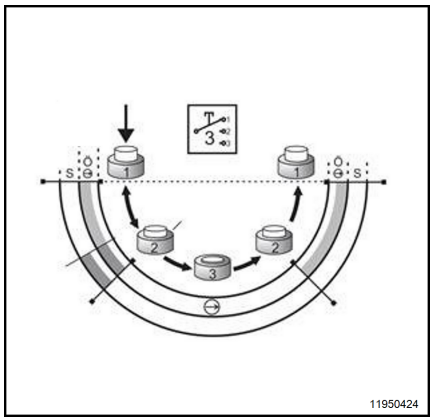
The manual control unit is equipped with 2 dual-axis, cross-type, electronic joysticks. ▷

- The right-hand joystick controls forward (1) and reverse (2) travel.
- The left-hand joystick controls lifting (3), lowering (4), and left (5) and right (6) cornering via the steering motor.
- Emergency stop button: In the event of an emergency, press the emergency stop button (7). To resume operation, pull up the emergency stop button.



Enable switch

The MCU enable switch has three positions, as shown in the figure: 1) Start position 2) Operation position 3) Stop position ▷

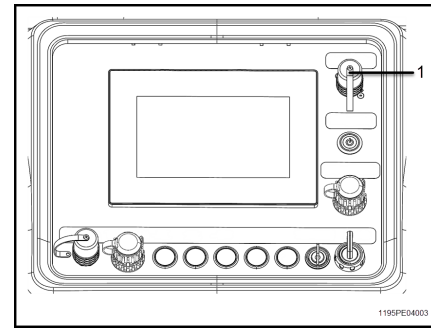


Operation

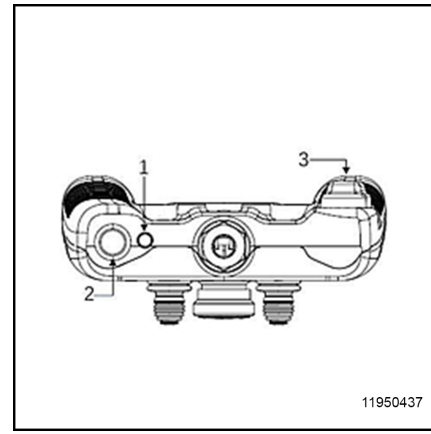
NOTE

When operating the driverless truck in maintenance mode, if the truck is already loaded, lower the forks to a proper height before driving the truck and do not adjust the forks during driving.

– Connect the manual control unit connector to the manual control unit port on the control screen (1). ▷



– When the manual control unit is switched on, the power supply LED (1) turns green. ▷
– Turn the Maintenance/Auto Key Switch (2) on the control panel to "Maintenance".
– The joysticks can be operated simultaneously by pressing the switch (2) with your left index finger and by gently setting the enable switch (3) to position (2) using your right index finger.



NOTE

Pay attention to the following items when using MCU to operate the truck:

- *Only authorized personnels are allowed to operate the truck with MCU.*
- *The operator must stay alert and keep a safe distance from the truck.*
- *The operator must have a clear view of the truck's operating surroundings.*

Additional notes for handling loads

⚠ DANGER

Observe the following notes when handling loads on the site, in order to avoid injuries to persons:

- Make sure the racks, loads, pallets, and other carriers used meet the pre-defined requirements.
- The loads/pallets are placed properly, leaving sufficient space between each other and between the loads and the racks or the walls.
- The loads/pallets shall not be lifted over the maximum lift height.
- It is strictly forbidden for persons to be in the load handling areas.
- No person or object shall be located underneath the forks.
- The operators shall stay out of the operating areas of the driverless truck.
- The operators shall always observe the activation of the visible and audible warnings.

NOTE

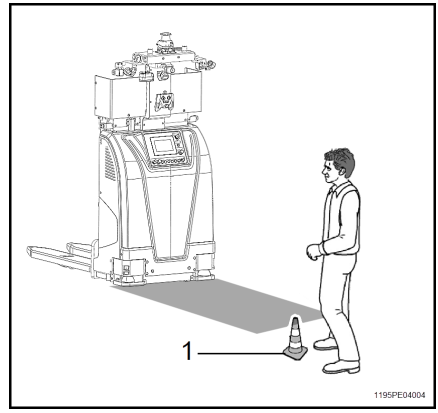
Refer to other technical documents accompanied, such as technical agreement, contract, etc., for more information.

Stopping

Standard shutdown of automatic mode

To stop the driverless truck, proceed as follows:

– Position an object (e.g. traffic cone) (1) directly in front of the truck. The safety scanner should be able to identify the obstacle. ▷



The driverless truck slows down and then stops.

⚠ DANGER

Risk of injury

Do not stand in the path of the driverless truck at a short distance when it is in motion. The braking distance would be insufficient.

– Stay within the field of the front safety laser scanner.

– Press the Stop button on the control screen.

– Or switch the truck to maintenance mode by turning the key to Maintenance.

⚠ DANGER

Danger of crushing

Never position yourself at the side of the forks. The procedure to stop the truck must ONLY be performed when the truck is in motion and in the direction of the tiller

⚠ DANGER

Risk of injury

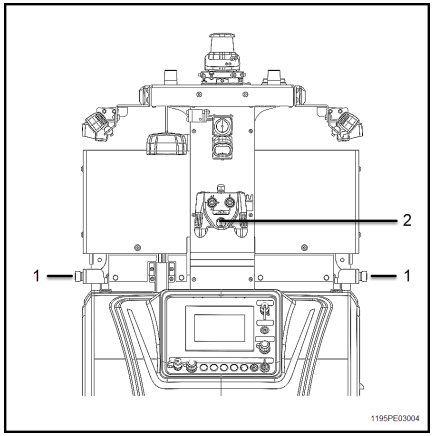
Never stop automatic mode during rack loading or unloading operations. Except in an emergency.

Emergency stopping

There are two emergency stop buttons on each side of the driverless truck and one on the MCU to avoid any hazardous situation during operations. Emergency stop buttons should be used only in emergencies.

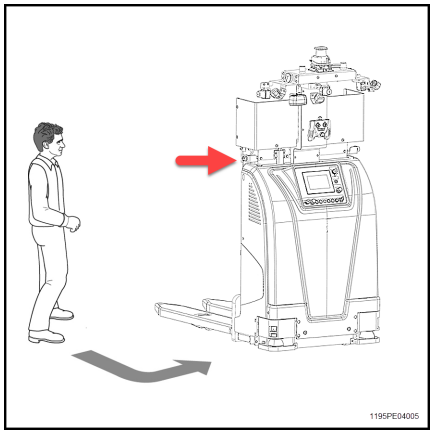
In an emergency:

– Do not stand in the direction of travel. Pay close attention to the warning lights.



– Press one of the emergency stop buttons.

– Move to the side of the truck.



⚠ CAUTION

Risk of injury

Do not cross the path of a driverless truck. Do not stand on the forks side.

As soon as the emergency stop button is activated, the power to the motor is cut off and the brake is applied. The truck can still have a braking distance (up to operating speed and environment). Personnel must remain vigilant.

Stoppage following the detection of an object

The driverless truck stops if an obstacle is detected. It emits acoustic signals and light signals.

To restart the driverless truck:

– Remove the obstacle.

– Ensure that there is no hazard in the vicinity of the truck.

– Move out of the truck's path.

The truck starts in automatic mode.

If the driverless truck does not move off on its own, consult the dialogue box on the control screen.

Only trained staff can start the truck in automatic mode. They must be entirely familiar with the safety rules.

⚠ WARNING

Risk of injury

Be careful when handling the start of mode of operation function.

Move away from the driverless truck immediately in the event of beeps or flashing lights.

Stopping the truck from the supervision software

The driverless truck cannot establish communication with the supervision software when the truck is switched off. The software considers the truck to have been removed from the circuit.

⚠ WARNING

Danger of material damage

The switched off driverless truck is invisible in the supervision software. It will no longer be on the guidepath as normal. The truck must not be in the environment of other driverless trucks still in motion.

To stop the automatic mode, proceed as follows:

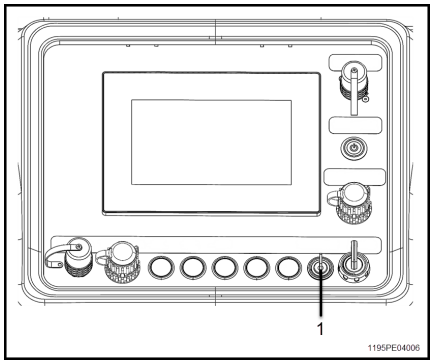
– Make sure that the truck is no longer on its circuit or that of another driverless truck. If this is the case, switch it to maintenance mode.

– Ensure that it does not interfere with the work of other driverless trucks (picking, removal, movement areas etc.).

– Place the driverless truck in Removed mode in the supervision software.

Stopping

– Turn the mode switch (1) to maintenance mode. ▷



The automatic system is switched off.

Battery

Overview

This driverless truck is powered by a 24 volt Lithium-Ion battery. The battery provides suitable voltage and amperage capacity from a single connection. The battery is installed on the truck in the technical compartment within the front cover.

