

User Guide (en)

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MiR 250

Shelf Carrier

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Table of contents

1. About this document	8
1.1 Where to find more information	8
1.2 Version history	9
2. Product presentation	10
2.1 Main features of MiR250 Shelf Carrier	11
2.2 External parts	13
2.3 Internal parts	19
2.4 How MiR250 Shelf Carrier works	28
3. Accessing the internal parts	30
3.1 Front compartment	30
3.2 Rear compartment	31
3.3 Side compartments	33
3.4 MiR Shelf Carrier 250	33
4. Safety	35
4.1 Safety message types	35
4.2 General safety precautions	36
4.3 Intended use	41
4.4 Users	42
4.5 Foreseeable misuse	43
4.6 Warning label	43
4.7 Residual risks	44
5. Getting started	45
5.1 In the box	45

5.2 Unpacking MiR250 Shelf Carrier	46
5.3 Connecting the battery and powering up	49
5.4 Connecting to the robot interface	52
5.5 Driving the robot in Manual mode	54
5.6 Moving the robot by hand	56
5.7 Checking the hardware status	58
5.8 Mounting the nameplate	59
5.9 Enable MiR250 Shelf Carrier feature	60
5.10 Testing the top application	62
5.11 Shutting down the robot	64
6. Battery and charging	66
6.1 Charging the robot	66
6.2 Enabling fast swap and swapping out the lithium-ion battery	67
6.3 Battery storage and disposal	71
7. IT security	73
7.1 Managing users and passwords	73
7.2 Software security patches	73
7. Navigation and control system	75
7.3 System overview	75
7.4 User input	77
7.5 Global planner	77
7.6 Local planner	79
7.7 Obstacle detection	80
7.8 Localization	85

7.9 Motor controller and motors	88
7.10 Brakes	88
7. Safety system	90
7.11 System overview	90
7.12 Collision avoidance	94
7.13 Overspeed avoidance	99
7.14 Stability	100
7.15 Emergency stop buttons	100
7.16 MiR Shelf Carrier 250 safety functions	101
7.17 Light indicators and speakers	102
8. Commissioning	106
8.1 Analysis of the work environment	106
8.2 Risk assessment	108
8.3 Shelf specifications	109
8.4 Creating and configuring a map	112
8.5 Creating markers and positions	126
8.6 Creating a mission	135
8.7 Creating a footprint	139
8.8 Operating hazard zones	143
8.9 Brake test	147
8.10 Creating user groups and users	148
8.11 Creating dashboards	151
8.12 Creating a marker type	153
8.13 Updating MiR250 Shelf Carrier software	156

8.14 Creating backups	157
8.15 System settings	157
9. Usage	164
9.1 Creating the Prompt user mission	164
9.2 Creating the Try/Catch mission	169
9.3 Creating the Variable footprint mission	175
9.4 Creating the 80 cm doorway mission	178
9.5 Creating the Pick up and place shelf mission	185
9.6 Creating the Place shelf at VL-marker mission	190
9.7 Testing a mission	196
10. Unmounting the top module	197
11. Maintenance	201
11.1 Regular weekly checks and maintenance tasks	201
11.2 Regular checks and replacements	202
11.3 Battery maintenance	206
12. Packing for transportation	207
12.1 Original packaging	207
12.2 Packing the robot for transportation	208
12.3 Battery	209
13. Disposal of robot	210
14. Payload specifications	211
15. Interface specifications	212
15.1 Left side interfaces	212
15.2 Right side interfaces	214

16. Error handling	219
16.1 Software errors	219
16.2 Hardware errors	220

1. About this document

This user guide explains how to set up and start operating your MiR250 Shelf Carrier and provides examples of simple missions you can expand to your purposes. This guide also contains information regarding the external and internal components of MiR250 Shelf Carrier along with a guide for proper maintenance of the robot. You will also find information regarding safety and specifications needed to commission a safe MiR250 Shelf Carrier robot application.



NOTICE

Save this manual. It contains important safety and operating instructions.

1.1 Where to find more information

At [the MiR website](#), you can find the following resources under the **Manuals** tab on each product page:

- **Quick starts** describe how you start operating MiR robots quickly. This document is in print in the box with the robots. Quick starts are available in multiple languages.
- **User guides** provide all the information you need to operate and maintain MiR robots. User guides are available in multiple languages.
- **Risk Analysis Guides** include guidelines on how to create a risk assessment of your robot solution.
- **Commissioning guides** describe how to commission your robot safely and prepare it to operate in the workplace.
- **Operating guides** describe how to set up and use top modules and accessories, such as charging stations, hooks, shelf lifts, and pallet lifts.
- **Getting started guides** describe how to set up products that are mainly software-based, such as MiR Fleet.
- **Reference guides** contain descriptions of all the elements of the robot interface and MiR Fleet interface. Reference guides are available in multiple languages.
- **REST API references** for MiR robots, MiR hooks, and MiR Fleet.
- The **MiR network and WiFi guide** specifies the performance requirements of your network and how you must configure it for MiR robots and MiR Fleet to operate successfully.

