

# The GoPal® E22 & Pallet Station (E) Operators Manual



## Robotize

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# 1 General Information

This manual provides a detailed overview of the GoPal Solution, which includes a GoPal® E22 Autonomous Mobile Robot and one or more Accessory Stations. The system is designed to simplify the movement of pallets within a facility where pallets are collected or delivered.

<b>GoPal E22:</b>	<b>Type No. ATR3212</b>	A robot designed to transport EUR or ½ EUR pallets up to a maximum weight of 500 kg.
<b>Pallet Station (E):</b>	<b>Type No. PST013</b>	A rack engineered to accommodate EUR pallets at a suitable height for loading and unloading by GoPal robots.
<b>Pallet Station Expansion (E):</b>	<b>Type No. PST014</b>	An accessory module to extend the Pallet Station (E), enabling increased pallet capacity within a compact layout.

## 1.1 Purpose of the Manual

This manual, produced by Robotize, serves as a comprehensive guide for operators of the GoPal Solution. It offers necessary instructions for the efficient operation of the GoPal E22 and the Pallet Station throughout their lifespan. Personnel responsible for operating and maintaining the equipment must be familiar with these operating instructions. For future reference or for any new operators, keep this manual within reach. Please be aware that the actual product may slightly differ from the descriptions and illustrations in this manual. However, these variations will not impact the product's functionality.

## 1.2 Safety Notices

The following icons highlight safety instructions and crucial information:

### **DANGER!**

This signifies a highly dangerous situation. Failure to comply may result in serious, potentially fatal injuries.

### **WARNING!**

This underlines a potential risk. Ignoring these instructions could result in significant, possibly irreversible injuries.

### **CAUTION!**

This symbolizes a potentially hazardous situation. Neglecting these instructions could lead to minor or moderate injuries.

### **NOTICE**

This indicates potential property damage. Not adhering to these instructions may result in material damage.

## 1.3 Technical Assistance

For any issues not addressed by this manual, please seek technical assistance exclusively from your Robotize partner.

## 1.4 Important Safety Instructions

To ensure the safety of all personnel operating the GoPal robot and Pallet Station, adhere to the following additional safety instructions:

### **DANGER!**

**Serious injury or property damage can result from:**

- Misuse or incorrect operation,
- Unauthorized access or tampering with the devices,
- Inadequate installation, maintenance, or repair.

### **DANGER!**

All instructions concerning the correct usage, potential risks, installation, operation, and maintenance detailed in this manual must be understood and adhered to.

### **DANGER!**

It is not permitted to ride on the robot.

The robot is designed exclusively for moving pallets and not for transporting people. Any such misuse poses a high risk of serious or fatal injury.

### **WARNING!**

**Electrical hazard!**

The robot's battery can generate dangerous currents and voltages. To minimize risk, only individuals with specific training should handle the robot, adhering to these guidelines:

- Always deactivate the robot before performing any maintenance or work on it.
- Repairs should only be carried out by Robotize partners, who are authorized for such tasks.
- Under no circumstances should the robot be modified.

### **WARNING!**

**Damage or defects can cause accidents.**

Upon discovery of any safety-related modifications, damage, or operational defects in the GoPal robot or Pallet Station device:

- Label the faulty device and remove it from operation.
- Report defects to your Robotize partner immediately.
- Only return the device to operation after your Robotize partner has identified and corrected the fault.
- After repairing or servicing the robot's safety system, a safety function inspection is mandatory before returning the robot to operation. This inspection must be conducted by a certified Robotize safety inspector.

## 2 The GoPal Solution

### 2.1 General Description

The GoPal Solution is a fully automated system designed to transport various types of pallets using one or more Autonomous Mobile Robots.

These GoPal robots navigate using integrated sensors, which enable autonomous movement within different environments, such as factory buildings or warehouses.

The GoControl Fleet Management System, which can either be a virtual solution or a physical server installed on-site, centrally monitors, controls, and configures all aspects of the GoPal Solution, including the robots, stations, and potential accessories.

Key responsibilities of GoControl include:

- Assigning and prioritizing tasks for GoPal robots.
- Sending robots to the Charging Station for automatic charging when required.
- Collecting and displaying system data, including distances driven and number of pallets moved.
- Interfacing with your ERP/WMS system for seamless operations.

To pick up a pallet, a GoPal robot navigates to a Pallet Station where the pallet has been placed. These stations, which function as racks for pallets, come in various types, including basic stations, stations integrated with conveyor tracks, and stations equipped with a lifting function.

The GoPal Solution may also include one or more Buttons, which allow users to instruct the system to transport a pallet from one station to another. The system might feature an IO Box as well, which provides a generic interface for sensors or equipment such as automatic doors or fire alarm systems.

The GoPal robot communicates via Wi-Fi. To ensure successful operation of the GoPal Solution, it is crucial that the company's Wi-Fi network provides complete coverage of the operational area and maintains sufficient quality. Additional devices such as Buttons and IO Boxes can communicate through either wired Ethernet or Wi-Fi.

#### NOTICE

Designed for indoor use on level floors, the system can operate in temperatures ranging from -10 to +45 degrees Celsius in a non-condensing environment.

### 2.2 Compatibility

The GoPal Solution is designed to seamlessly integrate with a range of equipment, including Charging Stations, Lift Stations, Conveyor Stations, Buttons, and IO Boxes. Each component has been thoroughly tested and is approved for use with GoPal robots. For detailed operational guidelines, maintenance instructions, and safety information related to these components, please refer to their respective manuals.

### 2.3 Operating Environment

Each GoPal robot is equipped with two forward-facing 3D cameras: one camera detects objects on the path, and the other is used for detecting loads on Pallet Stations. Additionally, a single 3D camera is located at the rear of the GoPal robot, which detects objects when reversing.

#### NOTICE

The GoPal operator is responsible for ensuring that the entire operating floor surface meets the required coefficient of friction (see *Figure 15*). For instance, if oil or water is spilled in the transport area, it must be closed off to GoPal robots until the surface regains the necessary friction.

## NOTICE

Before installing the GoPal Solution, ensure that the transport area's floor has sufficient strength and is level, or nearly so (see *Figure 15*).

## ⚠ CAUTION!

Note that 3D detection is not 100% reliable. Therefore, the GoPal operator should perform a daily walkthrough of the GoPal operating area to check for potential obstructions. Any found objects should either be removed or safely indicated for GoPal by marking areas at LIDAR detection height (14 cm off the floor), for example, using warning cones. Ensure the distance between cones does not exceed 80 cm to guarantee that GoPal will not venture beyond the markings.

## 2.4 Pallet Transportation

The pallets to be transported by the GoPal robots should be loaded such that their centre of gravity is reasonably cantered and as low as possible. The permitted centre of gravity volume is detailed in Appendix A. Properly loading the pallets as per Appendix A ensures that:

1. The Pallet Stations can accommodate the load.
2. GoPal can lift the pallets.
3. GoPal can transport the load safely, regardless of whether the lifting mechanism is in the upper or lower position.
4. GoPal maintains enough load on the driving wheels for safe manoeuvring, also during emergency braking.

## ⚠ DANGER!

Please note that it's essential not to exceed the maximum load of the GoPal robot and any accessories.

Pallets used for transportation must be in good condition. Poor condition pallets could potentially collapse during use.

Always ensure that the pallet can withstand the load and usage conditions imposed by the GoPal Solution.

In addition to these load and pallet condition requirements, it's crucial that the load on the pallets does not extend beyond the GoPal bumper or the GoPal emergency stops. Any protrusions could compromise the GoPal safety functions.

## 2.5 GoPal Solution Installation

## ⚠ DANGER!

Installation of the GoPal Solution must only be conducted by a Robotize partner.

## 2.6 Servicing and Parts Replacement

## ⚠ DANGER!

All replacements of GoPal Solution parts must be carried out by an individual authorized by Robotize. This ensures the maintenance of the system's high safety level. In case of a breakdown, contact your Robotize partner.

After repairing or servicing the robot's safety system, a safety function inspection is mandatory before returning the robot to operation. This inspection must be conducted by a certified Robotize safety inspector.

## 3 Safety information

### 3.1 General Safety Directions

During the design and construction of the GoPal Solution, Robotize prioritized safety and health risks to those working with the system. In addition to complying with relevant legislation, Robotize adhered to all requirements of good construction techniques.

This manual aims to ensure that GoPal operators understand the need for caution in all operations to mitigate risks. Prior to initial use of the GoPal Solution, operators should read this entire manual and ensure they comprehend all the contents, particularly safety-related information.

#### **⚠ DANGER!**

The GoPal Solution and its accessories should only be used for purposes prescribed by Robotize. Using the system for unsuitable purposes could pose a health and safety risk to individuals and risk damaging the equipment. The intended and approved uses for the GoPal Solution are detailed in this manual.

Altering, removing, or bypassing the installed safety devices is strictly prohibited. Timely execution of the prescribed service inspections is also mandatory. Failure to comply with these requirements could result in serious health and safety risks as well as potential equipment damage.

#### **⚠ DANGER!**

All repairs to the GoPal Solution should generally be performed by an approved partner or individuals authorized by Robotize. Not adhering to this could result in personal health and safety risks.

A limited number of repairs may be performed by GoPal operators or other unauthorized individuals, but only if explicitly stated in this manual.

After repairing or servicing the robot's safety system, a safety function inspection is mandatory before returning the robot to operation. This inspection must be conducted by a certified Robotize safety inspector.

#### **⚠ DANGER!**

It is expressly forbidden to use any element of the GoPal Solution in areas with explosive or flammable atmospheres.

#### **NOTICE**

Maintaining the GoPal Solution and its accessories in good and functional condition is essential. Follow the maintenance instructions provided by Robotize to ensure operational reliability and extend the product's lifespan.

#### **NOTICE**

Take note of the symbols on all labels and understand their meanings. These symbols, their shapes, and colours, specifically relate to safety. Ensure that these labels remain legible and comply with the information they provide. If any labels become illegible, you can order new ones from your Robotize partner.

### 3.2 Warning Labels

The GoPal Solution features warning labels placed in high-risk areas for the safe operation of the system. These are explained as follows:



Figure 1: Risk of Trapping/Crushing

The safety label in *Figure 1* indicates areas where there's a risk of trapping or crushing fingers, hands, arms, or feet.



