



The Mobile Robot Company

Knowledge Center — Safety Functions · 2026-08-04

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

Safety Functions

The individual certified safety functions of the J1600 — braking, speed monitoring, safety-field adjustment, person detection, and more — with their assigned Performance Levels.



Braking

The J1600's certified braking system, rated Performance Level d, and the safety-certified motion components that support it.



Speed Monitoring

The J1600's certified speed monitoring and control function, rated Performance Level c, built on safety-certified speed and direction encoders.



Safety-Field Adjustment

How the J1600 adjusts its 360-degree protective field with speed — a certified safety function rated Performance Level d — and how blue floor lights display the active zone.



Person Detection

How the J1600 detects people in its 360-degree safety field using two certified 2D safety LiDAR scanners — a safety function rated Performance Level d.



Load Detection

The J1600's load-detection safety function, rated Performance Level b, and the load limits and operator judgment it works alongside.



Mode Selection

The J1600's certified automatic/manual mode-selection function, rated Performance Level c — the key switch, confirmation button, and step-away sequence.



Tiller Detection

The J1600's certified tiller-position detection function, rated Performance Level c — how the tiller acts as emergency stop, manual-control enable, and instant takeover.



Charging Safety

Safety in J1600 charging — the certified charging-current relay rated Performance Level b, the LiFePO4 battery, UN 38.3 transport testing, and safe manual and automatic charging.



Performance Levels

The complete table of Performance Levels (PL) assigned to the J1600's nine certified safety functions under EN ISO 13849-1, from PL b to PL d.

Braking

The braking system is one of the J1600's certified safety functions. It is rated **Performance Level d (PL d)** (<https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/>) — the highest level assigned to any J1600 safety function.

Role in the safety architecture

Braking is the reaction layer of the [safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/>): when a safety function demands a stop — [a person detected in 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/>), an emergency-stop input, or a takeover — the certified braking system halts the vehicle. It works together with:

- the independent safety controller;
- the safety-certified driving-speed encoder and driving-direction encoder;
- the two safety-certified motor controllers;
- [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), which supervises how fast the vehicle is allowed to travel.

The 360-degree protective field supports both forward and reverse autonomous travel, so certified stopping applies in both travel directions. The vehicle's top speed is 5.4 km/h (1.5 m/s), and the protective field expands at higher speeds to preserve reaction margin — 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/>).

Triggers

- [Person detection](https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/>) in the 360-degree safety field (PL d).
- Any of the three emergency-stop buttons (PL d) or the [tiller-position emergency-stop switch](https://info.mobilerobot.com/safety-compliance/safety-functions/tiller-detection/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/tiller-detection/>).
- The belly button, which stops and reverses the vehicle.

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 the full set of stop controls.

i PRELIMINARY SPECIFICATION

The January 2026 Performance Levels are preliminary and subject to change. This page does not give stopping distances or safety-distance curves; base deployment decisions on the current product documentation.

Speed Monitoring

Speed monitoring and control is a certified J1600 safety function rated **Performance Level c (PL c)**. It supervises how fast the vehicle travels and feeds the speed-dependent behavior of the other safety functions.

How it is built

The function rests on dedicated certified hardware in the [safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/):

- a safety-certified driving-speed encoder;
- a safety-certified driving-direction encoder;
- an independent safety controller;
- two safety-certified motor controllers.

Because the direction encoder is part of the certified chain, supervision covers both forward and reverse travel — the J1600's 360-degree protective field supports autonomous driving in both directions.

Why speed is safety-relevant

The J1600's top speed is 5.4 km/h (1.5 m/s / 3.4 mph). Its protective field is speed-dependent: the field changes with travel speed and expands at higher speeds, so the vehicle always monitors a zone matched to its current motion. Reliable speed measurement is what makes that adjustment trustworthy — 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/) (PL d).

Speed monitoring also underpins the certified [braking](https://info.mobilerobot.com/safety-compliance/safety-functions/braking/) (https://info.mobilerobot.com/safety-compliance/safety-functions/braking/) function (PL d), which stops the vehicle when a person enters the field or an emergency stop is triggered.

Related pages

- [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/) — how field size follows speed.
- [Person detection](https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/) (https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/) — what happens when someone enters the field.
- [Performance levels](https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) (https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) — all assigned levels in one table.

PRELIMINARY SPECIFICATION

Performance Levels come from the preliminary January 2026 product documentation and are subject to change.

Safety-Field Adjustment

Safety-field size adjustment is a certified J1600 safety function rated **Performance Level d (PL d)**. It matches the size of the protective field to the vehicle's current speed.