⚠ WARNING

When using batteries, you must follow local and regulatory authority safety regulations for battery disposal.

⚠ WARNING

The battery that comes with this system can only be used with the battery charger compatible with that type of battery. Using an incompatible battery charger can cause danger such as overheating, fire, explosions, chemical spills, and hazardous fumes.

NOTE

Operator should wear proper PPE (personal protection equipment) and insulted tools when working in the charging area or on the batteries.

Charging station

The battery of the driverless truck can be charged via the charging terminal (1).

The charging post (2) can be arranged along the truck's travel path. When the battery is low, the driverless truck brings its charging terminal (1) into contact with a charging post (2) to perform automatic charging.

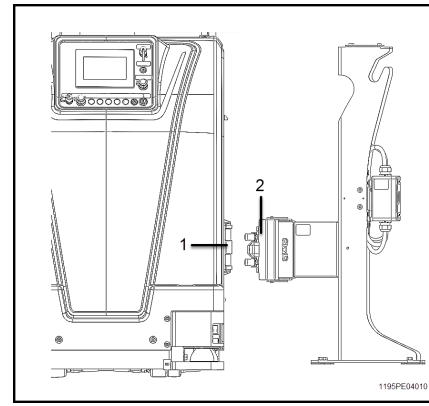
The battery will start charging.

NOTE

For instructions on how to use the charger, refer to the charger operating instructions.

⚠ CAUTION

Only qualified and authorized personnel are allowed to work with the charging station. Other people must not approach the charging station.



Charging methods

There are different charging methods used in AGV systems: opportunity charging and regular charging. Manual charging is also supported in some situations.

Opportunity charging

If the AGV is idle and hasn't been told to queue, it will drive to a charging point to recharge its battery. Opportunity charging is used when the system is operating normally and is designed for high current charging for short periods of time.

Regular charging

A pre-set schedule is included that requires the AGV to be charged before a set time. If the truck is loaded with goods, it will complete the loading process before driving to the charging point. This method is used for on-board charging or manual battery replacement and helps to avoid charging during busy shifts. This method can also be adapted to include fast charging and schedules to ensure that truck batteries are always kept charged.

The AGV system can have one or more chargers, depending on the system requirements. The chargers can provide the required daily charging, weekly maintenance charging, or both at the same time.

It is suggested to charge the truck every two weeks.

Manual charging

The truck supports manual charging in case automatic charging is not available in certain occasions.

To manually charge the truck:

– Put the truck to Maintenance mode.

– Move the truck to the charging station with MCU.

– Open the lid of the manual charging port (1) ▷ on the side of the truck body.
– Connect the manual charging port to the charging station with a power cable.
– Turn on the power and the charging starts.

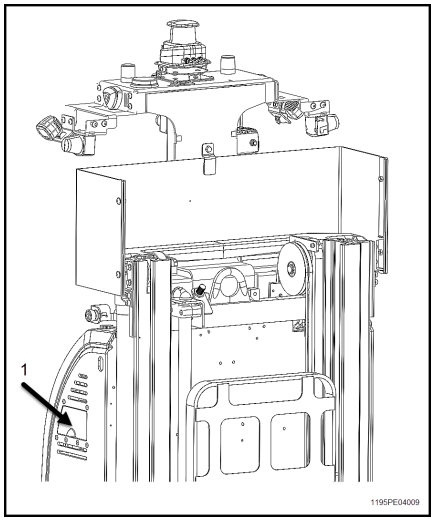
⚠ DANGER

During manual charging, accidental movement of the truck will cause the charger cable to break, resulting in an electric shock.

Follow the manufacturer's instructions for manual charging, which should be done in **maintenance** mode, not automatic mode.

⚠ CAUTION

Always keep the manual charging cover and port dry and avoid exposing these parts to water.



Battery charger operation and preventative maintenance

⚠ CAUTION

Only qualified and authorised personnel can be responsible for batteries and chargers within the maintenance system.

NOTE

Personnel responsible for maintaining batteries and chargers must be familiar with safety instructions, operation instructions, and any necessary preventative maintenance instructions relating to battery chargers.

The battery chargers that come with the AGV system have already been properly set up for battery charging that meets battery service life and warranty requirements. The design of battery charging methods takes into consideration the overall efficiency of the AGV system.

⚠ CAUTION

Users may not alter or adjust the battery charger settings without consulting the manufacturer's technicians. Alterations or adjustments may cause battery charging to work improperly, which may affect the expected service life of batteries and system efficiency.

Battery chargers require very little maintenance. Preventative maintenance can differ between manufacturers. However, most battery chargers require the following:

- Check connections and terminals. They should be kept clean and close together.
- Check and clean battery chargers as needed to prevent excess dirt building up on their components.

⚠ CAUTION

You should take care not to touch or move any components during the cleaning process. Before cleaning, ensure that the AC power and battery are disconnected.

NOTE

Cleaning frequency depends on the environment where the charger is installed.

- If the truck will not be used for a long time, make sure the power switch of the battery is turned off.

Operating the truck in specific situations

Jacking up the driverless truck

⚠ DANGER

Danger of tipping

The driverless truck must be jacked up carefully.

⚠ DANGER

Risk of damage to safety laser scanner at front of the driverless truck

Do not jack the truck too high.

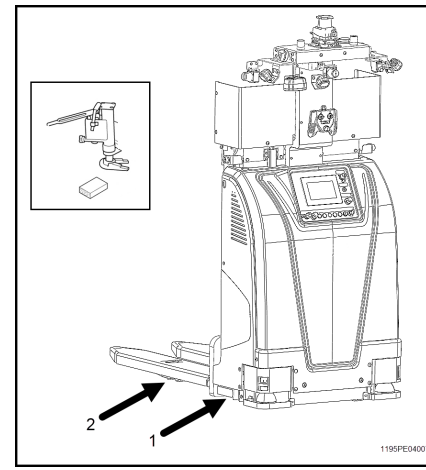
The truck must be jacked up for certain tasks, such as load wheel maintenance.

– Raise the forks.
– Turn off the key switch and unplug the battery connector.
– Use a jack with sufficient lifting capacity.

Working in front of the driverless truck while it is raised:

– Position the jack under the main chassis (1).
– Place the jack under the fork arm in the position indicated (2).
– As a safety precaution, always insert wooden wedges under the truck.

▷



⚠ DANGER

Risk of the driverless truck falling

After jacking up the driverless truck, secure it using chocks.

Lifting the driverless truck

⚠ DANGER

Risk of the driverless truck falling

Only spreaders and hoists with sufficient load capacity are permitted to be used. The lifting points are marked by a label.

– Remove the load before slinging the truck.

– Check the weight of the truck (including the battery) in order to select the appropriate lifting equipment. See manufacturer's nameplate.

⚠ DANGER

When lifting the truck, there is a risk of accident and fatal injury if personnel are in the working zone of the hoist.

– When using a hoist to lift the truck, be particularly careful to ensure that no-one is in the working zone of the hoist.

– Comply with the maximum load weight given on nameplate.

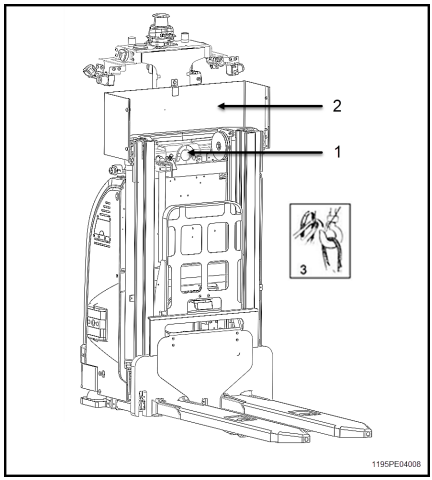
– Do not walk under suspended loads!

⚠ DANGER

Danger of damaging the truck.

Pay extra attention to the location of the slings and hooks to avoid damaging the various sensors (antenna, curtain laser, navigation laser scanner, etc.).

Procedure: ▷



– Switch off the driverless truck.

– Clean up any items that may have fallen onto the truck.

– Remove the protective plate (2).

– Take care to protect all components that come into contact with the lifting equipment.

– Open the cover plate of the truck and disconnect the battery connection plug.

– Securely fasten a rope (that is at least capable of bearing the weight of the forklift truck) to the lifting point (1).

– Attach the end of all slings to the hook (3) and engage the hook safety lock when the slings are attached to the hook. Prevent

the slings from rubbing against any sharp edges on the truck.

– Carefully lift the truck.

NOTE

It is recommended that you do not lift the truck yourself. Contact your authorised dealer to carry out this procedure.

Maintenance of the lifting ring

The lifting ring should undergo maintenance every 12 months or every 1000 working hours, for whether they are worn and stable or not.

⚠ WARNING

This maintenance procedure requires professional tools and knowledge.

Please contact the authorized dealers.

Restarting the truck

The following instructions are for restarting the driverless truck as it might stop in different circumstances when working in automatic mode.

To restart the driverless truck if it stops when an obstacle is detected:

– Remove the obstacle(s).

– Ensure that there is no hazard in the vicinity of the truck.

– Move out of the truck's guidepath.