Figure 2 Do Not Step

The safety label in *Figure 2* marks areas where stepping or sitting on the equipment is strictly prohibited.



Figure 3 Do Not Enter

The safety label in *Figure 3* denotes areas where entry into the equipment is strictly prohibited.



Figure 4 Max Load 300 kg

The maximum load sticker (*Figure 4*) is located on various stations, showing the maximum permissible loads ranging between 300 and 1530 kg.

### 3.3 Safety System Overview

#### Robot LIDAR Safety

The primary safety system of GoPal robots is comprised of two safety-approved LIDAR laser scanners. These scanners emit laser beams encircling the robot at approximately 14 cm above the floor. This system actively monitors the robot's surroundings, assessing collision risk with objects or people. If a potential collision is detected, the robot's safety functions initiate a safety stop. The slower the robot's speed, the closer an object or person can approach without triggering a safety stop.

If the LIDAR protection is activated by an object or person, the robot initiates a safety stop. After verifying that the path is clear, the robot resumes operation automatically. At low speeds, the LIDAR safety function is disabled to facilitate tight manoeuvring, such as through doorways.

#### Robot Bumper Safety

In addition to the primary LIDAR safety system, GoPal robots possess a secondary safety mechanism—a mechanical bumper encircling the robot. This system remains active even when the LIDAR safety is disabled. If the bumper makes contact, the robot performs an emergency stop and must be manually restarted using the Safety Reset button located at the robot's rear.

#### Robot Bumper Safety Automatic Reset Function

GoPal E22 robots with serial number 2289 or higher is manufactured with PLC script version 013284 which include an automatic reset function for the bumper safety stop. If the bumper safety switches are not activated within 3 seconds, the automatic reset function allows the robot to resume movement automatically after a bumper stop. As a warning, the robot will flash its LEDs and beep 2 seconds before resuming movement.

Note: Manual intervention via the safety release button is not required during this automatic reset functionality.

### CAUTION!

The 3-second bumper safety automatic reset function will automatically allow the robot to move, so operators should exercise caution.

#### Robot Emergency Stops

Beyond these two safety systems, GoPal robots feature four mechanical emergency stop buttons. A firm push on any of these red buttons halts the robot. To resume movement, the emergency stop must be released by turning the knob back to its original position and pressing the Safety Reset button at the robot's rear.

In an emergency or safety stop situation, the robot employs aural alerts and visual signals, such as flashing front and rear lights, to warn its surroundings. These signals also serve to draw attention when the robot performs actions associated with potential safety risks.

Additionally, GoPal robots are equipped with a green warning light at the front, illuminating the path ahead to alert other traffic of the robot's approach—particularly useful around corners and doorways.

Through these integrated safety systems, Robotize aims to minimize the risk of accidents and personal injuries associated with system use.

### 3.4 Role and Safety Responsibilities: GoPal Operator

Every GoPal Solution must designate at least one qualified GoPal operator responsible for the system's operation and safety. The operator's duties include:

- Ensuring the physical safety of individuals interacting with the GoPal Solution.

- Maintaining the system's safety features in proper working conditions.
- Complying with the specified service intervals for the GoPal Solution.

The operator must be familiar with all safety guidelines outlined in this manual.

### 3.5 Safety Instructions: Transportation Area

#### **⚠ DANGER!**

##### **Breaking and Friction:**

GoPal's braking system depends on the friction between the robot's wheels and the floor. The surface's friction coefficient should meet or exceed the value specified in *Figure 15*. If the area becomes slippery due to spills or debris, the friction can decrease drastically, endangering safe GoPal operation. This can present health and safety risks to personnel and potential damage to the equipment. GoPal operators are obligated to keep the GoPal's driving area clear and maintain the required friction coefficient.

#### **⚠ DANGER!**

##### **Load-Bearing Capacity:**

The floor's load-bearing capacity must support the combined weight of the load and the GoPal robot comfortably. Therefore, floors should have a minimum compressive strength of 25 MPa.

#### **⚠ DANGER!**

##### **Stairs and Ramps:**

The operational boundaries for the GoPal robot must be configured to prevent it from approaching stairs, ramps, or inclines steeper than those specified in *Figure 15*. Additionally, it is crucial to physically close off areas like stairs and ramps to the robot, for instance, by using cones or similar barriers. This physical demarcation is necessary as a safety measure, even when such areas are marked in the robot's operational configuration. Failure to adequately secure these areas can lead to significant safety hazards and equipment damage.

#### **⚠ DANGER!**

##### **Operation on Inclines:**

GoPal robots are certified for operation on near-level floors (see *Figure 15* for more technical information). Using the robot on inclines steeper than recommended could destabilize the robot or its load, posing risks to people's health and safety and potential equipment damage.

You must verify the maximum floor inclination during the installation process.

#### **⚠ WARNING!**

##### **High and Low Obstacles:**

Objects that protrude into the GoPal robot's path but are above or below the LIDAR detection range (see *Figure 15* for more technical information) can be hit by the robot or its load. Such collisions can cause severe damage to the robot, the load, or the object.

The GoPal operator is responsible for keeping the robot's driving area free from both protruding and small objects.

### 3.6 Safety Instructions: Personnel and Vehicles

#### **⚠ DANGER!**

##### **Avoiding Contact:**

Do not place hands or feet under the GoPal robot or its load.

Doing so poses a health and safety risk and could cause equipment damage.

#### **⚠ DANGER!**

##### **Prohibited Use:**

GoPal robots must not be used to transport people, and the stations of the GoPal Solution should not be stepped or sat upon. These actions could result in personal injury.

#### **⚠ DANGER!**

##### **Interactions with Traffic:**

The GoPal robots are designed to avoid stationary objects and people. However, sudden movements from individuals on foot or vehicles, such as trucks, may trigger emergency braking. During this process, the robot continues its path, and a collision may not always be avoidable due to the required braking distance. The robot will emit aural and visual warnings during emergency braking. It's particularly sensitive to cross-traffic, so extra care is necessary when crossing the robot's path. This situation poses a health and safety risk and could additionally cause equipment damage.

Forks on forklift trucks may sometimes be undetectable by GoPal robots. Therefore, it's the responsibility of truck operators to maintain a safe distance from the robots.

### 3.7 Safety Instructions: Handling Loads

#### **⚠ DANGER!**

##### **Exceeding Maximum Load:**

Overloading a specific GoPal model or Pallet Station could cause the robot to become damaged or malfunction, and it could also compromise the robot's driving stability. Overloading may pose health and safety risks and risk equipment damage.

The GoPal operator must ensure that the weight of the pallets transported by the GoPal Solution does not exceed the maximum limit through appropriate staff training.

#### **⚠ DANGER!**

##### **Loads Protruding Beyond the Robot's Dimensions:**

As mentioned in section 3.3 *Safety System Overview*, the main safety components of GoPal robots are the LIDAR and bumper detectors, which detect nearby objects or individuals. Thus, it's crucial that the pallets (or their load) transported by GoPal robots do not extend beyond the robot's dimensions on any side. If a load is longer or wider than the GoPal robot, it won't be adequately protected by the robot's safety function and may collide with surrounding objects or individuals. This could pose serious health and safety risks and damage equipment.

The GoPal operator is responsible for ensuring, through appropriate staff training, that pallets and their loads do not extend beyond the GoPal bumper or cover the GoPal emergency stops.

#### **⚠ DANGER!**

##### **Load Stability:**

The GoPal robot's movements are designed based on guidelines for the load's centre of gravity and stability. Non-compliance with these guidelines may cause the load to fall off the robot during transportation and strike people or equipment. An incorrect centre of gravity can also significantly impact the robot's braking capacity. This could pose health and safety risks and risk equipment damage.

It is the GoPal operator's responsibility to comply with the GoPal robot's loading guidelines (refer to *Appendix A*).

#### **⚠ DANGER!**

##### **Robot Lifting Mechanism:**

When the GoPal robot's pallet lifting mechanism has been activated, there is a risk of people or goods becoming trapped and crushed between the pallet and GoPal. The robot will warn of the danger via both audible and light signals. Special care must be shown when the robot lowers the pallet onto the GoPal robot or Pallet Stations. Trapping and crushing risk areas are marked by a safety label (see *Section 3.2*).

If a situation with an acute danger of personal injury or equipment damage arises, the robot and its lifting mechanism can be brought to an immediate stop using one of the four emergency stops located on the robot or by activating the bumper at any location.

### 3.8 Safety Instructions: GoPal Accessories

#### **⚠ DANGER!**

##### **While Parked:**

When a GoPal robot is parked in one of the stations, its LIDAR safety function is deactivated to facilitate parking in the limited space available. The mechanical bumper remains active, but certain areas of the robot unprotected by automatic safety functions present a potential risk to personal health and safety, as well as equipment damage. The robot will emit continuous audio and light signals to alert personnel to potential dangers. In situations with a potential trapping risk, activate the robot's manual emergency stop to halt its operation. Risk areas for trapping are marked with a safety label (see *Section 3.2*).

#### **⚠ DANGER!**

##### **Pallet Placement:**

It is crucial that pallets are correctly positioned within the Pallet Stations (see *Figure 14*). An incorrectly positioned pallet can lead to improper loading onto the robot, risking load instability during transportation. This could pose a health and safety risk to personnel and cause equipment damage.

#### **⚠ WARNING!**

##### **Pallet Condition:**

Only use pallets in good condition with the Pallet Stations. Using damaged or worn pallets can risk a pallet collapsing under load in the station, posing a health and safety risk or causing equipment damage. The GoPal operator must ensure, through suitable staff training, that only pallets in satisfactory condition are used with the GoPal robots.

## 4 The GoPal E22

The GoPal E22 is an Autonomous Mobile Robot designed to transport pallets. Equipped with a lifting mechanism, the GoPal robot can raise and lower pallets for collection or deposit at a Pallet Station. The GoPal E22 is CE-approved and adheres to safety standards for operation among people as stipulated by the Machine Directive.