The 360-degree protective field

Two 2D safety LiDAR scanners, mounted front and rear on the chassis, together cover the vehicle's full perimeter. The resulting 360-degree protective field supports autonomous travel in both forward and reverse — including certified safe reversing without specially marked target zones.

Speed-dependent sizing

The protective field is not static:

- the field changes with travel speed;
- it expands as speed increases, up to the top speed of 5.4 km/h (1.5 m/s);
- certified [speed monitoring](https://info.mobilerobot.com/safety-compliance/safety-functions/speed-monitoring/) (https://info.mobilerobot.com/safety-compliance/safety-functions/speed-monitoring/) (PL c), built on safety-certified speed and direction encoders, supplies the speed signal.

A faster vehicle needs more room to react, so the monitored zone grows with speed. When a person enters the active field, 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) respond.

Visible status on the floor

People near the vehicle can see what is protected:

- three blue light strips display the current safety zone in automatic mode;
- white light indicates manual mode;
- floor-indicator lights signal automatic operation.

Related pages

- [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/) — why the 2D safety LiDARs are separate from the 3D navigation LiDAR.
- [Safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) — the complete certified component list.
- [Performance levels](https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) (https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) — all assigned levels in one table.

PRELIMINARY SPECIFICATION

Performance Levels are preliminary (January 2026) and subject to change. Exact field geometries and safety-distance curves are not available.

Person Detection

Person detection in the safety field is a certified J1600 safety function rated **Performance Level d (PL d)** (<https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/>) — the highest level assigned to any J1600 safety function.

How it works

Two 2D safety LiDAR scanners, mounted front and rear on the chassis, monitor a 360-degree protective field around the vehicle. The field covers forward and reverse autonomous travel and is speed-dependent: it expands as the vehicle drives faster, so detection distance grows with speed. 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/>).

Detection feeds an independent safety controller, and the certified [braking](https://info.mobilerobot.com/safety-compliance/safety-functions/braking/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/braking/>) function (PL d) provides the [stopping reaction](https://info.mobilerobot.com/support/troubleshooting/obstacle-or-safety-field-stops/) (<https://info.mobilerobot.com/support/troubleshooting/obstacle-or-safety-field-stops/>). This chain is built from [certified safety components](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/>) and runs separately from the 3D navigation system.

Detection vs. obstacle avoidance

The J1600 also [avoids obstacles](https://info.mobilerobot.com/products/j1600/navigation-and-obstacle-avoidance/) (<https://info.mobilerobot.com/products/j1600/navigation-and-obstacle-avoidance/>) using its 3D LiDAR map and RGB AI camera — but that is a navigation capability, not the certified protection layer. Person detection belongs to the independent 2D safety stack, so personnel protection does not depend on the AI navigation software. The distinction is explained in [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 bystanders see

Three blue floor light strips display the currently protected area during automatic operation, so people nearby can see the active safety zone. White light indicates

manual mode.

Operator's part

Before autonomous operation starts, the robot instructs the operator to step away — person detection protects people who end up in the vehicle's path, but the design keeps people clear of the field from the start. See [Human responsibilities](https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/>).

PRELIMINARY SPECIFICATION

Performance Levels are preliminary January 2026 specifications and are subject to change. For detection ranges, field geometries, and stopping distances, use current product documentation for deployment decisions.

Load Detection

Load detection is a certified J1600 safety function rated **Performance Level b (PL b)**. A dedicated load-detection sensor is part of the vehicle's [safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/>).

What the vehicle senses

The load-detection sensor lets the vehicle register whether it is carrying a load. Load state matters to safe operation: the J1600's rated payload is 1,600 kg (about 3,500 lb), and [performance figures](https://info.mobilerobot.com/products/j1600/dimensions-and-performance/) (<https://info.mobilerobot.com/products/j1600/dimensions-and-performance/>) differ between loaded and unloaded travel — for example, fork lifting speed is 0.10 m/s without load and 0.08 m/s at full load. A lifting-height sensor is also fitted as part of the control system.

The limits load detection works within

Load detection is a sensor function, not a substitute for load limits or judgment:

Limit	Value
Rated payload	1,600 kg / about 3,500 lb
Maximum pallet or load length, including overhang	1,250 mm / 49 in
Maximum pallet or load width, including overhang	1,250 mm / 49 in
Maximum load height from floor	1,700 mm / 67 in
Carrier type	Open-base, forkable, no bottom deck board

The operator's part

Judging load stability stays with the operator: pallet condition, stacking, top-heaviness, and whether a carrier is suitable at all. Pallet pickup is always manual, and no [blanket approval](https://info.mobilerobot.com/safety-compliance/safe-deployment/approved-loads-and-pallets/) exists for every carrier or for hazardous materials. See [Human responsibilities](https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/).