The truck restarts in automatic mode.

If the driverless truck does not move on its own, consult the dialogue box on the HMI touchcreen.

Only trained staff can start the truck in automatic mode. They must be entirely familiar with the safety rules.

⚠ WARNING

Risk of injury

Be careful when handling the switching of operation mode.

Move away from the driverless truck immediately in the event of beeps or flashing lights.

To restart the driverless truck if it stops when the Stop button is pressed:

Remove the obstacle(s), press the **Reset** button and then the **Start** button. The truck restarts in automatic mode.

To restart the driverless truck if it stops when the emergency stop button is pressed:

Slightly rotate the emergency stop button, pull it up, press the **Reset** button and then the **Start** button. The truck restarts in automatic mode.

NOTE

The truck is only operational after correctly resetting the emergency stop buttons and pressing the Reset and Start buttons.

Storage of the truck

Precautions should be taken if the truck must not be used for a reasonably long period. The operations depend on the length of time it is unused.

Storage for a period of less than two months

If the truck is not used for a period of up to two months, it is necessary to perform certain operations:

- Clean truck carefully.
- Check the hydraulic oil level and refill if necessary.
- Lower the forks onto a suitable support (e.g. a pallet) until the chains are slack.
- Remove the battery and recharge it at least once a month. Follow the battery manufacturer's instructions.
- Coat any unpainted metal parts with a thin layer of oil or grease.
- Grease all hinges and joints.
- Spray contacts with a suitable aerosol product.
- Raise the truck on chocks to avoid the tyres becoming flat.
- Cover the truck with a cotton cover to protect it from dust. Avoid using a plastic sheet.

Long-term truck storage

The following work must be carried out on the truck to prevent corrosion if it needs to be stored for a long period of time. If the truck is to be stored for more than two months, it must be positioned in a clean and dry area. The area must be well-ventilated with no risk of freezing.

The following operations must be performed:

- Clean the truck thoroughly.
- Check the hydraulic oil level and refill if necessary.
- Coat any unpainted metal parts with a thin layer of oil or grease.
- Grease all hinges and joints.
- Check battery condition and electrolyte density. Maintain the battery in accordance with the manufacturer's requirements. (Follow the instructions).
- Spray contacts with an aerosol product designed for contacts.
- Raise and chock the truck: the wheels must not touch the ground in order to prevent irreversible deformation of the tyres.
- Cover the truck with a cotton cover to protect it from dust.

⚠ CAUTION

We recommend that you do not use a plastic sheet as this encourages condensation to form.

Consult the service department for further measures to take if the truck must be stored for a longer period of time.

Recommissioning after storage

If the truck has been stored for more than six months, it must be checked carefully before being recommissioned. This check is similar to the workplace accident prevention inspection. It is therefore necessary to check all points and systems that are important for truck safety.

Carry out the following operations:

– Clean the truck thoroughly.
– Grease all hinges and joints.
– Check the condition and density of electrolyte, and, if necessary, recharge the battery.
– Check that there are no traces of condensation water in the hydraulic oil. Drain if necessary.
– Carry out the same maintenance work as for the first time it was commissioned.
– Commission the truck.
– In particular, check the following during start-up:
  • traction, control and steering
  • brakes (service brake and parking brake)
  • lifting device

5

Service and maintenance

Maintenance safety instructions

Safety precautions for maintenance and repair

Only personnel who are qualified and authorized are allowed to perform maintenance work.

To avoid accidents during maintenance and repair, carry out all necessary safety measures. Make sure that the truck is stationary and that there can be no unexpected movement or unexpected starting (disconnect the battery connector).

Safety devices

After performing maintenance and servicing, reinstall all safety devices and check that they work properly.

Additional notes

NOTE

- *Servicing work requires specialist knowledge. Special tools may also be required.*
- *In specific environmental conditions (dusty environments etc.), maintenance intervals may be shorter. Contact the authorized dealer.*

Service plan

Daily checks

Refer to ⇒ Chapter "Daily pre-shift check", Page 39 for the daily checklist in details.

Maintenance plans

1000-hour maintenance plan

No.	Inspection item	Maintenance procedures
1	MCU test	1. Check that the forward and reverse manual controls work properly.
		2. Check that the fork arm lifting and lowering manual controls work properly.
		3. Check that the emergency stop button works properly.
		4. Check that the Enable switch works properly for positions 1, 2 and 3.
		5. Check that the override button works properly
		6. Check the condition of the wheels and the truck's equilibrium.
		7. Checking the operation of the brake.
2	Switches and sensors	1. Visually inspect switches, sensors, and their supports for wear and damage. Repair or replace as needed.
		2. Clean switches and sensors.
		3. Check sensor alignment, adjustment, and range. Adjust or recalibrate if necessary.
3	Laser scanners	1. Visually inspect the laser scanner lenses for dust and scratches. Clean if necessary.
		2. Check the scanners' mechanical fittings, ensuring that they are secure. Tighten if necessary.
4	Electrical enclosure	1. Use a soft brush and vacuum cleaner to clean compartments and the electrical panel.
		2. Check the wiring, connectors, and fuses, ensuring that they are secure and undamaged. Tighten or replace as needed.
5	Steering sensor	1. Check the fittings and connections. Tighten and adjust if necessary.
		2. Confirm whether the current steering encoder reading matches the physical position of the wheels.
6	Steering transmitter connector	1. Rock the steering transmitter gears back and forth, but do not move the drive wheels. Confirm that the steering transmitter current does not change more than 0.2 degrees.
		2. Check for wear and incline between the steering motor's small gears and roller gears, as this could lead to navigation errors. The gears must be replaced if the incline is too great or they are too worn (the above two checks can be carried out by observing whether the wheels of the AGV are running in a straight line).

No.	Inspection item	Maintenance procedures
		3. Clean the forward positions of the steering motor's small gears and rolling gears, and then apply a small amount of lubricating grease.
7	Wheels	1. Check the wheels for cracks, flat points, gaps, and loss of adhesion. Replace if needed or errors are reported.
		2. Clean any debris from the wheels and wheel grooves.
		3. Turn the wheels to ensure that they move freely and that the bearings are not damaged.
8	Drive sensor	1. Check the fittings and connections. Tighten and adjust if necessary.
		2. Verify that the front ratio factor is less than 2%. If it is greater than 2%, you will need to calibrate or possibly replace the wheels (you can check the automatic calibration data inside the automation unit).
9	Electrical system	1. Battery: inspect condition.
		2. Battery: inspect cables and sockets.
		3. Cables and connectors: inspect condition and position.
		4. Electrical components: clean with compressed air.
		5. Pump motor: clean and inspect the motor.
		6. Lifting height encoder: check correct operation and installation.
		7. Low lift sensor (height measurement): clean and check that it works properly.
10	AGV cleanliness	1. The AGV must always be kept clean. When necessary, clean the truck and remove dust with compressed air.
		2. Visually check for dust build-up on optical sensors (laser head, laser scanner, and electrical conduits).
		3. Check the electrostatic belt on the truck's undercarriage and ensure that it is clean and undamaged. Clean or replace as necessary.
11	Pick-and- place accuracy test	1. Make sure the lift height encoder value is accurate, with an error of no more than 2 mm.
		2. Observe, during different processes, that the left and right fork arms are at the correct height and reasonably spaced apart.
12	Navigation laser system	1. In principle, the navigation positioning system should not require any maintenance. During regular maintenance on the truck, just clean the laser scanners with a soft cloth. Perform regular inspections to check whether the connections and cables are fastened or damaged. You should also check for wear or damage to the scanner's outer casing.
		2. Do not use any cleaning products on the navigation laser lens.
13	Reflector	If the site is dusty, clean the surface of the reflectors with a non-woven fibre cloth or microfibre cloth, carefully wiping the surface clean so that it is free of impurities. (Note that the reflectors cannot be moved).
14	Safety laser scanners	1. The safety laser scanners require virtually no maintenance. However, the front scanner lens must be cleaned regularly. Static electricity may cause dust particles to accumulate on the front lens, which can affect performance. (Do not use corrosive cleaning products or abrasive cleaning products on the front safety laser scanner lens.)

No.	Inspection item	Maintenance procedures
		2. Use a clean soft brush to remove dust from the front lens. Wet the lens cleaning cloth with anti-static plastic cleaner and then wipe the lens clean.
15	Testing the emergency stop function	1. Press an emergency stop button and check that: the AGV comes to a complete standstill and the alarm sounds; the display unit warning is activated; the contactor and safety relay are deactivated.
		2. Turn and release the emergency stop button.
		3. Press the reset button.
		4. Press the green start button.
		5. Repeat this test for all emergency stop buttons.
16	Components and hardware	1. Ensure that all protective devices and covers are installed and secured
		2. Check for damage to high stress components
		3. Check for cracks to welding points
		4. Check for lose or missing hardware
		5. Electromagnetic brake: Check the integrity of the electromagnetic brake dust protection measures (wiper ring, dust cap, dust plug) and remove airborne dust
		6. Electromagnetic brake: If necessary, check the electromagnetic brake air gap for wear
17	Hydraulic system	1. Hydraulics: check the oil level
		2. Hydraulics: inspect for leaks
18	Gear	1. Check all gears for wear and then lubricate them
19	Gearbox	1. Transmission gear: visually inspect the installation
		2. Transmission gear: check for leaks
		3. Traction motor: visually inspect the installation
		4. Traction motor: clean the cooling fins
20	Load lifting system	1. Mast: check condition
		2. Lift cylinder, chain, rollers and end stops: check condition, installation and operation
		3. Lift chain: clean, adjust and lubricate with chain spray
		4. Mobile chassis: inspect
		5. Protective devices/guards: inspect

2000-hour additional maintenance plan

No.	Inspection item	Maintenance procedures
1	Gearbox	Transmission gear: check installation (after 2000 hours only).
2	Electrical system	1. Replace the battery of the KAB PC (automation controller).
3	Hydraulic system	1. Hydraulics: change the hydraulic oil (at least once per year).
		2. Hydraulics: change the suction filter.