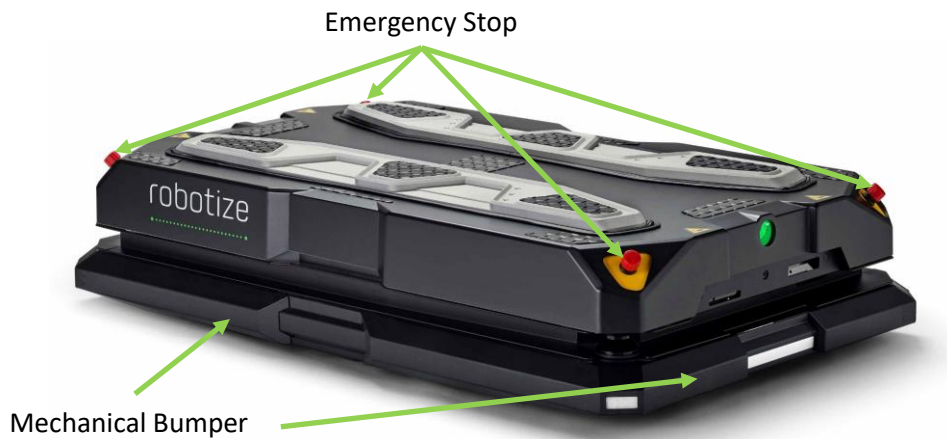


Figure 5 GoPal E22

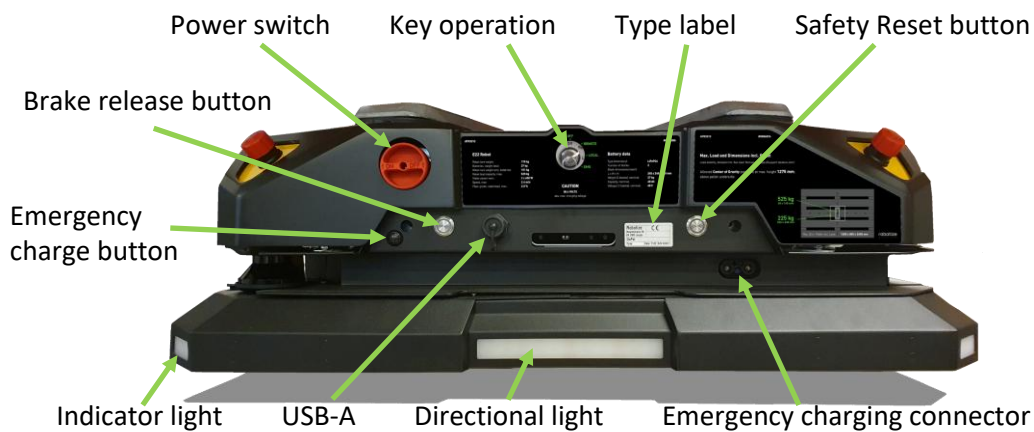


Figure 6 GoPal E22 rear view

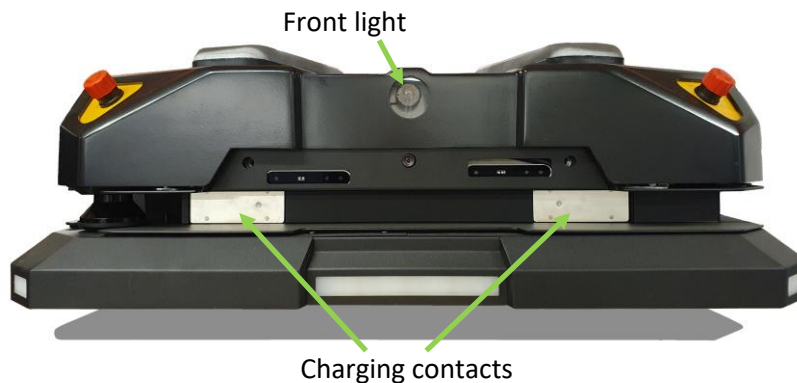


Figure 7 GoPal E22 front view

## 4.1 Type Label

The type label, located at the rear of the robot, displays information about the serial number, model, production date, and approval certification.



Figure 8 Type Label GoPal E22

## 4.2 Foil Label

The GoPal E22 has two foil stickers on its back, which provide information about, among other things, load capacity, weight, battery specifications, and speed. For a list of technical information, refer to *Figure 15*.

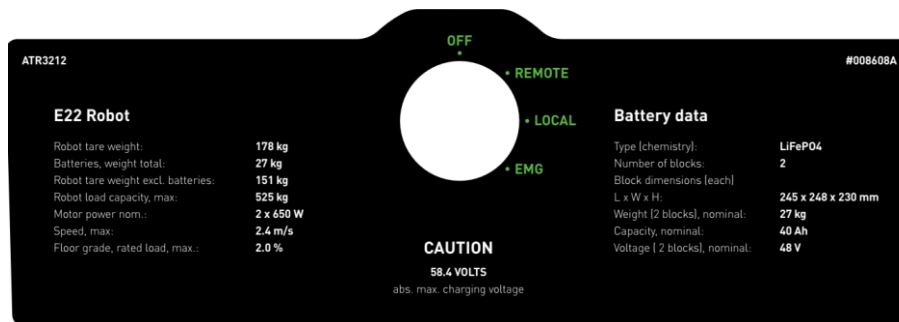


Figure 9 E22 centre foil label

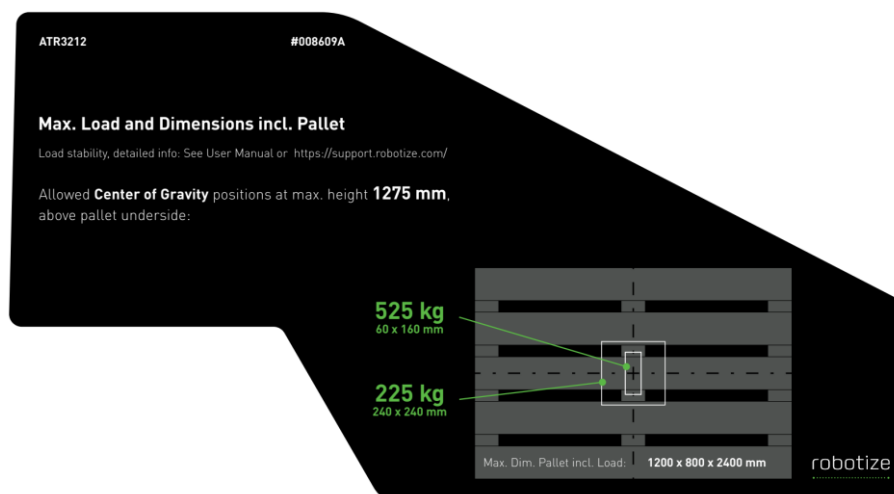


Figure 10 E22 right foil label

## 4.3 Function and Use

### NOTICE

Before using GoPal for the first time, it is required to read this entire manual and ensure its contents are fully understood, particularly the sections related to safety. GoPal should only be used for the purposes described in this manual. Any manipulation of the GoPal Solution to achieve performance deviating from the normal operating parameters may compromise safety.

#### 4.3.1 Stopping GoPal in Safety Mode

The GoPal robot can be safely brought to a halt by pressing one of the four red emergency stop buttons, each located at a corner of the robot. Activating an emergency stop will safely halt the robot, and it will remain non-operational until the emergency stop button is released by turning it. Following this, the Safety Reset button must be activated to resume operation.

#### 4.3.2 Emergency Stop

Each corner of the GoPal robot is equipped with an emergency stop button (see *Figure 5*). These buttons are activated by firmly pushing the top of the button. Once pressed, the button will stay in a depressed state until it is twisted slightly, which allows it to return to its normal position.

If an emergency stop button is pressed while GoPal is moving, the robot will perform a controlled braking manoeuvre to prevent loss of control and potential loss of load.

Following an emergency stop, the Safety Reset button must be pressed to reactivate the robot.

#### 4.3.3 Mechanical Bumper

The mechanical bumper (see *Figure 5*) spans all sides of the GoPal robot. Should GoPal touch an object via the bumper, it will execute a controlled braking manoeuvre. To reactivate the robot after the bumper has been triggered, the object and the robot must be separated. Then, the restart button must be activated for GoPal to resume operation.

#### 4.3.4 Safety Reset Button

The Safety Reset button (see *Figure 6*) is located at the rear of GoPal. If the mechanical bumper or any of the emergency stop buttons have been triggered, this button must be pressed to reset the safety system of the robot. After holding the Safety Reset button for a minimum of 1 second, GoPal will emit an audible warning signal and flash a light to indicate its active state.

#### 4.3.5 Brake Release Button

The Brake Release button (see *Figure 6*) is located at the rear of GoPal. To release the robot's brakes, press this button while the key switch is in the "Emg" position. The brakes will remain released if the button is pressed, allowing the robot to be moved away from an object if its bumper has been engaged.

### DANGER!

Exercise caution when activating the brake release system. If the robot is on an inclined surface, it may roll when the brakes are released.

#### 4.3.6 Key Switch for Operating GoPal

The key switch, located at the rear of the robot (see *Figure 6*) is used to control GoPal. The key switch has several positions:

- **“Off”**: Power to GoPal is turned off, and all lights are switched off. The robot stops and ceases movement. Although GoPal is turned off, the batteries will slowly drain and should be fully charged at least every other month. Note that it's typically not necessary to manually turn off the robot, except during prolonged periods of non-use, such as holidays.
- **“Remote”**: Powers on GoPal and sets it to a normal operating state.

#### NOTICE

After turning the key to “Remote”, the Safety Reset button must be pressed for GoPal to become operational and manageable by GoControl.

- **“Local”**: Powers on GoPal and sets it to a local manual control state. In this mode, GoPal can be controlled manually by logging into the robot's own Wi-Fi access point and accessing the GoPal user interface via a mobile device's browser. Through this interface, GoPal can be moved manually, and the lift can be moved up and down, independent of other tasks.

#### NOTICE

Even when controlled manually, GoPal's safety features remain active. Thus, the Safety Reset button must be pressed after the robot has been started in Local mode before GoPal can move.

- **“Emg” (Emergency)**: Partially powers on GoPal. While the key is in this position, the robot will not move, but the brakes can be released, allowing the robot to be moved manually. The robot's brakes can be released by pressing the brake release button.

#### 4.3.7 Main Power Switch

The Main Power Switch disconnects the batteries from the robot's electronics. The switch is set to OFF when the robot leaves the factory. Turn it to ON when you start using the robot.

#### ⚠ WARNING!

Do not use the Main Power Switch to turn OFF the robot during normal operation. Always use the key-switch to power the robot OFF and ON. This ensures that the robot is safely shut down and started up.

