



The Mobile Robot Company

Knowledge Center — Safety Overview · 2026-08-04

<https://info.mobilerobot.com/category/safety-overview>

Safety Overview

How the J1600's layered safety design works: the split between human and machine responsibilities, manual and autonomous mode behavior, certified safety components, and emergency controls.



How J1600 Safety Works

An overview of the J1600's layered safety design — certified sensors and controllers, a 360-degree protective field, operator confirmation, and immediate manual takeover.



Human Responsibilities

What the operator is responsible for when working with the J1600 — task initiation, manual pickup, judging the environment, confirming autonomous mode, and taking over.



Manual and Autonomous Mode Safety

How J1600 safety behaves in manual mode, in autonomous mode, and during the handover between them — key switch positions, confirmation, floor lights, and takeover.



Safety Architecture

The complete safety component set of the J1600 — independent safety controller, dual 2D safety LiDARs, emergency stops, certified encoders and motor controllers — and how the laye...



Navigation Sensors vs. Safety Sensors

Why the J1600 keeps two separate sensor systems — a 3D LiDAR and RGB AI camera for navigation, and two certified 2D safety LiDARs for personnel protection.



Emergency Stops and Manual Takeover

Every way to stop the J1600 or return it to manual control — three emergency-stop buttons, the belly button, tiller takeover, and the key switch.

How J1600 Safety Works

This page explains the safety design of the [J1600 self-driving pallet jack](https://info.mobilerobot.com/products/j1600/overview/) (<https://info.mobilerobot.com/products/j1600/overview/>) at a glance: what protects people around the vehicle, what the operator is responsible for, and where to find the details. It is written for anyone evaluating or working near the J1600.

Safety in layers

The J1600 does not rely on a single mechanism. Protection comes from several independent layers working together:

1. **Navigation and mapping.** [3D LiDAR SLAM](https://info.mobilerobot.com/products/j1600/navigation-and-obstacle-avoidance/) (<https://info.mobilerobot.com/products/j1600/navigation-and-obstacle-avoidance/>) (simultaneous localization and mapping) builds and updates a three-dimensional model of the facility so the vehicle plans routes around obstacles.
2. **Certified safety sensing.** Two separate 2D safety LiDAR scanners, mounted front and rear, provide a full 360-degree protective field around the vehicle. The field is speed-dependent and expands as travel speed increases.
3. **Independent safety control.** An independent safety controller, [safety-certified driving-speed and driving-direction encoders](https://info.mobilerobot.com/safety-compliance/safety-functions/speed-monitoring/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/speed-monitoring/>), and two safety-certified motor controllers supervise motion.
4. **Human confirmation.** A person initiates every task and must [confirm entry into automatic mode](https://info.mobilerobot.com/documentation/user-guides/autonomous-operation/) (<https://info.mobilerobot.com/documentation/user-guides/autonomous-operation/>) with a physical button press. The vehicle only enters autonomous mode when the operator judges the environment ready.
5. **Physical override.** Three emergency-stop buttons, a belly button for stop and reverse, and tiller-based takeover let anyone stop the vehicle or return it to manual control immediately.

The navigation stack and the safety stack are deliberately separate systems — see [Navigation sensors vs. safety sensors](https://info.mobilerobot.com/safety-compliance/safety-overview/navigation-sensors-vs-safety-sensors/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/navigation-sensors-vs-safety-sensors/>).

What the vehicle does

- [Detects people](https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/>) and obstacles in a 360-degree protective field that supports both forward and reverse autonomous travel.
- [Adjusts the size of its protective field with speed](https://info.mobilerobot.com/safety-compliance/safety-functions/safety-field-adjustment/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/safety-field-adjustment/>), expanding it at higher speeds.
- Shows its status on the floor: white light indicates manual mode, and blue light strips display the current protected area in automatic mode.
- Stops on any emergency-stop input and brakes with a [certified braking function](https://info.mobilerobot.com/safety-compliance/safety-functions/braking/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/braking/>).
- Asks the operator to confirm automatic mode and instructs the operator to step away before starting.