1.2 Version history

This table shows current and previous versions of this document.

Revision	Release date	Description	HW
1.0	2020-06-26	First edition	1.0
1.1	2020-07-01	Minor corrections throughout manual.	1.0

2. Product presentation

MiR250 Shelf Carrier is an autonomous mobile robot with a top module mounted to it. It is designed to transport wheeled shelves indoors within production facilities, warehouses, and other industrial locations where access to the public is restricted.



Users operate MiR250 Shelf Carrier via a web-based user interface, which is accessed via a browser on a PC, smartphone, or tablet. Each robot has its own network—see [Connecting to the robot interface on page 52](#). The robot can be set up to run a fixed route, be called on demand, or perform more complex missions.

The robot interface of MiR250 Shelf Carrier can be accessed via Google Chrome, Apple Safari, Mozilla Firefox, and Microsoft Edge browsers.

The robot uses a map of its work area to navigate and can move to any position on the map—see [Navigation and robot system on page 1 - REF-FAIL](#). The map can be created or imported the first time the robot is used. While operating, the robot avoids obstacles, like people and furniture, that are not mapped.

MiR250 Shelf Carrier is available both in an ESD approved version, which is black, and a non-ESD approved version, which is gray.

MiR250 Shelf Carrier transports shelves that are designed according to the specifications in [Shelf specifications on page 109](#). To ensure that the robot has enough traction to pull a payload of up to 300 kg, a traction kit is installed within the robot.



The payload includes both the weight of the shelf itself and the load on the shelf.



Specifications for MiR250 Shelf Carrier are available on the MiR website.

2.1 Main features of MiR250 Shelf Carrier

The main features of the MiR250 Shelf Carrier are:

- **Driving in a populated workspace**
The robot is designed to operate among people and maneuvers safely and efficiently in even highly dynamic environments.
- **Overall route planning and local adjustments**
The robot navigates autonomously to find the most efficient paths to its destinations. The robot adjusts the path when it encounters obstacles that are not on the map, like personnel and vehicles.
- **Efficient transportation of shelves**
The robot is designed to automate transportation of loaded shelves with a weight of up to 300 kg.
- **Sound and light signals**
The robot continuously signals with light and sounds indicating where it will drive and its current status, for example waiting for a mission, driving to a destination, or destination reached.
- **User-friendly and flexible**
The web-based user interface, accessed from a PC, tablet, or smartphone, gives easy access to operation and monitoring of the robot and can be programmed without any prior experience. Different user group levels and tailored dashboards can be set up to suit different users.
- **Alert for 'lost'**
If the robot enters a situation where it is unable to find a path to its destination, it stops, turns on the yellow-purple running error light, and a custom defined **Try/Catch** action may be used to alert personnel or take other actions—see [Creating the Try/Catch mission on page 169](#).

- **Automatic deceleration for objects**

The built-in sensors ensure that the robot is slowed down when obstacles are detected in front of it.

- **Internal map**

The robot can either use a floor plan from a CAD drawing, or a map can be created by manually driving the robot around the entire site in which the robot is going to operate. When the robot is mapping, the robot's sensors detect walls, doors, furniture, and other obstacles, and the robot then creates a map based on these input. After you've finished mapping, you can add positions and other features in the map editor.

2.2 External parts

This section presents the parts of MiR250 Shelf Carrier that are visible on the outside.



Pos.	Description	Pos.	Description
1	Corner bumper: four pcs, one on each corner	2	Front cover: opens to front compartment—see Internal parts on page 19
3	Swivel wheel with foot guard: four pcs, one in each corner	4	3D depth camera: two pcs, both in the front
5	Nanoscan3 safety laser scanner: two pcs, in opposite corners	6	Status light: on all four sides of the robot—see Light indicators and speakers on page 102
7	Side cover: opens to side	8	Control panel—see Control

Pos.	Description	Pos.	Description
	compartment—see Internal parts on page 19		panel on page 15
9	Manual brake release switch—see Control panel on the next page	10	Rear cover: opens to rear compartment—see Internal parts on page 19
11	Signal light: eight pcs, two on each corner—see Light indicators and speakers on page 102	12	Proximity sensor: eight pcs, two in each corner behind corner covers—see (linked document is not in XML format) REF-FAIL
13	Emergency stop button	14	Rear carrier pin
15	Front carrier pin		

Identification label

MiR250 Shelf Carrier is delivered with an identification label mounted to the product. The identification label identifies the product, the product serial number, and the hardware version of the product.