No.	Inspection item	Maintenance procedures
		3. Check the length of the carbon brush, which should be at least X=10.5 mm.
4	Load lifting system	1. Mast: inspect installation
		2. Fork carriage: inspect

Regular maintenance performed at least every 12 months

No.	Inspection item	Maintenance procedures
1	Gearbox	1. Transmission gear: check for leaks.
		2. Traction motor: clean the cooling fins.
2	Chassis, bodywork and fittings	1. Battery hood: inspect
		2. Load wheels: lubricate the axle and bearings
3	Steering unit and wheels	1. Steering unit: clean, inspect and lubricate pinion gears and sprockets
		2. Support wheels: check height adjustment
		3. Stabilising wheel: check height adjustment
4	Electrical system	1. Battery: inspect condition
		2. Battery: inspect cables and sockets
		3. Electrical components: clean with compressed air
		4. Initial lift sensor: inspect
5	Hydraulic system	1. Hydraulic equipment: clean the suction filter
		2. Hydraulics: check the oil level
		3. Hydraulics: inspect for leaks
		4. Hydraulics: change the hydraulic oil
6	Load lifting system	1. Mast: check condition
		2. Lift chain: clean, adjust and lubricate with chain spray
		3. Protective devices/guards: inspect
		4. Initial lift: inspect the connecting rods

Cleaning the truck

Disconnect the battery before cleaning the truck.

Avoid using steam jets or high-pressure cleaners to clean the truck.

Be very careful using cleaning products with a strong degreasing effect. They dilute the grease inside the sealed-for-life bearings, and relubrication is impossible. These cleaning methods damage the bearings.

⚠ CAUTION

When using a cleaning appliance, avoid exposing electrical circuits, motors, manual charging cover and port, or insulating panels to direct jets. Protect these items before starting the cleaning procedure.

Do not directly spray water onto the truck.

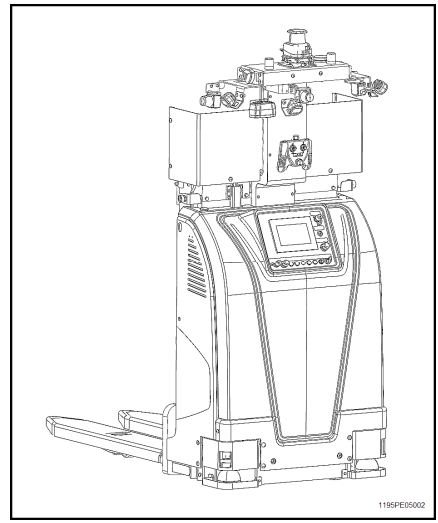
If using compressed air, first remove stubborn dirt with a cold cleaning agent. Before carrying out lubrication operations, thoroughly clean the oil filling openings and the areas around them, as well as the grease nipples. Dry the truck after cleaning.

If water enters the motors despite all of these precautions, the truck must be returned to service in order to prevent rust forming (it dries out by its own heat). The motors can also be dried using compressed air.

It is important that no water remains on the truck or inside the truck.

NOTE

A truck that is cleaned frequently will also require more frequent lubrication.



Cleaning the lasers and sensors

Always clean each laser regularly to ensure that different obstacles can be detected.

Clean all the lenses using the recommended wipes. Clean using only water (with a small amount of detergent if necessary) and a wipe (supplied with the AGV special tool kit). Do not use irritating chemicals.

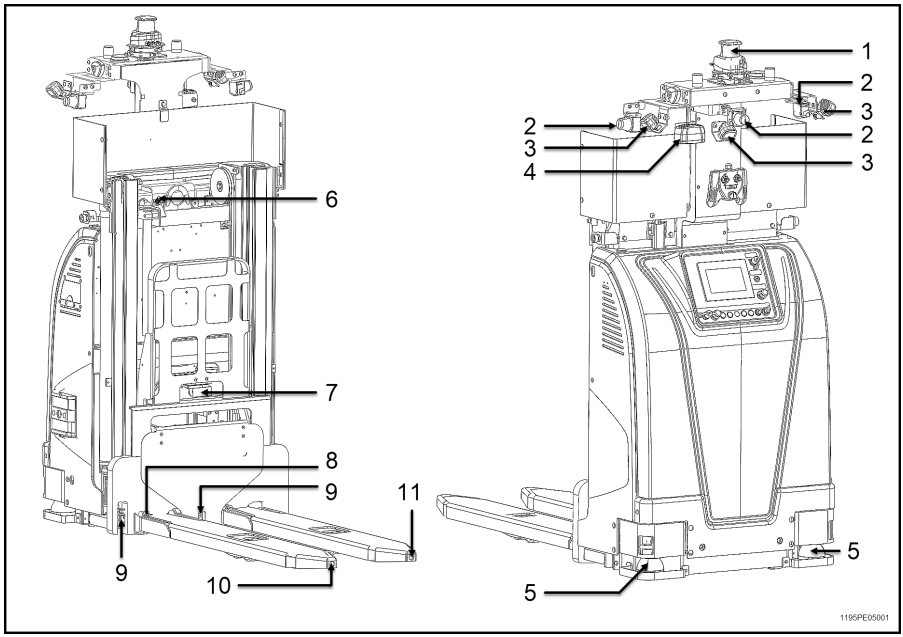
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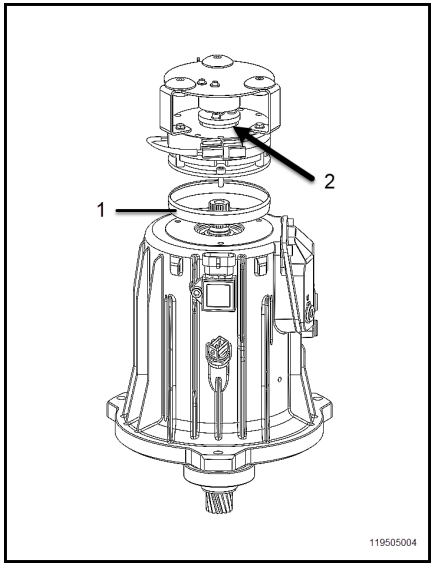
Sensors to be cleaned (depending on the model)



1	Navigation laser scanner	6	Second load detection sensor (if equipped)
2	Curtain laser (if equipped)	7	Barcode scanner (if equipped)
3	Linear warning light	8	Fork free sensor
4	BlueSpot™ (if equipped)	9	Push through sensor
5	Front safety laser scanners (and rear safety laser scanner)	10	Fork tip sensor
		11	Drop full sensor

Checking the electromagnetic brakes ▷

– To ensure braking effectiveness, the mechanical wear of the moving parts of the electromagnetic brakes needs to be checked and replaced if necessary.
– Remove airborne dust between the additional speed encoder (2) and the electromagnetic brake, the wiper ring (1) as well as the brake air gap, with compressed air.
– Check the wiper ring (1) for deterioration and replace it if necessary.
– Reinstall the wiper ring (1).
– Check the electromagnetic brake air gap if necessary.



NOTE

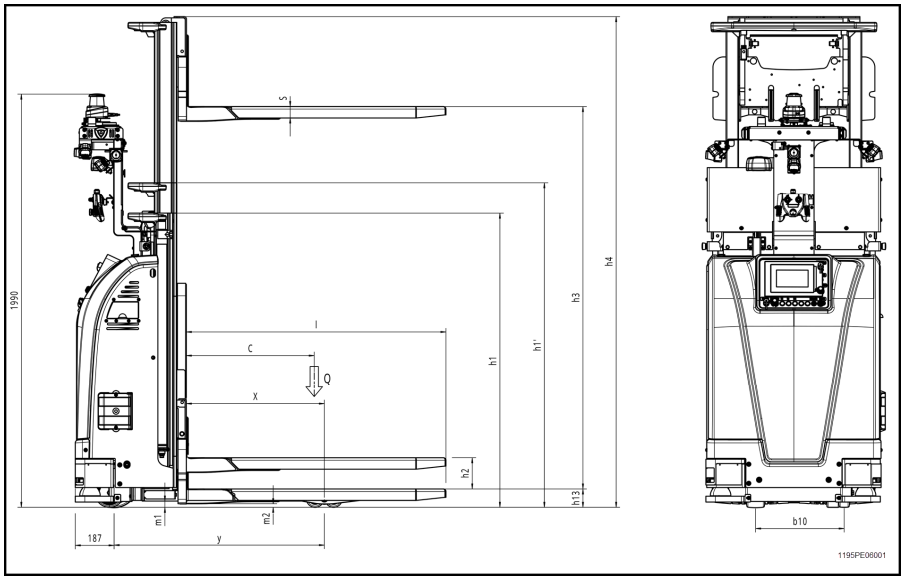
It is recommended that you contact an authorised service partner to do this.