Each certified safety function carries an assigned Performance Level (PL) between PL b and PL d under [EN ISO 13849-1](https://info.mobilerobot.com/safety-compliance/standards/iso-13849-1/) (<https://info.mobilerobot.com/safety-compliance/standards/iso-13849-1/>). The full list is in [Performance levels](https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/>).

What the operator does

The J1600 is built for [human-in-the-loop automation](https://info.mobilerobot.com/documentation/concepts/human-in-the-loop-automation/) (<https://info.mobilerobot.com/documentation/concepts/human-in-the-loop-automation/>): the operator keeps judgment-heavy work and full authority over when the machine drives itself. Pallet pickup is always manual, autonomous mode must be confirmed by a person, and grabbing or moving the tiller returns the vehicle to manual control at once. See [Human responsibilities](https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/>), and [Emergency stops and manual takeover](https://info.mobilerobot.com/safety-compliance/safety-overview/emergency-stops-and-manual-takeover/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/emergency-stops-and-manual-takeover/>).

Standards and certification

The J1600 is [CE marked](https://info.mobilerobot.com/safety-compliance/certificates/ce-declaration-of-conformity/) (<https://info.mobilerobot.com/safety-compliance/certificates/ce-declaration-of-conformity/>). Its preliminary [compliance list](https://info.mobilerobot.com/safety-compliance/certificates/compliance-statements/) (<https://info.mobilerobot.com/safety-compliance/certificates/compliance-statements/>) includes [EN ISO 3691-4:2023](https://info.mobilerobot.com/safety-compliance/standards/iso-3691-4/) (<https://info.mobilerobot.com/safety-compliance/standards/iso-3691-4/>) (driverless industrial trucks), [EN ISO 13849-1:2023](https://info.mobilerobot.com/safety-compliance/standards/iso-13849-1/) (safety-related control systems), [EN ISO 12100:2010](https://info.mobilerobot.com/safety-compliance/standards/iso-12100/) (<https://info.mobilerobot.com/safety-compliance/standards/iso-12100/>), [EN ISO 3691-1:2015+A1:2020](https://info.mobilerobot.com/safety-compliance/standards/iso-3691-1-2015+A1-2020/) (<https://info.mobilerobot.com/safety-compliance/standards/iso-3691-1-2015+A1-2020/>).

[obilerobot.com/safety-compliance/standards/iso-3691-1/](https://info.mobilerobot.com/safety-compliance/standards/iso-3691-1/)), [ANSI/ITSDF B56.5-2024](https://info.mobilerobot.com/safety-compliance/standards/ansi-itsdf-b56-5/) (<https://info.mobilerobot.com/safety-compliance/standards/ansi-itsdf-b56-5/>), and [ANSI/ITSDF B56.1-2020](https://info.mobilerobot.com/safety-compliance/standards/ansi-itsdf-b56-1/) (<https://info.mobilerobot.com/safety-compliance/standards/ansi-itsdf-b56-1/>), together with the Machinery, [EMC](https://info.mobilerobot.com/safety-compliance/standards/emc-red-rohs-and-battery-regulations/), [Radio Equipment](https://info.mobilerobot.com/safety-compliance/standards/emc-red-rohs-and-battery-regulations/), and [RoHS](https://info.mobilerobot.com/safety-compliance/standards/emc-red-rohs-and-battery-regulations/) directives and the [EU Batteries Regulation](https://info.mobilerobot.com/safety-compliance/standards/emc-red-rohs-and-battery-regulations/) (<https://info.mobilerobot.com/safety-compliance/standards/emc-red-rohs-and-battery-regulations/>). The battery is tested to [UN 38.3](https://info.mobilerobot.com/safety-compliance/certificates/battery-un-38-3-documentation/) (<https://info.mobilerobot.com/safety-compliance/certificates/battery-un-38-3-documentation/>) for transport.