The identification label of MiR250 is located on the rear cover next to the battery, and the identification label of MiR Shelf Carrier 250 is located on the frame beneath its cover.

Item number:	800255
Product serial number:	204403000
Hardware version:	V.1

Figure 2.1. Example of a MiR250 Shelf Carrier identification label.

Nameplate

Every MiR application is delivered with a nameplate that must be mounted to the robot. The nameplate of MiR250 Shelf Carrier identifies the application model and serial number and includes the CE mark, the technical specifications, and the address of Mobile Industrial Robots. The nameplate identifies the complete MiR application, for example, a robot with a top module.

It is the responsibility of the commissioner to place the nameplate on the application—see [Mounting the nameplate on page 59](#).

Mass unloaded :	133 kg	Dimension	495x210x75 mm	Contains FCC ID: TV7RB952-5AC2ND
Rated speed :	1.2 m/s	Nominal power :	2x537 W	Contains FCC ID: RYK-261ACNBT
Max slope :	1 %	Type :	Driverless truck	
Rated drawbar pull :	0	Model :	MiR250 Shelf Carrier	This device complies with part of the FCC
Max supporting force:	0	S/N :	100703000	Rules. Operation is subject to the following
		Year of construction :	2020	two conditions:
Coupling height	383 mm			(1) This device may not cause harmful inter-
Max payload footprint :		Mobile Industrial Robots ApS		ference, and (2) this device must accept any
Lithium ion battery		Emil Neckelmannsvej 15F		interference received, including interferen-
Nominal voltage :	48 V	5220 Odense SØ		ce that may cause undesired operation.
Rated capacity :	34.2 Ah			
Mass :	14 kg			



Figure 2.2. Example of a MiR250 Shelf Carrier nameplate.

Control panel

MiR250 Shelf Carrier has a control panel in the rear-left corner of the robot.

The Operating mode key

The Operating mode key lets you switch between operating modes.

- **Left position: Autonomous mode**
Puts the robot in Autonomous mode.



- **Middle position: Locked**

Locks the robot. The robot blocks the wheels; you cannot start a mission or drive the robot manually.



- **Right position: Manual mode**

Puts the robot in Manual mode.



For more information on operating modes—see [Operating modes on page 19](#).

The control panel buttons

The following table identifies the three buttons on the control panel.



Pos.	Description	Pos.	Description
1	Manual stop	2	Resume
3	Power		

Manual stop

Pressing this button stops the robot. After pressing this button, you must press the Resume button to let the robot continue operating.

Color indication:

- Red: It is possible to engage the Manual stop.

Resume

Pressing this button:

- Clears the Emergency stop state.
- Lets the robot continue operating after the Manual stop button was pressed or after the operating mode change.
- Lets the robot start operating after powering up.

Color indication:

- Blinking blue: The robot is waiting for a user action (clear the Emergency stop state, acknowledge the change of operating mode).

Power

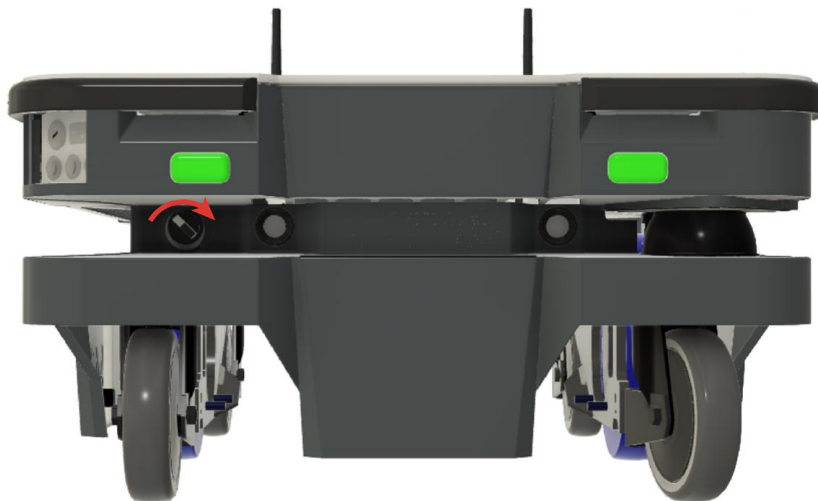
Pressing this button for three seconds turns the robot on or shuts it off.

Color indication:

- Blue: The robot is off.
- Blinking green: The robot is starting up.
- Green: Normal operation.
- Blinking red: The battery level is too low to start without additional charging or the robot is shutting down.