6

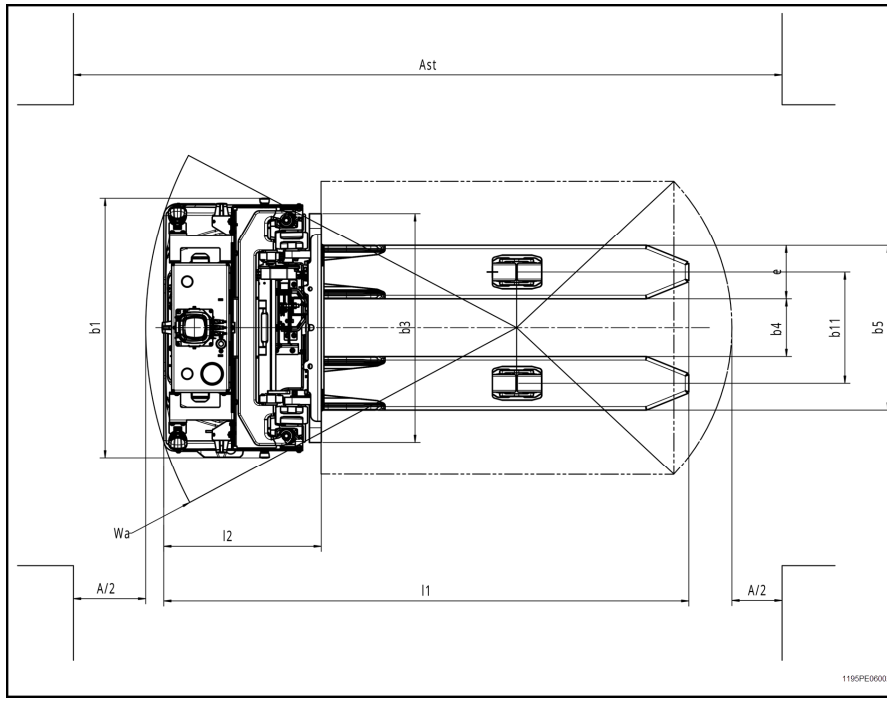
Technical data

AXV 12 iGo datasheet

Overview - front and side view (for the standard navigation height)



Overview - top view



Technical Data

Characteristics			
1.1	Manufacturer	-	STILL
1.2	Model designation	-	AXV 12 iGo
1.3	Power unit	-	Li-ion battery
1.4	Operation	-	Automatic/Mainte-nance
1.5	Load capacity	Q (kg)	1200
1.6	Load centre	C in (mm)	600
1.8	Axle centre to fork face	X in (mm)	665
1.9	Wheelbase	Y in (mm)	1013
Weight			
2.1	Service weight	-	850
2.2	Axle load, fork with load, front/rear	-	695/1355

2.3	Axle load without load, front/rear	-	670/180
Tyres			
3.1	Tyres, front (drive+auxiliary)/rear (load) C=cushion rubber, P=polyurethane	-	P+P/P
3.2	Tyre size, front (drive) wheel	in (mm)	Ø 230xL90
3.3	Tyre size, rear (load) wheel	in (mm)	Ø 85x65
3.4	Auxiliary wheels (dimensions)	in (mm)	Ø 140x54
3.5	Wheels, number front (drive)/rear (load) (x=driven)	-	1x+1/4
3.6	Track width, front (drive)	b10 in (mm)	426.5
3.7	Track width, rear (load) (±5 mm)	b11 in (mm)	380
Dimensions			
4.2	Height of mast, lowered (±5 mm)	h1 in (mm)	1415
4.3	Free lift	h2 in (mm)	264
4.4	Lift height	h3 in (mm)	1844
4.5	Height of mast, extended	h4 in (mm)	2364
4.15	Fork height, lowered	h13 in (mm)	86
4.19	Overall length	l1 in (mm)	1785
4.20	Length to fork face	l2 in (mm)	535
4.21	Overall width	b1 in (mm)	887
4.22	Fork dimension	s/e/l in (mm)	55/182/1250
4.24	Width of fork carriage	b3 in (mm)	780
4.25	Fork spread, min/max	b5 in (mm)	560
4.26	Width between reach legs	b4 in (mm)	196
4.31	Ground clearance, laden, below mast	m1 in (mm)	30
4.32	Ground clearance, center of wheelbase	m2 in (mm)	17
4.33	Aisle width for pallets 1000 x 1200 crossways	Ast in (mm)	2148(1)/2750(2)

4.34	Aisle width for pallets 800 x 1200 lengthways	Ast in (mm)	2129(1)/2480(2)
4.35	Turning radius	Wa in (mm)	1261(1)
Performance			
5.1	Travel speed, with/ without load	km/h	4/4(1) 6.0/7.2(2)
5.2	Lifting speed, with/ without load	m/s	0.19/0.30
5.3	Lowering speed, with/ without load	m/s	0.31/0.24
5.10	Service brake	-	Electromagnetic
Drive			
6.1	Drive motor output (60 minutes, ratings)	kW	1.5
6.2	Lift motor output (15% rating)	kW	3.2
Electric-engine			
6.3	Battery according to DIN 43531/35/36 A,B,C,no	-	1P8S 206
6.4	Battery voltage/rated capacity (5h)	V/Ah	24/206
6.5	Battery weight (±5%)	kg	65
6.6	Power consumption according to VDI cycle	kWh/h	0.57
Other characteristics			
8.1	Type of drive control	-	LAC
10.7	Noise level at operator's ear	dB(A)	65
(1) Maintenance operation (2) Automatic operation			

7

Troubleshooting

Error Codes

Error # 330135 ERR_PLS_WEAK_1 (*) **Condition:** Safety laser scanner contaminated; Front PLS left contamination **Cause:** The optics cover of the safety laser scanner is dirty **Resolution:** Thoroughly clean the entire surface of the glass pane (360°) and dust the scanner housing To clean the glass pane of the safety laser scanner: Use oil-free compressed air to remove dust from the optical window Dampen a cleaning cloth with an anti-static cleaning agent for plastic Using a horizontal motion, wipe the optical window Do not wipe vertically If this error continues, contact your local service partner.
Error # 330136 ERR_PLS_WEAK_2 (*) **Condition:** Safety laser scanner contaminated; Rear PLS contamination **Cause:** The optics cover of the safety laser scanner is dirty **Resolution:** Thoroughly clean the entire surface of the glass pane (360°) and dust the scanner housing To clean the glass pane of the safety laser scanner: Use oil-free compressed air to remove dust from the optical window Dampen a cleaning cloth with an anti-static cleaning agent for plastic Using a horizontal motion, wipe the optical window Do not wipe vertically If this error continues, contact your local service partner.
Error # 330137 ERR_PLS_WEAK_3 (*) **Condition:** Safety laser scanner contaminated; Front PLS right contamination **Cause:** The optics cover of the safety laser scanner is dirty **Resolution:** Thoroughly clean the entire surface of the glass pane (360°) and dust the scanner housing To clean the glass pane of the safety laser scanner: Use oil-free compressed air to remove dust from the optical window Dampen a cleaning cloth with an anti-static cleaning agent for plastic Using a horizontal motion, wipe the optical window Do not wipe vertically If this error continues, contact your local service partner.

Error # 330530 ERR_BATT_TOO_LOW (*) **Condition:** Battery is too low; battery level too low **Cause:** The battery charge is too low **Note:** When this error occurs, the truck will stop all automatic movements and will shut down **Resolution:** Switch the truck to manual mode Move to a maintenance position for manual charging If this error continues, contact your local service partner.
Error # 330531 ERR_BATT_TOO_LOW_WRN (*) **Condition:** Battery almost too low for operation **Cause:** The battery charge is too low. **Note:** When the battery charge becomes too low the truck will stop all automatic movements and will shut down **Resolution:** Using the fleet manager, send the truck to a charging location If this error continues, contact your local service partner.
Error # 462132 ERR_DRIVE#_BLOCK (*) **Condition:** The truck traction motor is blocked; drive 1 actuator blockage error **Cause:** The truck is pushing against an obstacle **Resolution:** Remove the obstacle or switch to manual mode and drive the truck to a startup position Restart the truck in automatic mode If this error continues, contact your local service partner.
Error # 462139 ERR_DRIVE#_PAT (*) **Condition:** The setpoint position and current position of the truck differ too much; drive 1 actuator patine error **Cause:** The floor is slippery or dirty causing the truck to move in unexpected ways **Resolution:** Verify the condition of the floor If necessary, clean up any dirt, spills, or debris If this error continues, contact your local service partner.