The Main Power Switch should only be in the OFF position when the robot is being shipped or when you are servicing the robot.

#### 4.3.8 USB-A Interface

The USB-A interface, located at the robot's rear (see *Figure 6*), is used for maintenance and service activities and configuration settings.

#### 4.3.9 Charging Connector

The automatic battery charging connector points are located at the front of GoPal (see *Figure 7*). These connectors are used when GoPal is docked at a Charging Station for charging. An emergency charge connector is located at the rear of GoPal (see *Figure 6*). This connector is typically not used but can be employed if an error prevents GoPal from driving into a Charging Station. The robot will not drive while emergency charging is in progress.

#### 4.3.10 Emergency Charge Button

The Emergency Charge Button is located at the rear of the robot (see *Figure 6*). Use this button for emergency charging when the robot's battery is critically low and it is unable to charge, even when connected to charging power.

##### Manual Charging:

- Connect the provided DC power cable to the robot's emergency charge connector. (see *Figure 6*)
- Press the Emergency Charge Button to initiate manual charging until the battery reaches a level that allows the robot to drive to the charging station.
- For additional details, consult Robotize Document No. 011040 GoPal Emergency Charging.

##### Voltage Measurement:

- Turn the key switch to the OFF position.
- Connect a voltmeter to the emergency charging connector.
- Press the Emergency Charge Button to display the battery's voltage level.

## 4.4 Deployment

To deploy your GoPal E22 and Pallet Station, you should follow these steps:

- Set up GoControl in coordination with your Robotize partner or directly with Robotize.
- Configure the settings in GoControl as per your specific needs.
- Charge the GoPal E22 for the first time using the Charging Station or the emergency charging connector (refer to *Section 4.3.9*).
- Install the Pallet Stations according to the installation instructions provided in Robotize Document No. 011383 Assembly Instructions – Pallet Station (E).  
No. 011384 Assembly Instructions – Pallet Station Expansion (E).
- Your Robotize partner or Robotize will use the GoPal E22 to map the desired operational area.
- Your Robotize partner or Robotize will provide training to GoPal Operators for the safe and effective operation of the GoPal Solution.

Always remember to follow each step closely to ensure a smooth and successful deployment process.

## 4.5 GoPal Light and Sound Indications

The GoPal robot is equipped with operating lights (see *Figure 6*) that function in the same way as those on a car. GoPal has white lights at the front, red braking lights at the rear, and orange corner lights that function as indicators when turning.

Additionally, GoPal has a powerful green light installed at the front (see *Figure 7*) illuminating the floor several meters in front of the robot. The purpose of this light is to alert other traffic to an approaching GoPal robot.

The GoPal is also equipped with a warning horn (buzzer) that is activated when the robot performs operations requiring extra caution for safety.

*Table 1* provides an overview of GoPal's light and sound indications. It is designed to assist users in understanding and responding to the robot's status and needs.

Colour/Sound	Indication
Green, pulsing light	The robot is idle and ready
Green, blinking light	The robot is charging and cannot take orders
Blue/yellow, blinking light	The robot is under user control in either local or emergency mode, the robot is in remote mode but not in service, the robot is configured not to take orders, or robot operation is suspended by GoControl
Blue, blinking light accompanied by a buzzer sound	The robot requires assistance due to: safety stop, task failure, alarm, robot blocked while docking, or while driving towards its goal
Red, blinking light accompanied by a buzzer sound	The robot is issuing a warning signal due to increased risk; laser safety zones may be inactive due to slow driving, there is a risk for pinch and crush hazards while docking, or the lift is moving.
Yellow, blinking light	Communication with GoControl has timed out

Table 1 GoPal Light and Sound Indications

## 4.6 Routine Maintenance

### **⚠ CAUTION!**

Before beginning any maintenance or service tasks, ensure that GoPal is in safety mode (refer to *Section 4.3.1*).

#### 4.6.1 Safety Inspections

The GoPal operator is responsible for ensuring the safety functions of the GoPal robot are always operating correctly:

- Ensure warning lights and buzzer function as expected. Test by observing the GoPal entering a Pallet Station or provoking an emergency stop situation.
- Confirm the forward green light is working correctly and emitting a clear, green light onto the floor.
- Check that warning labels are intact and easily readable.
- Each of the four manual emergency stops must be tested individually. Verify that activation causes the robot to enter safety mode.
- Test the bumper function by activating it sideways and longitudinally. Confirm that activation causes the robot to enter safety mode.
- Confirm automatic emergency stop functionality by suddenly introducing an object (e.g., a broom) in front of the moving robot. The robot should execute emergency braking, halt for a couple of seconds, then restart and attempt to navigate around the obstacle. Perform this test from both sides of the GoPal robot. If the GoPal robot does not respond by braking for the sudden obstacle, it must be immediately taken out of operation and your Robotize partner must be contacted.

#### 4.6.2 Battery Care and Management

During normal operation, the system automatically maintains the battery power at a healthy level.

##### **NOTICE**

If a system error prevents the robot from charging, it will automatically shut off when the remaining power reaches a lower limit. The robot will maintain vital functions, so it's important not to leave the robot in this condition for more than a few days. Longer periods without charging could damage the batteries, necessitating replacement.

##### **NOTICE**

If the robot will be powered off for an extended period, make sure the batteries are fully charged before turning off the power using the key switch (refer to *Section 4.3.6*). Even when the robot is turned off, the batteries will continue to drain some power. Therefore, every second month, turn the robot on and fully charge it again. Failure to do so could cause the batteries to reach a critical power level, damaging them and requiring replacement. This will not be covered by the warranty.

#### 4.6.3 Exterior Maintenance and Cleaning

Set GoPal to safety mode before cleaning. Clean all exterior surfaces with a cloth dampened (not wet) with lukewarm water or a mild, neutral soap.

##### **⚠ CAUTION!**

Avoid using solvents or similar substances as these could damage painted surfaces and plastic components. Never wash the internal parts of GoPal, and never use any type of running water, to avoid damaging electrical and electronic components. These components are not waterproof.

Regularly check the safety lasers for any dust or dirt. To clean them, use a soft, clean cloth and be careful not to leave fingerprints or scratch the surfaces. Since the lasers have a 270-degree field of view, make sure to clean all sides thoroughly. After cleaning, use a bright torch to double check that no dust or dirt remains on the lasers. See more details in Robotize Document No. 11582 GoPal Service Note – Laser Cleaning.

##### **⚠ CAUTION!**

Inspect the GoPal robot's underside (the area around the wheels) and remove any accumulated materials that could impair GoPal's efficient functioning.

Clean the charging contact surfaces and remove any foreign bodies. Wipe away any oxidation with a dry cloth.

## 4.7 Disposal

### NOTICE

Proper disposal of the GoPal E22 is essential. When the product reaches the end of its service life, responsible disposal is crucial to prevent environmental harm and to comply with local waste disposal laws.

Follow these steps for proper disposal:

**Disconnect the Equipment:** Ensure that the GoPal E22 is disconnected from all power sources, network connections, and any attached peripherals.

**Contact a Professional:** Consult your Robotize partner or local waste management authority for guidance on the proper disposal methods.

**Recycling:** This equipment contains electronic components that can often be recycled. Verify if local recycling facilities accept such materials.

**Follow Regulations:** Comply with all local, national, and international laws related to the disposal of electronic waste.

Under the WEEE Directive (Waste of Electric and Electronic Equipment), you are required to separate electrical and electronic components for disposal. Deliver them to an approved collection centre or your Robotize partner. Failure to comply can lead to penalties as outlined in the relevant legislation of your jurisdiction. Improper disposal can result in the release of harmful substances that pose a threat to both the environment and human health. Always dispose of electronic components responsibly.

## 5 Pallet Station (E)

The Pallet Station (E) is designed for EUR pallets and is compatible with the GoPal® E22 and GoPal® E24 robots.



Figure 11 Standalone Pallet Station

### 5.1 Pallet Station Expansion (E)

The Pallet Station Expansion (E) is an add-on module for the Pallet Station (E), designed to increase pallet capacity within the existing area. It allows for a more compact yet accessible arrangement of additional pallets, optimizing space efficiency.



Figure 12 Pallet Station Expansions Configuration Example

### 5.2 Type Label

The type label, located at the inside of the rear wall, shows information about the serial number, model, production date, and approval certification.

<b>Robotize</b> Maglebjergvej 5B DK 2800 Lyngby		<b>Robotize</b> Maglebjergvej 5B DK 2800 Lyngby	
GoPal Pallet Station Modular (E)		GoPal Pallet Station E Expan.	
Type PST013	Date 0124	Type PST014	Date 0124

Figure 13 Type Label Pallet Station (E) & Pallet Station Expansion (E)

## 5.3 Function and Use

The configuration of the Pallet Station allows GoPal robots to lift the pallet off the rack onto the robot, or vice versa. The design of the Pallet Station ensures consistent placement of the pallet, allowing GoPal robots to collect the pallet from the same location every time.

A Pallet Station can operate as a standalone station or in combination with others to form a group. Each station can be installed with or without a back piece. Typically, the back piece is omitted if a forklift is used to deliver or collect pallets from the backside of the station.

To ensure system safety, it is crucial that the pallet is correctly placed in the Pallet Station when positioned manually.

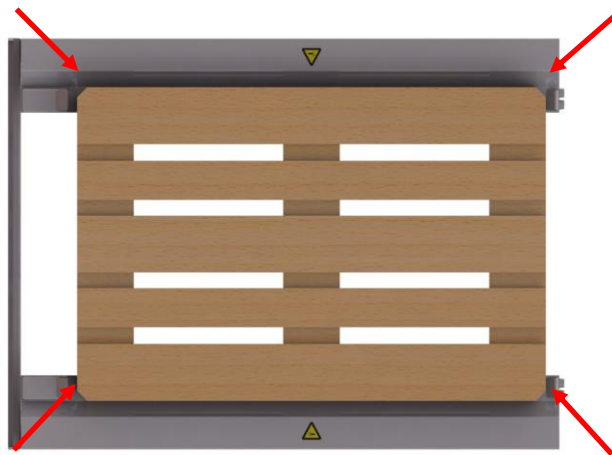


Figure 14 Placing of a pallet in the Pallet Station.