Related pages

- [Performance levels](https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) — all assigned levels in one table.
- [Technical specifications](https://info.mobilerobot.com/products/j1600/technical-specifications/) — full load and dimension data.

PRELIMINARY SPECIFICATION

Performance Levels come from the preliminary January 2026 product documentation and are subject to change.

Mode Selection

Automatic/manual mode selection is a certified J1600 safety function rated **Performance Level c (PL c)** (<https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/>). It guarantees that the vehicle is always in a deliberately chosen state: powered off, manual, or automatic.

The key switch

A three-position key switch selects:

Position	State
Power off	Vehicle powered down
Manual	Manual tiller operation only
Automatic	Autonomous task execution permitted

Entering automatic mode

Turning the key to automatic is not enough on its own. The sequence requires **deliberate operator action at every step** (<https://info.mobilerobot.com/safety-compliance/safe-deployment/operator-responsibilities/>):

1. The operator creates or selects a task on the touchscreen.
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 **begins autonomous operation** (<https://info.mobilerobot.com/documentation/user-guides/autonomous-operation/>).

The operator only confirms when the environment is ready — **this judgment stays human** (<https://info.mobilerobot.com/safety-compliance/safety-overview/human-responsibilities/>). See **Manual and autonomous mode safety** (<https://info.mobilerobot.com/safety-compliance/safety-overview/manual-and-autonomous-mode-safety/>).

Leaving automatic mode

Automatic mode ends immediately when:

- the operator grabs or moves the tiller ([tiller detection](https://info.mobilerobot.com/safety-compliance/safety-functions/tiller-detection/) (https://info.mobilerobot.com/safety-compliance/safety-functions/tiller-detection/), PL c);
- an emergency-stop control is used;
- the key switch is turned to manual or power off.

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/).

Mode visibility

White light indicates manual mode; blue floor light strips display the protected area during automatic operation, and floor-indicator lights signal automatic mode to people nearby.

PRELIMINARY SPECIFICATION

Performance Levels come from the preliminary January 2026 product documentation and are subject to change.

Tiller Detection

Tiller-position detection is a certified J1600 safety function rated **Performance Level c (PL c)**. The tiller — the handle familiar from any walk-behind electric pallet jack — doubles as a safety device.

Two tiller-position switches

The [safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/>), includes two dedicated tiller-position switches:

- **Emergency-stop switch.** One tiller position acts as an emergency stop.
- **Manual-control switch.** Another tiller position enables manual control.

Certified detection of the tiller's position is what makes both behaviors reliable.

Instant takeover

During autonomous operation, grabbing or moving the tiller returns the vehicle to manual control immediately. There is no menu, code, or delay — immediate human intervention is central to the [dual-mode](https://info.mobilerobot.com/products/j1600/dual-mode/) (<https://info.mobilerobot.com/products/j1600/dual-mode/>) concept. Tiller takeover works alongside the three emergency-stop buttons and the belly button; the full set of stop controls is listed in [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/>).

A familiar tool by design

One of the product's [design principles](https://info.mobilerobot.com/company/about/our-approach-to-automation/) (<https://info.mobilerobot.com/company/about/our-approach-to-automation/>) is that the tiller and manual behavior should feel like a conventional electric pallet jack, so an experienced operator needs only about 30 minutes of training. The [safety design](https://info.mobilerobot.com/safety-compliance/safety-overview/how-j1600-safety-works/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/how-j1600-safety-works/>) builds on that familiarity: the natural reaction of reaching for the handle is also the takeover mechanism.

Related pages

- [Mode selection](https://info.mobilerobot.com/safety-compliance/safety-functions/mode-selection/) (https://info.mobilerobot.com/safety-compliance/safety-functions/mode-selection/) — the key switch and confirmation sequence (PL c).
- [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/) — safety behavior in each mode.
- [Performance levels](https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) (https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) — all assigned levels in one table.

PRELIMINARY SPECIFICATION

The assigned Performance Levels are preliminary January 2026 specifications and subject to change.

Charging Safety

Charging the J1600 is covered by a certified safety function: the **charging-current relay**, rated **Performance Level b (PL b)**. This page collects the safety-relevant facts about the battery and both charging methods.