PRELIMINARY SPECIFICATIONS

The January 2026 specifications, including the assigned Performance Levels, are preliminary and subject to change. No stopping-distance curves, validation reports, or declaration of conformity are published; use current product documentation for deployment decisions.

Where to go next

- [Human responsibilities](https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/>) — the operator's share of safe operation.
- [Manual and autonomous mode safety](https://info.mobilerobot.com/safety-compliance/safety-overview/manual-and-autonomous-mode-safety/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/manual-and-autonomous-mode-safety/>) — how safety behaves in each mode and during handover.
- [Safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/>) — the complete list of safety components.
- [Emergency stops and manual takeover](https://info.mobilerobot.com/safety-compliance/safety-overview/emergency-stops-and-manual-takeover/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/emergency-stops-and-manual-takeover/>) — every way to stop the vehicle.
- [Performance levels](https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/>) — each certified function and its Performance Level.

Human Responsibilities

The J1600 automates repetitive travel, not judgment. This page describes the operator's share of safe operation: the decisions and actions that stay with a person in the [human-in-the-loop](https://info.mobilerobot.com/documentation/concepts/human-in-the-loop-automation/) design.

The division of work

Human operator	J1600
Judge load stability, pallet condition, congestion, urgency, and exceptions	Build and update a 3D map and navigate to saved points
Pick pallets and perform manual height handling up to 1.6 m	Carry up to 1,600 kg along repetitive routes
Select the destination and what happens after delivery	Avoid obstacles and apply speed-dependent safety fields
Confirm entry into autonomous mode	Drop at floor level, then return, park, continue, or wait
Override or resume manual control at any time	Repeat stored tasks consistently

Before starting an autonomous task

- **Pick up the pallet manually.** [Pallet pickup is always a manual operation](https://info.mobilerobot.com/applications/scenarios/manual-pickup-and-autonomous-delivery/) (<https://info.mobilerobot.com/applications/scenarios/manual-pickup-and-autonomous-delivery/>). Use your own judgment on pallet condition, load stability, fork placement, and approach.
- **Check the load.** The operator judges whether a pallet or open-base carrier is stable and within the supported envelope. No [blanket approval](https://info.mobilerobot.com/safety-compliance/safe-deployment/approved-loads-and-pallets/) (<https://info.mobilerobot.com/safety-compliance/safe-deployment/approved-loads-and-pallets/>) exists for every carrier or for hazardous materials.
- **Judge the environment.** The vehicle only [enters autonomous mode](https://info.mobilerobot.com/documentation/user-guides/autonomous-operation/) (<https://info.mobilerobot.com/documentation/user-guides/autonomous-operation/>) when the operator

judges the environment ready. Autonomous driving requires level floors — automatic gradeability is 0 percent, so dock plates and slopes remain [manual work](https://info.mobilerobot.com/documentation/user-guides/manual-operation/) (<https://info.mobilerobot.com/documentation/user-guides/manual-operation/>).

- **Confirm the mode change.** The robot asks for confirmation before [entering automatic mode](https://info.mobilerobot.com/safety-compliance/safety-overview/manual-and-autonomous-mode-safety/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/manual-and-autonomous-mode-safety/>). Confirm with the physical start/resume button, then step away when the interface instructs you to.

During autonomous operation

The vehicle drives itself, but a person remains in charge of [exceptions](https://info.mobilerobot.com/applications/scenarios/handling-exceptions-and-irregular-loads/) (<https://info.mobilerobot.com/applications/scenarios/handling-exceptions-and-irregular-loads/>):

- Take over immediately by grabbing or moving the tiller, or stop the vehicle with any emergency-stop control. See [Emergency stops and manual takeover](https://info.mobilerobot.com/safety-compliance/safety-overview/emergency-stops-and-manual-takeover/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/emergency-stops-and-manual-takeover/>).
- Reprioritize when circumstances change — for example, when a production line urgently needs material.