Be particularly aware of the pallet's location at the four corners where the pallet must be level in the recess (see Figure 14). The load limit of the Pallet Stations depends on them being correctly bolted to the floor and the pallet being able to support the weight.

## 5.4 Routine Maintenance

### 5.4.1 Safety Inspections

It is the responsibility of the GoPal operator to ensure that the warning labels on the Pallet Station are intact, legible, and that the Pallet Station is in good condition and always securely bolted to the floor.

### 5.4.2 Exterior Maintenance and Cleaning

Clean all exterior surfaces of the Pallet Station with a cloth moistened (not wet) with lukewarm water or a mild, neutral soap. Do not use solvents or similar materials to avoid damaging painted surfaces, the reflective tape at the entrance of the station and at the end stop marker. The schedule depends on the environment where the Pallet station is located.

## 5.5 Disposal

### NOTICE

Proper disposal of the Pallet Station is essential. When the product reaches the end of its service life, responsible disposal is crucial to prevent environmental harm and to comply with local waste disposal laws.

Follow these steps for proper disposal:

**Disconnect the Equipment:** Ensure that the Pallet Station is disconnected from any attached peripherals.

**Contact a Professional:** Consult your Robotize partner or local waste management authority for guidance on the proper disposal methods.

**Recycling:** This equipment can contain electronic components that can often be recycled. Verify if local recycling facilities accept such materials.

**Follow Regulations:** Comply with all local, national, and international laws related to the disposal of electronic waste.

Under the WEEE Directive (Waste of Electric and Electronic Equipment), you are required to separate electrical and electronic components for disposal. Deliver them to an approved collection centre or your Robotize partner. Failure to comply can lead to penalties as outlined in the relevant legislation of your jurisdiction. Improper disposal can result in the release of harmful substances that pose a threat to both the environment and human health. Always dispose of electronic components responsibly.

## 6 Pallet Sensor

The Pallet Sensor is an optical sensor that can be attached to a Pallet Station.

The optical sensor should be connected to an I/O port of an IO Box. Once connected, the sensor provides real-time status information about whether the Pallet Station is loaded or unloaded, which is then relayed to GoControl.

Depending on the system configuration, this information can either enable automated pallet pickup at the station or prevent a GoPal robot from wasting time investigating the current load status of a Pallet Station.

## 7 GoControl Fleet Management System

The GoControl Fleet Management System, referred to as GoControl, is the central control unit for the GoPal Solution. GoControl is a localized solution, meaning it operates autonomously within your facility's network environment. This design allows GoControl to independently manage the operation of the GoPal robots and other components within the GoPal Solution at your company, without relying on external networks.

GoControl is tasked with determining the activities of GoPal robots, including task prioritization and sequence. It manages the power needs of the GoPal robots, sending them to a Charging Station for recharging as necessary. In its role, GoControl also collects and displays comprehensive system data, such as the position of the robots on the map, distance driven, and the number of pallets moved.

Additionally, GoControl is designed to integrate with your existing ERP/WMS system, facilitating seamless operation and data flow within your logistics infrastructure. It can be configured either as a virtual solution or as a physical server installed on-site, providing operational adaptability to meet specific needs.

## 8 GoPal Solution Service Inspections

To maintain the high safety standards of the GoPal robot, Robotize mandates service inspections every six months. These services must be carried out by an authorized Robotize safety inspector. It is the responsibility of the GoPal operator to ensure ongoing system maintenance and adherence to inspection requirements.

### 8.1 Semi-annual GoPal Safety Inspection

The semi-annual safety inspection assesses the general condition of the GoPal robot and conducts an enhanced inspection of the components listed in *Table 2*.

Component	Service Inspection Type
LIDAR	Enhanced safety function inspection
Emergency brake	Inspection of function and brake lining
Warning labels	Legibility and presence
Lifting Mechanism	Function and safety system inspection
Rubber Areas	Examination for wear on rubber elements on the GoPal robot
Bumper	Bumper function test
Wheels	Examination for wear
Emergency Stop	Verification of functionality of the four emergency stops
Protecting Shield	Inspected for damage
Warning Lights	Functionality check for warning lights
Horn	Verification of horn functionality
Pallet Station(s)	Inspected for damage
Charging Station(s)	Inspected for damage

*Table 2 Semi-annual GoPal inspection*

## 9 Troubleshooting

This section provides guidance for identifying and resolving issues that might arise during the operation of the GoPal robot. While most errors can be addressed by the GoPal operator, some may require specialized technical skills or extensive experience. In such instances, contact your Robotize partner. Most error types will trigger a GoControl alert that clearly describes the error encountered by the system. GoControl will also provide instructions on how to rectify the error. *Table 3* lists some common errors, their causes, and potential solutions:

Error	Cause	Solutions
GoPal robot does not enter the Pallet Station	There is a foreign body in the Pallet Station	Remove the object
	The Wi-Fi connection is poor and GoPal cannot communicate with GoControl	Check GoControl and Wi-Fi connection
	The LIDAR is dirty	Clean LIDAR
GoPal robot has struck an object with its bumper and is stationary	The GoPal robot will remain in safety mode for as long as the bumper is impacted, and the reactivation button is not activated	Remove the object impacting the bumper and reactivate the robot with the Safety Reset button
GoPal robots stop performing tasks - Call Buttons stop working	The Wi-Fi Network unavailable or unstable	Re-establish or enhance Wi-Fi network coverage
	GoControl offline or inactive	Check GoControl status and restart GoControl Server if required
The GoPal lifting mechanism does not lift the pallet off the Pallet Station	The pallet is overloaded, or the weight distribution does not comply with requirements	Reload the pallets to comply with requirements
	The lifting mechanism is defective	Call for service
The lifting mechanism does not lower the pallet	There is an object caught in the lifting mechanism preventing it from functioning	Stop GoPal robot in safety mode. Remove the pallet and its load manually, then remove the object
	The lifting mechanism is defective	Call for service

*Table 3 Typical GoPal Solution errors*

## 10 Technical Information GoPal E22

This section provides detailed technical specifications for the GoPal E22. These specifications are critical for ensuring proper installation, operation, and maintenance of the equipment.

### 10.1 Technical Specifications

Group	Parameter		Condition/remark		Unit	Value
Weights	Load carrying capacity	incl. 25 kg pallet	CoG within spec. limits	max	kg	525
	Robot weight	no load	Operational	max	kg	190
	Total weight	incl. load	Operational	max	kg	715
Dimensions	Length	over all		nom	mm	1400
	Width	over all		nom	mm	860
	Height	excl. pallet	Pallet lift down	nom	mm	340
	Clearance under pallet	over floor	Pallet lift up	nom	mm	385
		standard pallet	Pallet lift up	min	mm	370
	Circumscribed circle radius	physical	Robot center to corner	max	mm	800
	Turning radius	min required	Autonomous navigation	typ	mm	950
Load dimen.	Narrow passage	min required	Autonomous navigation	typ	mm	1200
	Length	excl. pallet	20 mm overhang OK	max	mm	1240
	Width	excl. pallet	No overhang allowed	max	mm	800
Floor	Height	excl. pallet	Standard	max	mm	1800
	Flatness (over 1000 mm)	peak-peak	Max local slope 5 %	max	mm	10
	Edges	step height	Local slope above 5 %	max	mm	3.0
	Slope	average	Over any 1000 mm	max	%	2.0
Safety system	Friction coefficient	all conditions	Wheels: SH A 75-80	min	-	0.60
	Bumper system	effective speed		max	m/s	0.16
		depression for activation		max	mm	5
		max depression		min	mm	30
	Hand operated emergency stops	number	One, each robot corner	-	-	4
Environmental	Brake acceleration in case of emergency stop		Both directions	nom	m/s <sup>2</sup>	0.75
	Operating temperature	robot opr. range	NB! Batt. charge at >0 °C	min / max	°C	-10 / +45
	Operating humidity		Non condensing	max	%	95
	IP rating			-	-	00
	Battery temperature	range	Discharge	min / max	°C	-10 / +45
Electrical			Charge	min / max	°C	0 / +45
	Battery capacity			nom	Ah	40
	Battery voltage	total	2 blocks	nom	V	48.0
	Battery charge time	30 - 95 % SOC	50 A max charge current	typ	mn.	45
		30 - 100 % SOC	50 A max charge current	typ	mn.	55
		10 - 100 % SOC	50 A max charge current	typ	mn.	65
	Robot run time, high activity	-65 % SOC	~15 km, 500 kg, 50 lifts	typ	h	8
	Robot run time, medium activity	-65 % SOC	~10 km, 100 kg, 40 lifts	typ	h	12
	Robot run time, idle	-90 % SOC	no activity	min	h	48

Abbreviations;  
CoG: Center of Gravity  
SOC: State Of Charge  
SH: Shore Hardness