Error # 462140 ERR_DRIVE#_POS (*)

Condition: The setpoint position and current position of the truck differ too much; drive 1 actuator positioning timeout

Cause: The truck is pushing against an obstacle

Resolution:
Remove the obstacle or switch to manual mode and drive the truck to a startup position
Restart the truck in automatic mode

If this error continues, contact your local service partner.

Error # 462141 ERR_DRIVE#_SLIP (*)

Condition: The setpoint position and current position of the truck differ too much; drive 1 actuator slip error

Cause: The truck is pushing against an obstacle

Resolution:
Remove the obstacle or switch to manual mode and drive the truck to a startup position
Restart the truck in automatic mode

Cause: The castor wheels are blocked

Resolution:
Check the castor wheels for debris or blockage
Remove any obstructions

If this error continues, contact your local service partner.

Error # 463146 ERR_LIFT#_POS (*)

Condition: The lift cannot reach its destination on time; lift 1 timeout error

Cause: The lift is pushing against an obstacle during upward movement

Resolution:
Remove the obstacle or switch to manual mode and drive the truck to a startup position
Restart the truck in automatic mode

Cause: The load is too heavy

Resolution:
Check the load weight is within the specified weight range for the truck

If this error continues, contact your local service partner.

Error # 463147 ERR_LIFT#_POS_FAIL (*)

Condition: Lift 1 positioning fail

Cause: The lift is pushing against an obstacle

Resolution:
Remove the obstacle or switch to manual mode and drive the truck to a startup position
Restart the truck in automatic mode

Cause: The load is too heavy

Resolution:
Check the load weight is within the specified weight range for the truck

If this error continues, contact your local service partner.

Error # 463148 ERR_LIFT#_PRESS_LOW (*)

Condition: Lift pressure too low; lift 1 pressure too low

Cause: A minimal lift pressure is necessary to allow actuator movement

Resolution:
Switch to manual mode, using the tiller adjust the lift position
Move the truck to a startup location
Switch back to automatic mode

Cause: An obstacle is blocking the lift from going down

Resolution:
Switch to manual mode, using the tiller move the lift upward and remove the obstacle
Move the truck to a startup location and restart in automatic mode

If this error continues, contact your local service partner.

Error # 463149 ERR_LIFT#_SLIP (*)

Condition: The setpoint velocity and actual velocity of the lift differ too much; lift 1 slip error

Cause: The lift is pushing against an obstacle during upward movement

Resolution:
Remove the obstacle

Cause: The load is too heavy

Resolution:
Check the load weight is within the specified weight range for the truck

If this error continues, contact your local service partner.

Error # 464531 ERR_LS#_NOT_UNLOADED (*) **Condition:** Unexpected load; Load Flap Sensor unexpected load **Cause:** The load sensor is detecting a load that should not be there **Resolution:** Check if the truck is loaded, if so, switch to manual mode and unload the truck Move to a startup location and restart the truck in automatic mode If this error continues, contact your local service partner.
Error # 464532 ERR_LS#_NOT_LOADED (*) **Condition:** Lost load; Load Flap Sensor lost load **Cause:** The load has fallen off or moved out of the load flap range **Resolution:** Check the position of the load Switch to manual mode Manually reposition the load or reload the truck if necessary Move the truck to a startup position and restart in automatic mode If this error continues, contact your local service partner.
Error # 464533 ERR_LS#_NOT_UNLOADED (*) **Condition:** Unexpected load; Load Sensor 2 unexpected load **Cause:** The load sensor is detecting a load that should not be there **Resolution:** Check if the truck is loaded. If necessary, switch to manual mode and unload Move to a startup position and restart the truck in automatic mode **Cause:** The load sensor is dirty **Resolution:** Clean the sensor If this error continues, contact your local service partner.

Error # 464534 ERR_LS#_NOT_LOADED (*) **Condition:** Lost load; Load Sensor 2 lost load **Cause:** The load has fallen off or moved out of the sensor's field **Resolution:** Check the position of the load. If necessary, switch to manual mode and manually reposition the load or reload the truck Move to a startup position and restart in automatic mode If this error continues, contact your local service partner.
Error # 464535 ERR_LS#_NOT_UNLOADED (*) **Condition:** Unexpected load; Forks Free Sensor, unexpected load **Cause**: The fork free sensor is detecting a load that should not be there **Resolution:** Check if the truck is loaded. If necessary, switch to manual mode and manually remove the load Move to a startup position and restart in automatic mode **Cause:** The fork free sensor is dirty **Resolution:** Clean the screen of the sensor If this error continues, contact your local service partner.
Error # 464536 ERR_LS#_NOT_LOADED (*) **Condition:** Lost load Forks; Free Sensor, lost load **Cause:** The load has fallen off or moved out of the sensor's field **Resolution:** Check the position of the load. If necessary, switch to manual mode and manually reposition the load Move to a startup position and restart in automatic mode If this error continues, contact your local service partner.

Error # 710409 ERR_ACE_CNCL_DUMP (*) **Condition:** Fleet manager communication conflict after fleet manager was restarted E'tricc Cancel FIFO not possible **Cause:** The fleet manager has restarted while the truck is driving **Resolution:** Switch to manual mode to clear the error Move the truck to a startup location Restart in automatic mode If this error continues, contact your local service partner.
Error # 710451 ERR_STARTUP_VALID (*) **Condition:** No valid startup point found **Cause:** The truck is not located on a valid startup point **Resolutions:** Move the truck to a valid startup point and restart it If this error continues, contact your local service partner.
Error # 710603 ERR_METHMNGR_ISUID (*) **Condition:** Invalid startup ID; Invalid startup identification code **Cause:** The entered startup ID is unknown **Resolution:** Enter an existing startup ID If this error continues, contact your local service partner.

Error # 710604 ERR_METHMNGR_ISUPOS (*) **Condition:** Invalid startup position **Cause:** The truck is not on a startup location **Resolution**: Move the truck to a startup location **Cause:** The truck is not accurately positioned on a startup location **Resolution:** Position the truck more accurately on a startup location **Cause:** The direction of the truck is incorrect **Resolution:** Position the truck on a startup location Use the ONYX screen to ensure the truck is facing the correct direction If this error continues, contact your local service partner.
Error # 710605 ERR_METHMNGR_USUPOS (*) **Condition:** Unknown truck position on startup **Cause:** The truck does not know its position **Resolution:** Switch to manual mode Move the truck to a startup location and restart in automatic mode If this error continues, contact your local service partner.
Error # 710653 ERR_PICK_NO_LOAD (*) **Condition:** No load found on location **Cause:** There is no load present in the pick location **Resolution:** Evaluate the situation. If necessary, correct the fleet manager data If this error continues, contact your local service partner.

Error # 710655 ERR_NO_STACK (*)

Condition: No stack detected

Cause: There is no pallet stack in the pick location

Resolution:
Evaluate the situation. If necessary, correct the fleet manager data

If this error continues, contact your local service partner.

Error # 710656 ERR_DROP_LOC_FULL_AR (*)

Condition: Load detected in drop location; Drop location full

Cause: The truck is detecting a load in the drop location

Resolution:
Check the drop position. If necessary, remove the obstructing load
Verify the position in the fleet manager. If necessary, correct the settings

Cause: The sensor is dirty

Resolution:
Check the sensor. If necessary, clean the sensor

If this error continues, contact your local service partner.

Error # 710657 ERR_UNLOADED_INVALID (*)

Condition: Unexpected load detected by the distance sensor; Inconsistent load detection

Cause: The distance sensor detects a load, but the load sensor does not detect a load

Resolution:
Check the position of the load. If necessary, switch to manual mode and manually reposition the load or reload the truck
Move to a startup location and switch to automatic mode

If this error continues, contact your local service partner.

Error # 710658 ERR_PICK_NO_LOAD_AR (*)

Condition: No load found on location

Cause: There is no load in the pick location

Resolution:
Evaluate the situation. If necessary, correct the fleet manager data

If this error continues, contact your local service partner.

Error # 710659 ERR_DROP_LOC_FULL (*)

Condition: Drop location full

Cause: The truck is detecting a load in the drop location

Resolution:
Check the drop position. If necessary, remove the obstructing load
Verify the position in the fleet manager. If necessary, correct the settings

Cause: The sensor is dirty

Resolution:
Check the sensor and clean if necessary

If this error continues, contact your local service partner.

Error # 710663 ERR_DS_LOAD_MOV_PD (*)

Condition: Load is moving during pick/drop; Load moved in pick/drop

Cause: The truck is pushing or dragging the load

Resolution:
Evaluate the situation and reposition the load if necessary

Cause: The load sensor is malfunctioning

Resolution:
Contact your service partner to have the sensor tested

Cause: The sensor’s signal is corrupted during transmission to the onboard software

Resolution:
Contact your service partner to have the sensor tested

If this error continues, contact your local service partner.

Error # 710664 ERR_DS_LOAD_MOV_FORK (*)

Condition: Load is moving on forks; Load moved on forks

Cause: The distance sensor has detected movement of the load

Resolution:
Check the position of the load
Switch to manual mode
Manually reposition the load or reload the truck if necessary
Drive to a startup position and restart in automatic mode

If this error continues, contact your local service partner.