Situations that stay human

The design deliberately keeps the following in human hands, because context and improvisation matter:

1. Spotting damaged pallets — a broken bottom board or protruding nail — before they become a hazard or a jam.
2. Judging a [top-heavy, leaning, or poorly stacked load](https://info.mobilerobot.com/applications/use-cases/sensitive-or-unstable-loads/) (<https://info.mobilerobot.com/applications/use-cases/sensitive-or-unstable-loads/>) before lifting it.
3. Seeing and tucking away a loose shrink-wrap tail before it snags a rack or doorframe.
4. Finding a pallet that is not exactly at its recorded position.
5. Catching leaks or crushed corners before goods reach a customer or production line.
6. Handling steep dock plates, bumps, and misalignment when entering a truck or trailer.
7. Improvising a safe route through a [crowded or cluttered receiving area](https://info.mobilerobot.com/applications/scenarios/operation-in-crowded-environments/) (<https://info.mobilerobot.com/applications/scenarios/operation-in-crowded-environments/>).

8. Responding immediately to urgent reprioritization.
9. [Teaching new routes](https://info.mobilerobot.com/documentation/concepts/teach-and-rep-eat/) (<https://info.mobilerobot.com/documentation/concepts/teach-and-rep-eat/>), by driving to a point and saving it, instead of calling in an automation expert.

Responsibility is a complement, not the whole system

Human control is not the vehicle's only safety mechanism. Independent controllers, certified components, two safety LiDAR scanners, emergency stops, and a 360-degree protective field operate regardless of the operator. Human takeover complements the [safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/>); it does not replace it. See [How J1600 safety works](https://info.mobilerobot.com/safety-compliance/safety-overview/how-j1600-safety-works/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/how-j1600-safety-works/>) for the full picture.

Manual and Autonomous Mode Safety

The J1600 is a [dual-mode](https://info.mobilerobot.com/products/j1600/dual-mode/) vehicle: it drives like a conventional walk-behind electric pallet jack under manual control and drives itself to saved locations in autonomous mode. This page describes how safety works in each mode and at the handover between them.

Selecting a mode

A three-position key switch selects the vehicle's state:

Key position	Meaning
Power off	Vehicle powered down
Manual	Manual tiller operation only
Automatic	Autonomous task execution permitted

Automatic/manual mode selection is a certified safety function rated PL c — see [Mode selection](https://info.mobilerobot.com/safety-compliance/safety-functions/mode-selection/)).

Manual mode

In [manual mode](https://info.mobilerobot.com/documentation/user-guides/manual-operation/), the operator controls travel and lift with the tiller, like a conventional electric pallet jack. Manual mode covers the judgment-heavy work: pallet pickup, handling up to 1.6 m, difficult approaches, [sensitive or unstable loads](https://info.mobilerobot.com/application/use-cases/sensitive-or-unstable-loads/), and [exceptions](https://info.mobilerobot.com/applications/scenarios/handling-exceptions-and-irregular-loads/).

- White light indicates that the vehicle is in manual mode.
- Tiller-position switches serve two safety roles: one acts as an emergency stop, the other enables manual control. Tiller-position detection is rated PL c — see [Tiller detection](https://info.mobilerobot.com/safety-compliance/safety-functions/tiller-detection/).

- Manual gradeability is 5 percent (2.86°) without load and 3 percent (1.72°) with full load; slopes and dock plates are manual-mode territory.

Handover to autonomous mode

Handover is deliberate and operator-controlled:

1. The operator creates or selects a task on the 15-inch touchscreen and chooses the saved destination and post-delivery behavior.
2. The robot asks for confirmation to enter automatic mode.
3. The operator confirms with the physical LED start/resume button.
4. The interface instructs the operator to step away.
5. The vehicle starts the autonomous task.

The vehicle only [enters autonomous mode](https://info.mobilerobot.com/documentation/user-guides/autonomous-operation/) (<https://info.mobilerobot.com/documentation/user-guides/autonomous-operation/>), when the operator judges the environment ready. Pallet pickup has already happened manually; autonomous delivery is at floor level.