Figure 15 GoPal E22 Spec Sheet

## 10.2 Outline

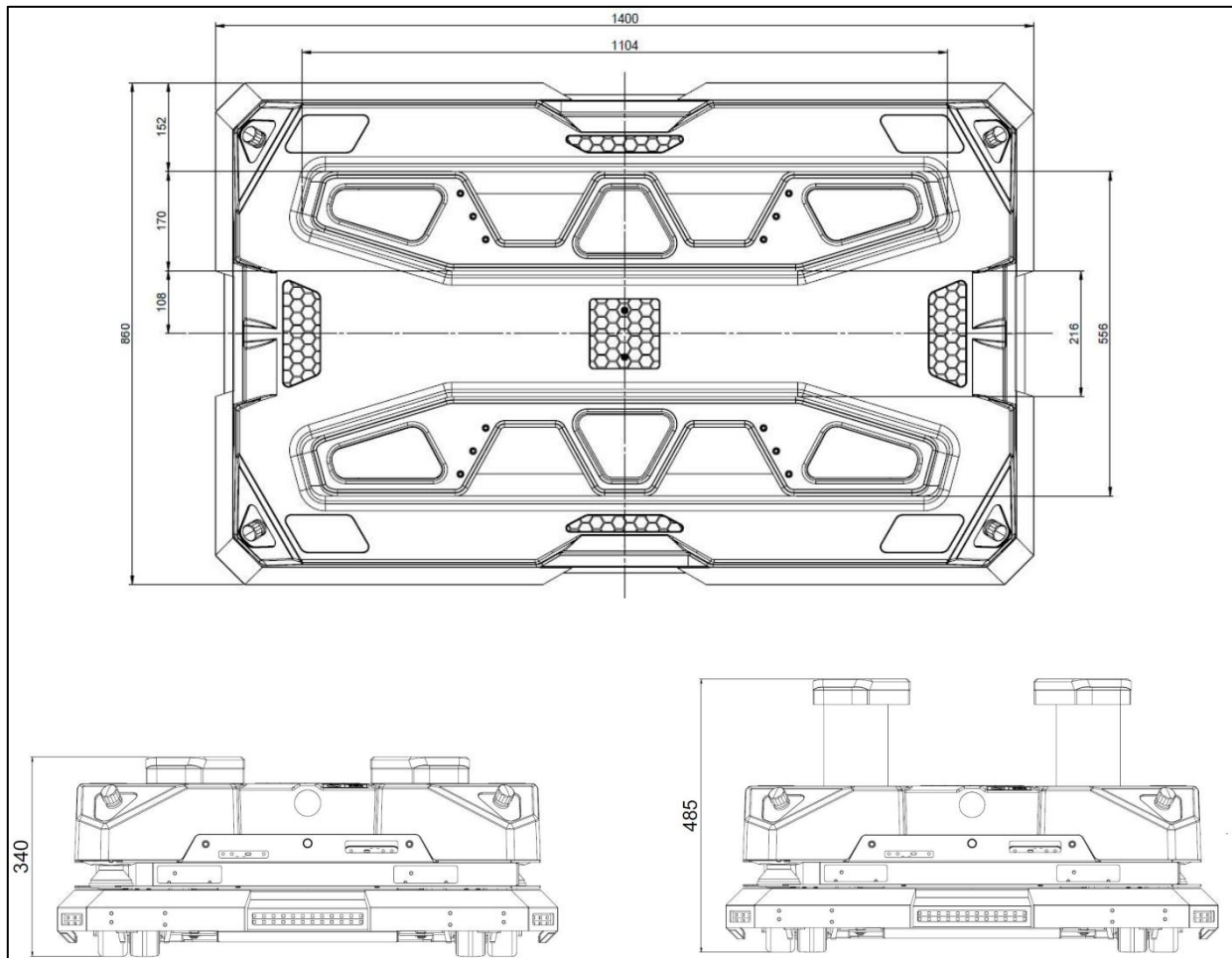


Figure 16 GoPal E22 outline (all measurements in mm)

## 11 Technical Information Pallet Station (E) & Expansion (E)

This section provides detailed technical specifications for Pallet Station (E). These specifications are critical for ensuring proper installation, operation, and maintenance of the equipment.

### 11.1 Technical Specifications Pallet Station (E)

Pallet Station (E)	Specifications
Weight	61 kg
Dimensions (LxWxH)	1404 x 1000 x 393 mm
Max. load on pallet supports	1000 kg
Pallet offset from floor	330 mm

*Table 4 Pallet Station (E) Spec Sheet*

### 11.2 Technical Specifications Pallet Station Expansion (E)

Pallet Station Expansion (E)	Specifications
Weight	45 kg
Dimensions (LxWxH)	1404 x 950 x 393 mm
Max. load on pallet supports	1000 kg
Pallet offset from floor	330 mm

*Table 5 Pallet Station Expansion (E) Spec Sheet*

### 11.3 Outline Pallet Station (E)

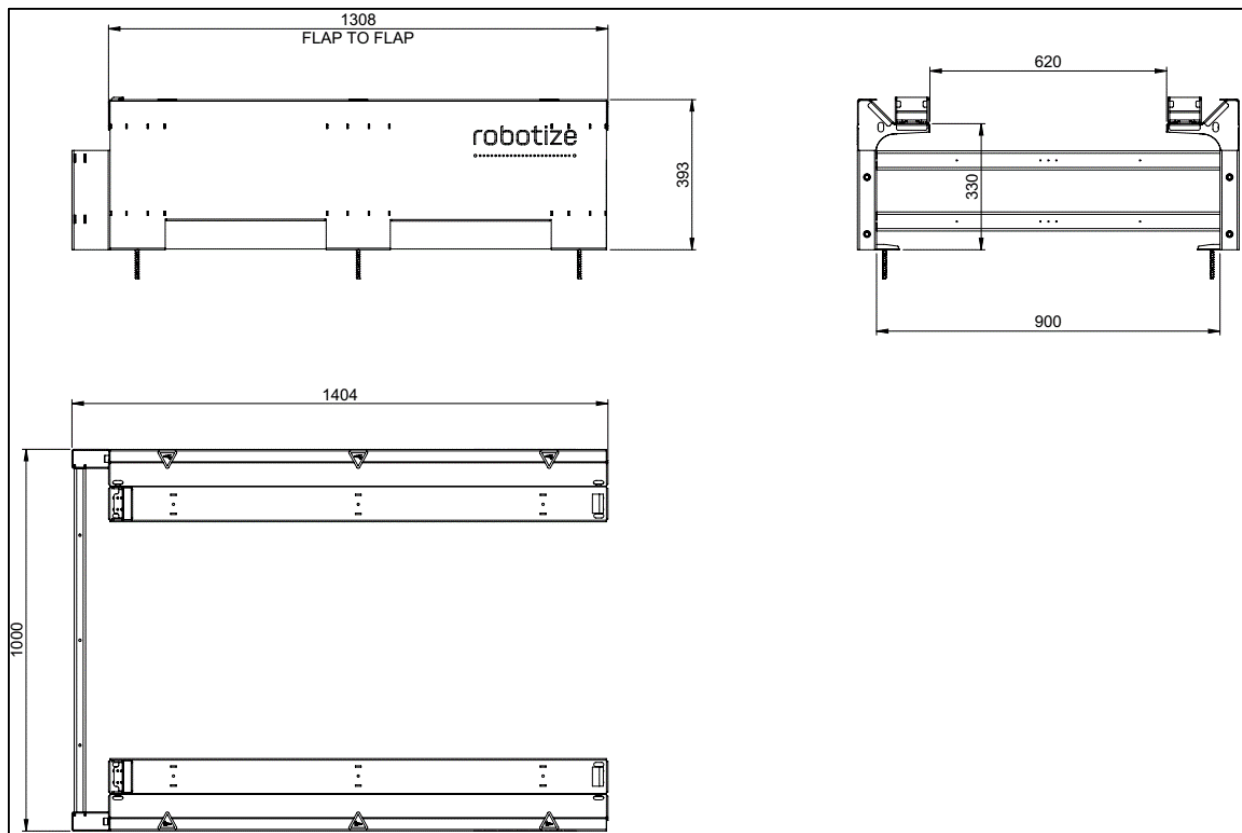


Figure 17 Pallet Station (E) outline (all measurements in mm)

### 11.4 Outline Pallet Station Expansion (E)

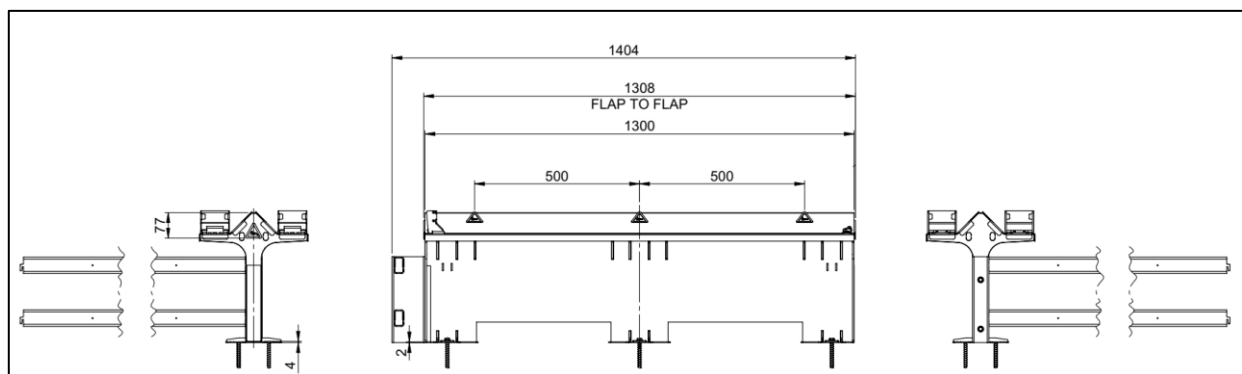


Figure 18 Pallet Station Expansion (E) outline (all measurements in mm)

## 12 Appendix A

### 12.1 GoPal E22 Stability Diagrams

EUR pallets to be transported by GoPal E22 must be loaded in such a way that the centre of gravity is located as centrally as possible on the pallet and as low as practicable. The permitted centre of gravity area is indicated in *Figure 19* through *Figure 23*. In these diagrams, distances are indicated in millimetres (mm) from the centre of the pallet surface. Each figure shows a different acceptable configuration for the load's centre of gravity.

Remember to refer to these figures when loading your pallet to ensure safe and efficient transportation by the GoPal E22.