The battery

Parameter	Value
Battery	24 V, 200 Ah
Chemistry	Lithium iron phosphate (LiFePO4)
Charging rate	About 47 percentage points per hour
Transport testing	UN Manual of Tests and Criteria, subsection 38.3 (UN 38.3)
Regulatory coverage	Regulation (EU) 2023/1542 — Batteries Regulation

[LiFePO4 chemistry](https://info.mobilerobot.com/documentation/technical-reference/battery-specifications/) (<https://info.mobilerobot.com/documentation/technical-reference/battery-specifications/>) is part of the vehicle's industrial-use design, alongside its certified safety architecture. 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/>), the standard transport-safety test series for lithium batteries.

Charging-current relay

The charging-current relay is one of the nine certified safety functions on the [Performance levels](https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/>) table. It governs the charging current path between charger and vehicle.

Manual charging

Manual charging works like charging a conventional electric pallet jack: plug in the charger during a break or when the machine is idle.

Automatic charging

With the optional automatic charger, the robot drives to the station, positions itself at the charger, and a charging interface extends to the vehicle's charging plates — no human contact with the connection is needed. This supports [opportunity charging](https://info.mobilerobot.com/applications/scenarios/automatic-charging/) (<https://info.mobilerobot.com/applications/scenarios/automatic-charging/>) while the robot is not busy. Automatic charging is an advanced automation capability; when purchased, its setup is part of installation Day 1.

Related pages

- [Safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (<https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/>) — where the charging-current relay sits among the certified components.
- [Performance levels](https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/) (<https://info.mobilerobot.com/safety-compliance/safety-functions/performance-levels/>) — all assigned levels in one table.
- [Technical specifications](https://info.mobilerobot.com/products/j1600/technical-specifications/) (<https://info.mobilerobot.com/products/j1600/technical-specifications/>) — full battery and power data.

PRELIMINARY SPECIFICATION

Performance Levels come from the preliminary January 2026 product documentation and are subject to change.

Performance Levels

A **Performance Level (PL)** describes the reliability of a safety function in a machine's control system, defined by [EN ISO 13849-1](https://info.mobilerobot.com/safety-compliance/standards/iso-13849-1/) (<https://info.mobilerobot.com/safety-compliance/standards/iso-13849-1/>). Levels run from PL a (lowest) to PL e (highest). The J1600's certified safety functions are assigned levels from PL b to PL d.

Assigned levels

Safety function	Performance Level	Details
Braking system	PL d	Braking (https://info.mobilerobot.com/safety-compliance/safety-functions/braking/)
Emergency-stop button	PL d	Emergency stops and manual takeover (https://info.mobilerobot.com/safety-compliance/safety-overview/emergency-stops-and-manual-takeover/)
Person detection in safety field	PL d	Person detection (https://info.mobilerobot.com/safety-compliance/safety-functions/person-detection/)
Safety-field size adjustment	PL d	Safety-field adjustment (https://info.mobilerobot.com/safety-compliance/safety-functions/safety-field-adjustment/)
Speed monitoring and control	PL c	Speed monitoring (https://info.mobilerobot.com/safety-compliance/safety-functions/speed-monitoring/)
Automatic/manual mode selection	PL c	Mode selection (https://info.mobilerobot.com/safety-compliance/safety-functions/mode-selection/)
Tiller-position detection	PL c	Tiller detection (https://info.mobilerobot.com/safety-compliance/safety-functions/tiller-detection/)
Load detection	PL b	Load detection (https://info.mobilerobot.com/safety-compliance/safety-functions/load-detection/)
Charging-current relay	PL b	Charging safety (https://info.mobilerobot.com/safety-compliance/safety-functions/charging-safety/)

Reading the table correctly

- The levels apply to **individual safety functions** within the [safety architecture](https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) (https://info.mobilerobot.com/safety-compliance/safety-overview/safety-architecture/) — they are not a statement that every subsystem shares the same PL.
- The highest-rated functions (PL d) are those protecting people directly: braking, emergency stop, person detection, and safety-field adjustment.

- EN ISO 13849-1:2023 appears in the J1600's preliminary [compliance list](https://info.mobilerobot.com/safety-compliance/certificates/compliance-statements/) (<https://info.mobilerobot.com/safety-compliance/certificates/compliance-statements/>) together with [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/>), the standard for driverless industrial trucks. 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 standards context.

PRELIMINARY SPECIFICATION

These Performance Levels come from the preliminary January 2026 product documentation and are subject to change. No [certificates](https://info.mobilerobot.com/safety-compliance/certificates/) (<https://info.mobilerobot.com/safety-compliance/certificates/>), test reports, declaration numbers, or notified-body information are published here; use current product documentation for deployment decisions.