Autonomous mode

While driving itself, the J1600:

- applies a 360-degree protective field from two 2D safety LiDAR scanners, supporting forward and reverse travel;
- [expands the protective field as speed increases](https://info.mobilerobot.com/safety-compliance/safety-functions/safety-field-adjustment/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/safety-field-adjustment/>), up to the top speed of 5.4 km/h (1.5 m/s);
- displays the current protected area with blue floor light strips;
- detects people in the safety field ([person detection](https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/>), PL d) and brakes with a certified [braking function](https://info.mobilerobot.com/safety-compliance/safety-functions/braking/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/braking/>) (PL d);
- [avoids obstacles](https://info.mobilerobot.com/products/j1600/navigation-and-obstacle-avoidance/) (<https://info.mobilerobot.com/products/j1600/navigation-and-obstacle-avoidance/>) using its continuously updated 3D map, separately from the certified safety sensing — see [Navigation sensors vs. safety sensors](https://info.mobilerobot.com/safety-compliance/safety-overview/navigation-sensors-vs-safety-sensors/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/navigation-sensors-vs-safety-sensors/>).

Autonomous mode is a level-floor application: automatic gradeability is 0 percent, the maximum traversable bump is 25 mm, and the maximum traversable gap is 20 mm.

Returning to manual control

Manual control is always immediately available:

- **Grab or move the tiller.** The vehicle returns to manual control at once.
- **Press an emergency stop.** Three emergency-stop buttons and a belly button for stop and reverse are fitted.
- **Use the key switch.** Turning to manual or power-off ends autonomous operation.

See [Emergency stops and manual takeover](https://info.mobilerobot.com/safety-compliance/safety-overview/emergency-stops-and-manual-takeover/) (https://info.mobilerobot.com/safety-compliance/safety-overview/emergency-stops-and-manual-takeover/) for details, and [Human responsibilities](https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/) (https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/) for what remains the operator's job in both modes.

Safety Architecture

The J1600's safety architecture layers navigation, sensing, safety control, certified actuation, human confirmation, and physical override. This page lists every safety component and explains how the layers combine. For the high-level introduction, see [How J1600 safety works](https://info.mobilerobot.com/safety-compliance/safety-overview/how-j1600-safety-works/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/how-j1600-safety-works/>).

Safety components

- Independent safety controller
- Two 2D safety LiDAR scanners, mounted front and rear on the chassis
- Three emergency-stop buttons
- Belly button for stop and reverse
- [Load-detection sensor](https://info.mobilerobot.com/safety-compliance/safety-functions/load-detection/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/load-detection/>)
- [Tiller-position switch](https://info.mobilerobot.com/safety-compliance/safety-functions/tiller-detection/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/tiller-detection/>) for emergency stop
- Tiller-position switch for manual control
- Safety-certified driving-speed encoder
- Safety-certified driving-direction encoder
- Two safety-certified motor controllers

The 360-degree protective field

The two 2D safety LiDAR scanners together cover the full perimeter of the vehicle, producing a 360-degree protective field that supports both forward and reverse autonomous travel — including certified safe reversing without specially marked target zones. The field is speed-dependent: it changes with travel speed and expands at higher speeds. Field-size adjustment is itself a certified safety function rated PL d — see [Safety-field adjustment](https://info.mobilerobot.com/safety-compliance/safety-functions/safety-field-adjustment/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/safety-field-adjustment/>).

Blue floor light strips — three in total — display the current safety zone so people nearby can see the protected area. White light indicates manual mode.

Certified motion control

Motion is supervised by the independent safety controller working with a safety-certified driving-speed encoder, a safety-certified driving-direction encoder, and two safety-certified motor controllers. These support the certified [braking](https://info.mobilerobot.com/safety-compliance/safety-functions/braking/) (PL d) and [speed monitoring and control](https://info.mobilerobot.com/safety-compliance/safety-functions/speed-monitoring/) (PL c) functions.