GoPal E22 Stability Diagrams  
for 0.75 m/s<sup>2</sup> brake acc and 2.0 % floor slope  
Load ≤ 100 kg (excl. 25 kg pallet)

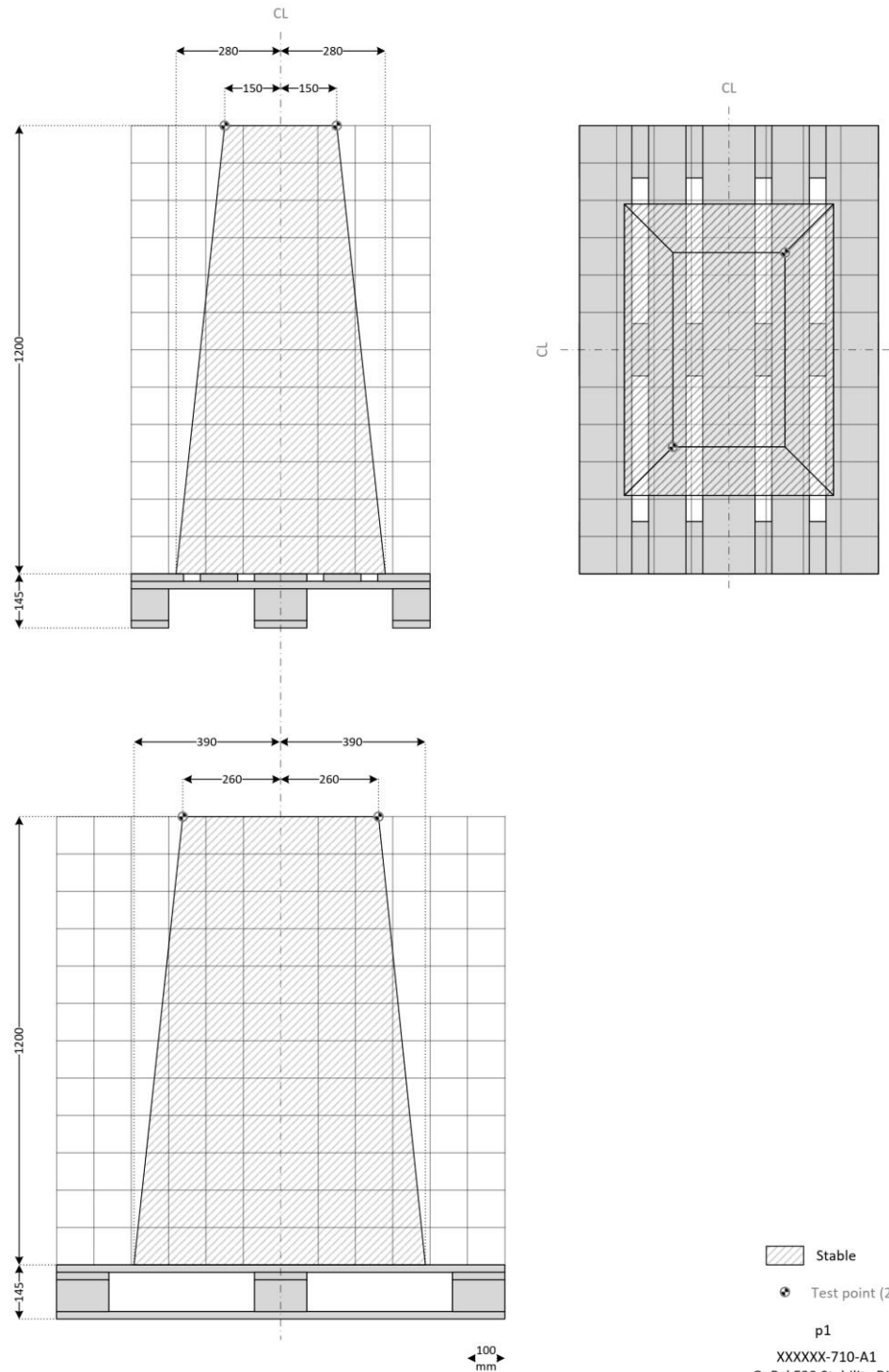


Figure 19 GoPal E22 Stability Diagrams p1

GoPal E22 Stability Diagrams  
for 0.75 m/s<sup>2</sup> brake acc. and 2.0 % floor slope  
Load ≤ 200 kg (excl. 25 kg pallet)

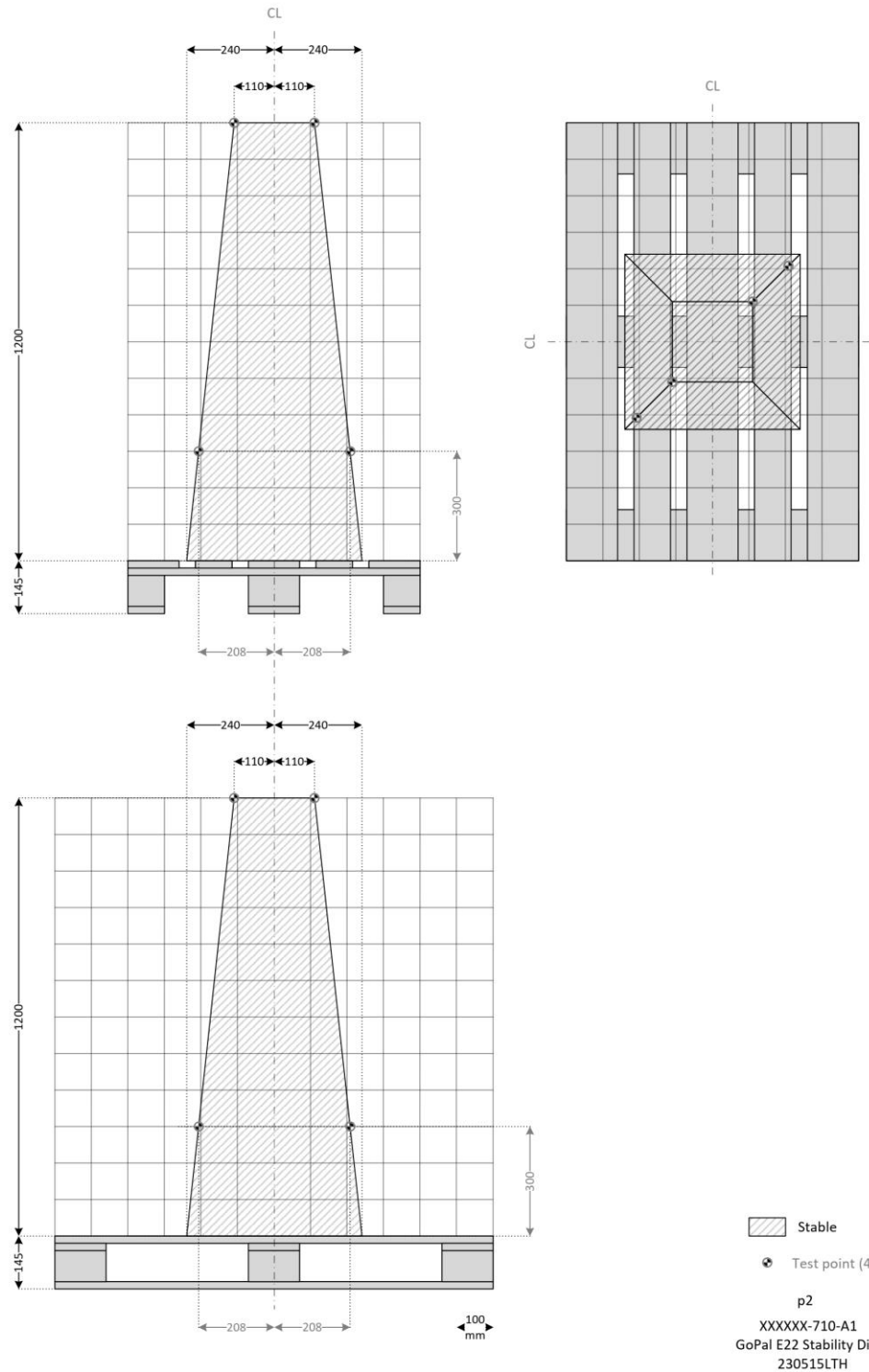


Figure 20 GoPal E22 Stability Diagrams p2

GoPal E22 Stability Diagrams  
for 0.75 m/s<sup>2</sup> brake acc. and 2.0 % floor slope  
Load ≤ 300 kg (excl. 25 kg pallet)

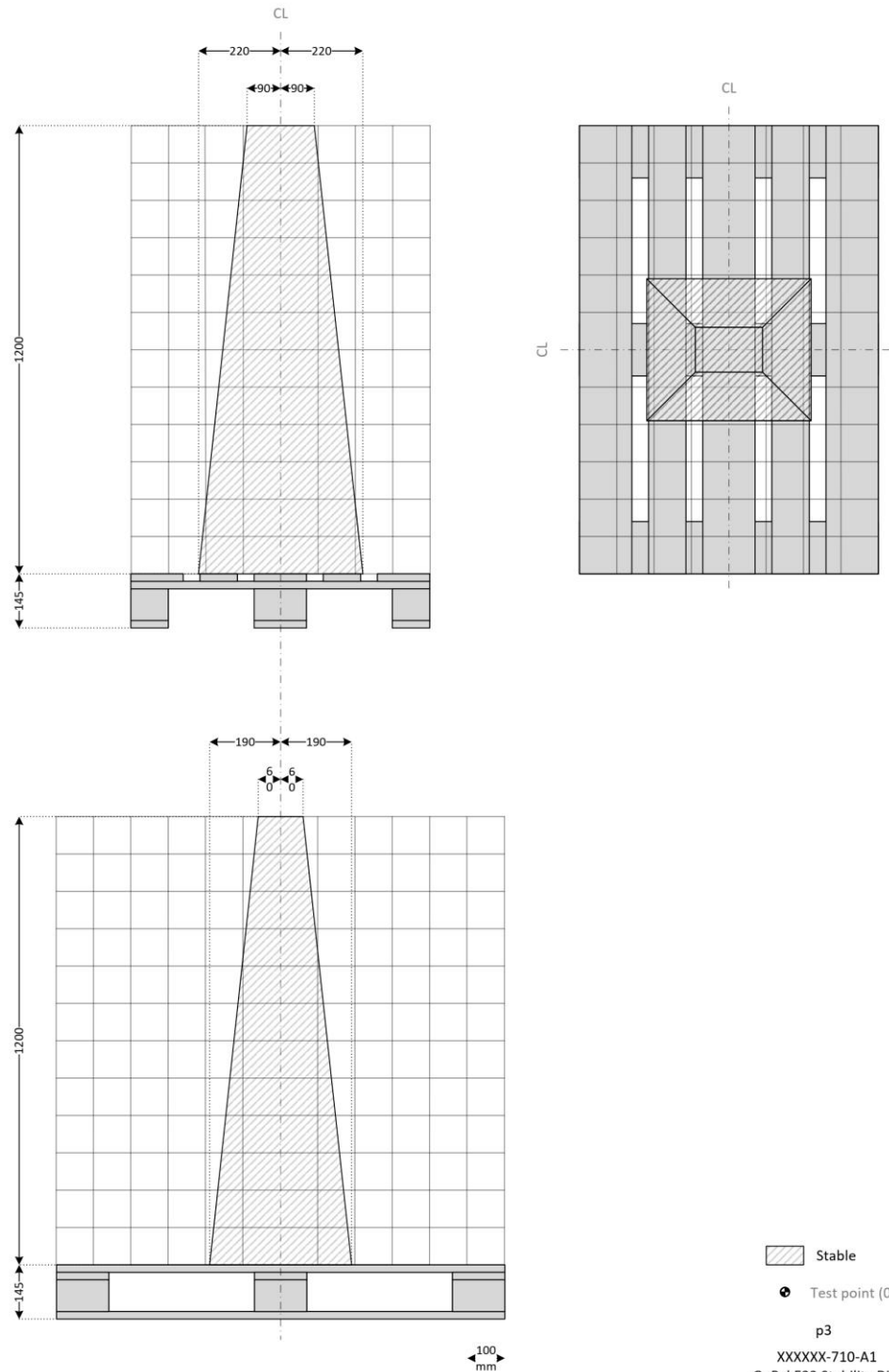


Figure 21 GoPal E22 Stability Diagrams p3

GoPal E22 Stability Diagrams  
for 0.75 m/s<sup>2</sup> brake acc. and 2.0 % floor slope  
Load ≤ 400 kg (excl. 25 kg pallet)