Error # 710669 ERR_PICK_NOT_EMPTY (*)

Condition: The truck is starting a pick action while loaded; Pick while truck is not empty

Cause: The truck is trying to perform a pick while carrying a load

Resolution:
Check if there is a load on the truck
Restart the truck to do a drop

If this error continues, contact your local service partner.

Error # 710672 ERR_LIFT_END_POS (*)

Condition: The lift is stalling during the downward movement, or the lift is commanded to go above the maximum allowed height; Lift move end position error; The Lift did not stop on its commanded destination

Cause: The lift is stopped because the forks are meeting an obstacle

Resolution:
Check the forks pathway for obstacles
If necessary, move the obstacle
If it is not possible to move the obstacle, switch to manual mode and move the truck to a startup location
Restart the truck in automatic mode

If this error continues, contact your local service partner.

Error # 710674 ERR_DROP_LOC_FULL_HR (*)

Condition: Drop location full

Cause: The truck is detecting a load in the drop location

Resolution:
Check the drop position. If necessary, remove the obstructing load
Verify the settings of the position in the fleet manager and correct if necessary

Cause: The sensor is dirty

Resolution:
Check the sensor
If necessary, clean the sensor

If this error continues, contact your local service partner.

Error # 710675 ERR_NAVP_WDW (*)

Condition: The truck is not on track to execute Pick/Drop operations; Truck off track in pick/drop

Cause: The layout on the truck does not match the layout in the fleet manager

Resolution:
Switch the truck to manual mode and drive to a startup location
Restart the truck in automatic mode
The truck will automatically retry the pick/drop job

If this error continues, contact your local service partner.

Error # 710676 ERR_METH_OPT_TIMEOUT (*)

Condition: Method options not received in time

Cause: There is a Wi-Fi communication failure

Resolution:
Check the Wi-Fi network for connectivity
Resolve if there are issues

Cause: The fleet manager is in error

Resolution:
Check the fleet manager for issues

If this error continues, contact your local service partner.

Error # 710677 ERR_FORKS_NOT_FREE (*)

Condition: Forks not free after drop; Forks not free

Cause: The forks free sensor is detecting something between the forks and the pallet

Resolution:
Check to see if the sensor is blocked
Remove any obstructions

Cause: The pallet is still on the forks after executing a drop

Resolution:
Check the forks are free and clear of obstructions
If necessary, switch to manual mode and remove obstacles or manually remove the pallet from the forks
Move the truck to a startup position and restart in automatic mode

If this error continues, contact your local service partner.

Error # 715031 ERR_PATHP_SP (*)

Condition: The truck has deviated too much from its actual path; Setpoint lost

Cause: The rear of the truck is not on the expected path after driving along a curve

Resolution:
Switch the truck to manual mode
Move the truck to a startup position and restart in automatic mode

If this error continues, contact your local service partner.

Error # 715040 ERR_POSFUS_DRDIST (*)

Condition: The truck has driven too far by using the encoder values without a position update of a navigation beacon; The truck did not detect any installed beacons during a specific distance

Cause: The laser scanner is dirty

Resolution:
Inspect the scanner
If necessary, clean the navigation scanner

Cause: The truck is not sensing the presence of reflector beacons

Resolution:
On the truck screen, check the location status
Check if the truck laser sensor can see at least 3 laser beacons

If this error continues, contact your local service partner.

Error # 715204 ERR_LADARPOS_ACAL (*)

Condition: Navigation scanner automatic calibration failed; Laser auto calibration rejected

Cause: The navigation scanner optics cover is covered in dust or dirt

Resolution:
Check the scanner optics cover
If necessary, clean the scanner optics cover

If this error continues, contact your local service partner.

Error # 715205 ERR_LADARPOS_BDIST (*)

Condition: The distance between the truck and the laser-beacons is too large; Laser position big distance

Cause: The truck is not in the right location

Resolution:
Switch to manual mode
Drive the truck to a startup point and restart in automatic mode

If this error continues, contact your local service partner.

Error # 715209 ERR_LADARPOS_LBCNS (*)

Condition: The truck detects insufficient reflectors to be able to position itself correctly; Laser positioning low number of reflectors

Cause: One of the reflectors is dirty

Resolution:
Investigate the reflector
If necessary, clean the reflector
Switch the truck to manual mode and drive to a startup position
Restart the truck in automatic mode

Cause: There is an obstacle between the truck and one of the reflectors

Resolution:
Switch the truck to manual mode
If necessary, remove the obstacle
Move to a startup position and restart the truck in automatic mode

If this error continues, contact your local service partner.

Error # 715210 ERR_LADARPOS_LQUAL (*)

Condition: The quality of the reflector data is too low to position; Laser positioning low quality

Cause: One of the reflectors is dirty

Resolution:
Investigate the reflector
If necessary, clean the reflector
Switch the truck to manual mode and drive to a startup position
Restart the truck in automatic mode

Cause: There is an obstacle between the truck and one of the reflectors

Resolution:
Switch the truck to manual mode
If necessary, remove the obstacle
Move to a startup position and restart the truck in automatic mode

If this error continues, contact your local service partner.

Error # 715213 ERR_LADARPOS_UPDATE (*)

Condition: No laser position update; No laser update

Cause: The truck has deviated too far from its path

Resolution:
Switch the truck to manual mode
Drive the truck to a startup position and restart the truck in automatic mode

Cause: The truck is not sensing the presence of reflectors

Resolution:
On the truck screen, check the location status
Check if the truck laser sensor can see at least 3 reflectors

Cause: The truck sees less than 3 reflectors

Resolution:
Investigate the reflectors
If necessary, clean the reflectors
Switch the truck to manual mode and drive to a startup position
Restart the truck in automatic mode

If this error continues, contact your local service partner.

Error # 716002 ERR_FAILSAFE_AMWAIT (*) **Condition:** Wait automation control ready **Resolution:** This is an information message; no action needed.
Error # 716003 ERR_FAILSAFE_AUTO (*) **Condition:** Switched from manual to auto mode **Cause:** The truck was switched to automatic mode by the operator **Resolution:** Press the blue reset button, then the green start button If this error continues, contact your local service partner.
Error # 186 ERR_FAILSAFE_AUTORBI (*) **Condition:** Auto Reboot initialization **Cause:** Auto reboot initialization request **Resolution:** This is an information message; no action needed
Error # 716006 ERR_FAILSAFE_AUTOREB (*) **Condition:** Pilot automatically rebooted **Cause:** A layout update has caused the truck to restart automatically **Resolution:** This is an information message; no action needed.
Error # 716007 ERR_FAILSAFE_CHARG (*) **Condition:** The truck detects a problem during the charging of the battery (battery voltage does not rise, or is not high enough); Battery charging fail **Cause:** The truck is not charging while in a charging station **Resolution:** Manually drive the truck to another charger location If the truck charges at a new location the original charger may need servicing.

Error # 716009 ERR_FAILSAFE_EXIT (*) **Condition:** Exit program **Cause:** Program exit requested **Resolution:** This is an information message; no action needed.
Error # 716010 ERR_FAILSAFE_INIT (*) **Condition:** Failsafe initialized **Cause:** The truck has just restarted **Resolution:** This is an information message; no action needed If the message does not disappear, press the blue reset button.
Error # 716012 ERR_FAILSAFE_OSTOP (*) **Condition:** Stopped by operator **Cause:** The truck has been stopped by an operator **Resolution:** Press the blue reset button to continue If this error continues, contact your local service partner.
Error # 83 ERR_FAILSAFE_OSWAIT (*) **Condition:** Wait on operator start **Cause:** The truck is waiting for the operator to press the start button **Resolution:** Press the green start button If this error continues, contact your local service partner.
Error # 716014 ERR_FAILSAFE_POWOFF (*) **Condition:** The truck will automatically switch off within 30 minutes; Truck Auto power Off **Cause:** The battery voltage is too low **Resolution:** Send the truck to a charging location If this error continues, contact your local service partner.

Error # 716015 ERR_FAILSAFE_REBOOT (*) **Condition:** The KAB-PC must be restarted to activate a software or layout change; KAB-PC Reboot requested **Cause:** The KAB PC has rebooted **Resolution:** This is an information message; no action needed.
Error # 716018 ERR_FAILSAFE_SENS (*) **Condition:** One of the sensors does not respond; Sensors not ready **Cause:** The truck has not finished its startup procedure **Resolution:** Wait a few seconds until the truck has finished its startup procedure **Cause:** One of the sensors did not start correctly **Resolution:** Power off the truck Power on the truck and switch to manual mode Drive the truck to a startup location and restart the truck in automatic mode If this error continues, contact your local service partner.
Error # 716019 ERR_FAILSAFE_TBSTOP (*) **Condition:** Bumper test mode is active; Bumper stop test is busy **Cause:** The truck is currently busy performing a bumper stop test **Resolution:** Wait until the truck is done with automatic testing If this error continues, contact your local service partner.