Human confirmation and override

Two layers involve people directly:

- **Confirmation.** The operator must confirm entry into automatic mode with the physical start/resume button, and the robot instructs the operator to step away before starting. See [Manual and autonomous mode safety](https://info.mobilerobot.com/safety-compliance/safety-overview/manual-and-autonomous-mode-safety/).
- **Override.** Grabbing or moving the tiller enables immediate manual takeover; emergency stops halt the vehicle. See [Emergency stops and manual takeover](https://info.mobilerobot.com/safety-compliance/safety-overview/emergency-stops-and-manual-takeover/).

Separation from the navigation stack

The 3D navigation LiDAR and RGB AI camera map the environment and route the vehicle around objects; the 2D safety stack supplies the certified personnel protection. The two systems are independent — see [Navigation sensors vs. safety sensors](https://info.mobilerobot.com/safety-compliance/safety-overview/navigation-sensors-vs-safety-sensors/).

Performance levels

Each certified safety function carries an assigned Performance Level between PL b and PL d — for example braking, emergency stop, [person detection](https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/), and safety-field adjustment at PL d. The full table is in [Performance levels](https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/).

What this architecture delivers — and its documentation limits

The layered design improves predictability and may [reduce workplace accidents](https://info.mobilerobot.com/applications/results/safety-improvements/) compared with manual pallet handling.

DEPLOYMENT DECISIONS NEED CURRENT DOCUMENTATION

No accident-rate test data, safety-distance curves, stopping distances, validation reports, or [declaration of conformity](https://info.mobilerobot.com/safety-compliance/certificates/ce-declaration-of-conformity/) are published on this site. The January 2026 specifications are preliminary and subject to change; use current product documentation for deployment decisions.

Navigation Sensors vs. Safety Sensors

The J1600 carries two distinct sensor systems that are easy to confuse: the navigation stack that drives the vehicle, and the safety stack that protects people. This page explains what each does and why they are separate.

Two stacks at a glance

	Navigation stack	Safety stack
Sensors	3D LiDAR, RGB AI camera	Two 2D safety LiDAR scanners, front and rear
Processing	Industrial NVIDIA Jetson AI computer	Independent safety controller
Job	Mapping, localization, route planning, obstacle avoidance	Certified person detection and protective fields
Certification role	Control/navigation function	Certified safety functions with assigned Performance Levels

The navigation stack

The 3D LiDAR performs [SLAM](https://info.mobilerobot.com/products/j1600/navigation-and-obstacle-avoidance/) (simultaneous localization and mapping): it builds and continuously updates a three-dimensional map of the facility while an operator drives, then localizes the vehicle and plans routes to saved destinations. It scans environmental structures at heights reaching up to 70 m above the vehicle, works without fixed tracks, wires, reflectors, or building modifications, and routes around obstacles in dynamic environments. An RGB AI camera is part of the same control stack, and preferred travel zones can be defined for safer routing through production areas.

3D mapping is designed for greater precision and reliability than traditional 2D navigation in complex or changing environments — one reason the vehicle suits [brownfield sites](https://info.mobilerobot.com/applications/use-cases/brownfield-automation/).

For exact sensor geometry, range, accuracy, minimum aisle width, and localization tolerances, contact the company or a partner.

The safety stack

Personnel protection does not depend on the navigation system. Two separate 2D safety LiDAR scanners feed an independent safety controller and certified components. Together they produce a full 360-degree protective field that supports forward and reverse autonomous travel, changes size with speed, and triggers certified reactions:

- [Person detection in the safety field](https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/) (https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/) — PL d
- [Safety-field size adjustment](https://info.mobilerobot.com/safety-compliance/safety-functions/safety-field-adjustment/) (https://info.mobilerobot.com/safety-compliance/safety-functions/safety-field-adjustment/) — PL d
- [Braking](https://info.mobilerobot.com/safety-compliance/safety-functions/braking/) (https://info.mobilerobot.com/safety-compliance/safety-functions/braking/) — PL d
- [Speed monitoring and control](https://info.mobilerobot.com/safety-compliance/safety-functions/speed-monitoring/) (https://info.mobilerobot.com/safety-compliance/safety-functions/speed-monitoring/) — PL c