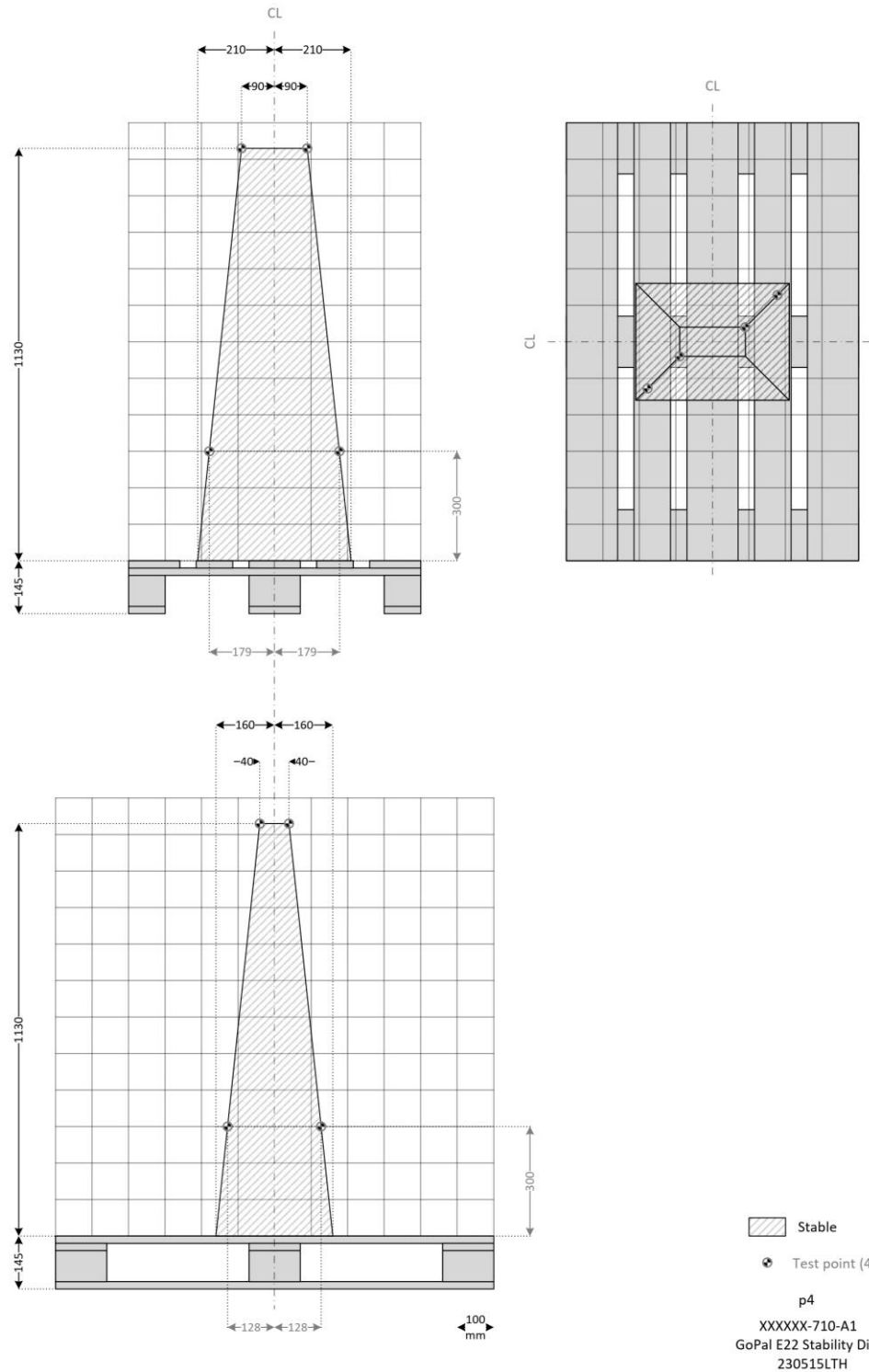


Figure 22 GoPal E22 Stability Diagrams p4

GoPal E22 Stability Diagrams  
for 0.75 m/s<sup>2</sup> brake acc and 2.0 % floor slope  
Load ≤ 500 kg (excl. 25 kg pallet)

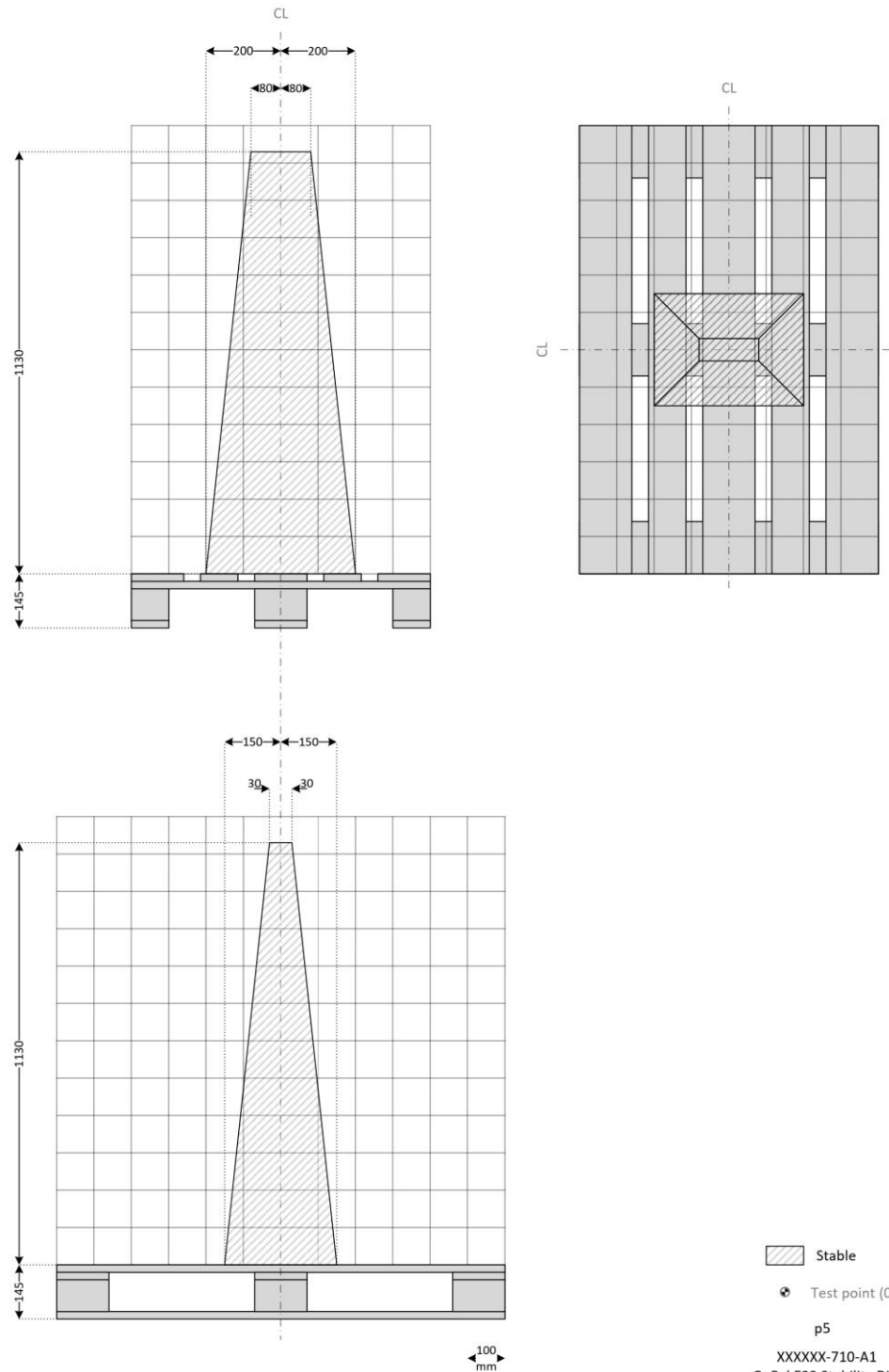



Figure 23 GoPal E22 Stability Diagrams p5

## 13 Appendix B - Declaration of Conformity

robotize



### EU Declaration of Conformity


The manufacturer: Robotize ApS  
 Maglebjergvej 5B  
 DK-2800 Kgs. Lyngby  
 Denmark  
 CVR: 37222941

Declare that the products: Robot, GoPal® E24, Type ATR3112  
 Robot, GoPal® E24W, Type ATR4112  
 Robot, GoPal® U24W, Type ATR4121  
 Robot, GoPal® E22, Type ATR3212

Are conformal to the following directives and standards - when used alone, or in conjunction with other products in the Robotize GoPal® series:

Directives	Applied harmonized standards
2006/42/EC Machinery (MD)	EN ISO 3691-4:2020 (Safety, Driverless industrial trucks and their systems)
2014/30/EU Electromagnetic compatibility (EMC)	EN 12895 (EMC, Industrial Trucks) EN 61000-6-2:2019 (Immunity, industrial) EN 61000-6-3:2019 (Emission, residential, commercial and light-industrial)
2014/53/EU Radio equipment (RED)	EN 301 489-3 V2.3.2:2023 (Radio equipment, Short-Range Devices)
2011/65/EU (RoHS)	EN IEC 63000:2018 (Restriction of hazardous substances)

Kgs. Lyngby, 10. Jan. 2024




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Anders Pjetursson  
 CEO Robotize ApS

Robotize doc. no. 011796-B

Figure 24 Declaration of Conformity GoPal E22