Error # 720016 ERR_FLEX_PLS_1 (*)

Condition: Emergency stop by safety scanner; Front PLS left stop

Cause: One of the safety scanner sensors has detected an object in its safety zone

Resolution:
Evaluate the situation. If necessary, remove the object

Cause: The optics cover of the safety scanner is dirty

Resolution:
Clean the screen of the scanner
Thoroughly clean the entire surface of the glass pane (360°) and dust the scanner housing
To clean the glass pane of the safety laser scanner:
Use oil-free compressed air to remove dust from the optical window
Dampen a cleaning cloth with an anti-static cleaning agent for plastic
Using a horizontal motion, wipe the optical window
Do not wipe vertically

If this error continues, contact your local service partner.

Error # 720017 ERR_FLEX_PLS_2 (*)

Condition: Emergency stop by safety laser scanner; Rear PLS stop

Cause: One of the safety laser scanner sensors has detected an object in its safety zone

Resolution:
Evaluate the situation. If necessary, remove the object

Cause: The optics cover of the safety laser scanner is dirty

Resolution:
Clean the optics cover of the safety laser scanner.
Thoroughly clean the entire surface of the glass pane (360°) and dust the scanner housing
To clean the glass pane of the safety laser scanner:
Use oil-free compressed air to remove dust from the optical window
Dampen a cleaning cloth with an anti-static cleaning agent for plastic
Using a horizontal motion, wipe the optical window
Do not wipe vertically

If this error continues, contact your local service partner.

Error # 720018 ERR_FLEX_PLS_3 (*)

Condition: Emergency stop by safety scanner; Front PLS right stop

Cause: One of the safety laser scanners has detected an object in the safety zone

Resolution:
Evaluate the situation. If an object is present, remove it

Cause: The optics cover of the safety laser scanner is dirty

Resolution:
Clean the optics cover of the safety laser scanner
Thoroughly clean the entire surface of the glass pane (360°) and dust the scanner housing
To clean the glass pane of the safety laser scanner:
Use oil-free compressed air to remove dust from the optical window
Dampen a cleaning cloth with an anti-static cleaning agent for plastic
Using a horizontal motion, wipe the optical window
Do not wipe vertically

If this error continues, contact your local service partner.

Error # 720021 ERR_FLEX_SAF_STOP_F (*)

Condition: During a controlled safety stop an error occurred; Controlled safety stop has failed

Cause: The safety module detected the truck did not slow down enough, causing an intervention in the brake sequence

Resolution:
This is a warning message; no action is needed.

Error # 720023 ERR_FLEX_STOP_CTRL (*)

Condition: Safety module has initiated a controlled stop (brake on drive); Safety-module controlled stop

Cause: An unsafe situation has caused an emergency stop

Resolution:
Check what has caused the truck to execute a controlled stop
Restart the truck once the situation is safe again

If this error continues, contact your local service partner.

Error # 720024 ERR_FLEX_STOP_HARD (*)

Condition: Hardware stop initiated by the safety module; Safety module hardware stop

Cause: The truck has performed an emergency stop using a mechanical brake instead of a controlled stop

Resolution:
Check what has caused the truck to execute an emergency stop
Restart the truck once the situation is safe again

If this error continues, contact your local service partner.

Error # 724001 ERR_LDSCAN#_CONTAM (*)

Condition: Optics of the navigation scanner are contaminated; Navigation Laser cover contaminated

Cause: The optics of the navigation scanner are covered in dust or dirt

Resolution:
Investigate the navigation scanner. If necessary, clean the navigation sensor

If this error continues, contact your local service partner.

Error # 731001 ERR_MANUAL_PREPAR (*)

Condition: Preparing manual mode

Cause: The truck is preparing to switch into manual mode

Resolution:
Wait until the preparation phase is completed

Cause: During the preparation phase the MCU is shortly deactivated

Resolution:
Wait until the preparation phase is completed

If this error continues, contact your local service partner.

Error # 731040 ERR_SAFE_AUTO_PAUSE (*)

Condition: Truck is in automatic mode and MCU enable button has been pressed; Safe auto mode pause

Cause: The enable button of the manual control unit is pressed during automatic mode. The truck entered safe-auto mode

Resolution:
Press the green start button, the truck will continue in automatic mode

If this error continues, contact your local service partner.

Error # 733002 ERR_VEH_ALIGNMENT (*)

Condition: Truck improperly aligned for opportunity charging; Truck incorrectly aligned for charging

Cause: The truck is not aligned with the charger

Resolution:
Check the charger position. Switch to manual mode and drive the truck to a startup position
Restart the truck in automatic mode
The truck will drive back to the charger

If this error continues, contact your local service partner.

Error # 733003 ERR_CHARGE_START (*)

Condition: Charger status indicating failure; Unable to start charge process

Cause: Battery charger issue

Resolution:
Verify the battery charger is plugged in

If this error continues, contact your local service partner.

Error # 733004 ERR_CHARGE_PROCESS (*)

Condition: Charger status indicating failure; Error in charge process

Cause: The battery charger is not charging the truck

Resolution:
Verify the battery charger is plugged in

If this error continues, contact your local service partner.

Error # 733005 ERR_BATT_LOADED (*)

Condition: Loaded before battery exchange

Cause: The truck is carrying a load while going to the battery exchange station

Resolution:
Check if the truck is carrying a load
If the truck is carrying a load, check the conditions in the fleet manager and have them corrected if necessary

If this error continues, contact your local service partner.

Error # 745005 ERR_X90_IO_VIN (*)

Condition: KAB-SAFE – I/O mismatch with VIN (Vehicle Identification Number); KAB-Safe I/O mismatch with VIN file

Cause: The truck serial number was not read correctly

Resolution:
Restart the truck

Cause: The KAB-SAFE has experienced a failure

Resolution:
Restart the truck

Cause: The KOB has experienced a failure

Resolution:
Restart the truck

If this error continues, contact your local service partner.

Error # 746005 ERR_SAFE_ESTOP (*)

Condition: E-stop is pressed; E-Stop circuit stop

Cause: An emergency stop button has been pressed

Resolution:
Verify the situation is safe and release the engaged emergency stop button

If this error continues, contact your local service partner.

Error # 746009 ERR_SAFE_PLS_NOK (*)

Condition: Safety fields are not free; SafetyStatus PLS Bumper Stop

Cause: An object is detected in a safety field

Resolution:
Verify the safety fields are free of obstructions and the scanners are not in error

If this error continues, contact your local service partner.

Error # 746012 ERR_SAFE_RESET_REQ (*)

Condition: KAB-SAFE – request to push blue reset button; SafetyStatus Reset request

Cause: There is a pending request to reset the truck

Resolution:
Press the blue reset button

If this error continues, contact your local service partner.

Error # 746016 ERR_SAFE_REL_BRD_NOK (*)

Condition: KAB-SAFE relay option board is not functioning; SafetyStatus RelayBrdOK is not set

Cause: The KAB-SAFE has experienced a failure

Resolution:
Switch to manual mode and drive to a startup position
Restart the truck in automatic mode

Cause: The KAB-SAFE has experienced a hardware problem

Resolution:
Switch to manual mode and drive to a startup position
Restart the truck in automatic mode

If this error continues, contact your local service partner.

Error # 746021 ERR_SAFE_TILLER_NOK (*)

Condition: Tiller signal in ‘driver present’ state not valid for KAB-SAFE; SafetyStatus TillerActivated(DriverPres)

Cause: The tiller is pulled while the truck is driving in automatic mode

Resolution:
Press the green start button to resume automatic operation

If this error continues, contact your local service partner.

Error # 746023 ERR_SAFE_STOP_ERROR (*) **Condition:** Overspeed during safe stop in KAB-SAFE; SafetyStatus SafeStopError **Cause:** The truck did not slow down fast enough during a safe stop **Resolution:** Check if the load weight is too heavy. If necessary, adjust the load Check the floor condition. If necessary, clean the floor If this error continues, contact your local service partner.
Error # 746024 ERR_SAFE_RESET_ERROR (*) **Condition:** Invalid reset pulse was received in KAB-SAFE SafetyStatus ResetError **Cause:** The blue reset button was not pressed for the correct interval **Resolution:** Press the blue reset button for between 100ms and 3s If this error continues, contact your local service partner.
Error # 746046 ERR_SAFE_RED_BUTTON (*) **Condition:** KAB-SAFE has detected that the base truck red stop button is pressed; SafetyStatus Red Stop Button pressed **Cause:** The red stop button is pressed in **Resolution:** Pull the red stop button up Reset the errors by pressing the blue reset button If this error continues, contact your local service partner.

Error # 950001 ERR_FORKTIP_L1 (*) **Condition:** Forktip stop; Forktip stop left Fork 1 **Cause:** The forktip sensor has detected an obstacle **Resolution:** Check for obstacles. If necessary, remove the obstacle Switch to manual mode and drive the truck to a startup position and restart in automatic mode If this error continues, contact your local service partner.
Error # 950002 ERR_FORKTIP_R1 (*) **Condition:** Forktip stop; Forktip stop right Fork 1 **Cause:** The forktip sensor has detected an obstacle **Resolution:** Check for obstacles. If necessary, remove the obstacle Switch to manual mode and drive the truck to a startup position and restart in automatic mode If this error continues, contact your local service partner.

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