Why the separation matters

Obstacle avoidance by the navigation stack is a productivity feature: it keeps the vehicle moving efficiently around whatever is in the way. The 2D safety stack is the certified protection layer: it guarantees [the response when a person enters the protective field](https://info.mobilerobot.com/support/troubleshooting/obstacle-or-safety-field-stops/) (https://info.mobilerobot.com/support/troubleshooting/obstacle-or-safety-field-stops/), independently of what the navigation software decides. Keeping the two systems separate means personnel protection rests on certified components rather than on the AI navigation stack.

For the complete component list, see [Safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/). For terms such as LiDAR, SLAM, and Performance Level, see the [glossary](https://info.mobilerobot.com/documentation/concepts/glossary/) (https://info.mobilerobot.com/documentation/concepts/glossary/).

Emergency Stops and Manual Takeover

Anyone working near a J1600 can stop it, and the operator can reclaim manual control at any moment. This page lists every stop and takeover control and what each does.

Emergency-stop buttons

The J1600 has three emergency-stop buttons. The emergency-stop function is rated [Performance Level d \(PL d\)](https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/>), the highest level assigned to any J1600 safety function. The emergency stop is one of the [externally visible controls](https://info.mobilerobot.com/documentation/technical-reference/interface-specifications/) (<https://info.mobilerobot.com/documentation/technical-reference/interface-specifications/>) on the vehicle, alongside the start/resume button, key switch, and tiller.

Belly button

A belly button provides stop and reverse. It protects the person at the tiller position: activating it stops the vehicle and reverses it away.

Tiller takeover

The tiller is both the manual control and a safety device:

- **Grab or move the tiller** during autonomous operation and the vehicle immediately returns to manual control.
- Two tiller-position switches back this up: one functions as an emergency stop, the other enables manual control. Tiller-position detection is a certified safety function rated PL c — see [Tiller detection](https://info.mobilerobot.com/safety-compliance/safety-functions/tiller-detection/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/tiller-detection/>).

Takeover requires no menu, code, or supervisor: the [design principle](https://info.mobilerobot.com/company/about/our-approach-to-automation/) (<https://info.mobilerobot.com/company/about/our-approach-to-automation/>) is that immediate human intervention is always available. See [Human responsibilities](https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/>).

Key switch

The three-position key switch selects power off, manual-only, or automatic mode. Turning it out of the automatic position ends autonomous operation. Mode selection is a certified safety function rated PL c — see [Mode selection](https://info.mobilerobot.com/safety-compliance/safety-functions/mode-selection/) (https://info.mobilerobot.com/safety-compliance/safety-functions/mode-selection/).

Start and resume

Autonomous execution is controlled by a physical LED start/resume button. The vehicle **does not enter automatic mode on a touchscreen tap alone** (https://info.mobilerobot.com/support/troubleshooting/robot-will-not-enter-autonomous-mode/) — the operator must confirm with this button, and the interface instructs the operator to step away before the task starts. See [Manual and autonomous mode safety](https://info.mobilerobot.com/safety-compliance/safety-overview/manual-and-autonomous-mode-safety/) (https://info.mobilerobot.com/safety-compliance/safety-overview/manual-and-autonomous-mode-safety/).

Automatic protection alongside manual controls

Manual stops complement, rather than replace, the automatic protection layers: certified [person detection](https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/) (https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/) (PL d) and [braking](https://info.mobilerobot.com/safety-compliance/safety-functions/braking/) (https://info.mobilerobot.com/safety-compliance/safety-functions/braking/) (PL d) act on the 360-degree protective field regardless of operator input. The full component list is in [Safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/).