Manual brake release switch

The manual brake release switch is located below the control panel and releases the mechanical brakes on MiR250 Shelf Carrier. You release the brakes by turning the Manual brake release switch clockwise.



The mechanical brakes require electrical power to be released, so if the robot is without power, the mechanical brakes cannot be released.

When driving in Autonomous mode, the robot engages and releases the mechanical brakes automatically.



The robot cannot operate while the mechanical brakes are released.

Operating modes

MiR250 Shelf Carrier has two operating modes: Manual mode and Autonomous mode.

Manual mode

In this mode, you can drive the robot manually using the joystick in the robot interface. Only one person can control the robot manually at a time. To ensure that nobody else takes control of the robot, the robot issues a token to the device on which you activate the Manual mode.

For information about activating this mode—see [Driving the robot in Manual mode on page 54](#).

Autonomous mode

In this mode, the robot executes the programmed missions. After switching the key to this mode, you can remove the key, and the robot will continue driving autonomously. In autonomous mode, the joystick is disabled in the robot interface.

2.3 Internal parts

Most internal parts of MiR250 Shelf Carrier are accessed through covers that open to different compartments:

- Front compartment
- Rear compartment
- Side compartments
- Top compartments



CAUTION

Removing covers from the robot exposes parts connected to the power supply, risking damage to the robot from a short circuit and electrical shock to personnel.

- Disconnect the battery by turning the Battery disconnect switch.

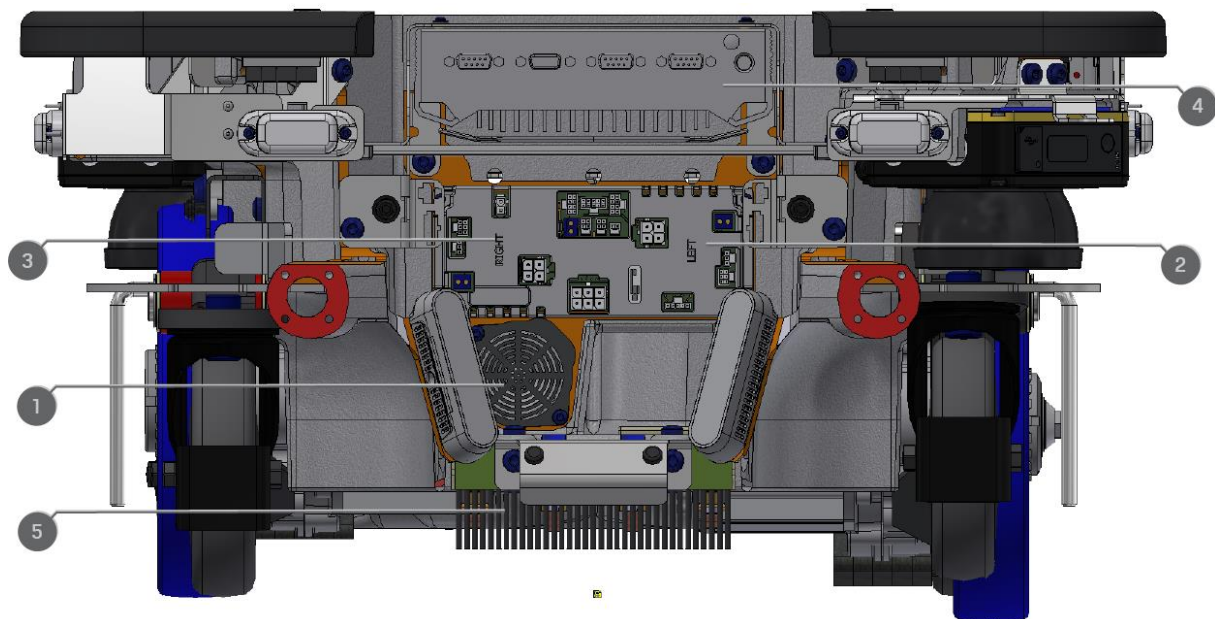
Front compartment

The front compartment holds several electronic components, such as the robot computer and the carrier board.

To open the front compartment, see [Accessing the internal parts on page 30](#).

Front compartment components

The front compartment contains the following components:



Pos.	Description	Pos.	Description
1	Loudspeaker	2	Carrier board with motor controller controlling the left-

Pos.	Description	Pos.	Description
			side drivetrain
3	Carrier board with motor controller controlling the right-side drivetrain	4	Robot computer
5	Charging pads under robot and broom for keeping dirt away from the charging pads		

Rear compartment

The rear compartment holds the robot's battery, battery disconnect switch, power board, and safety PLC. The battery and Battery disconnect switch can be accessed without the use of tools. The other components in the rear compartment are only accessible via use of tools.

To open the rear compartment, see [Accessing the internal parts on page 30](#):

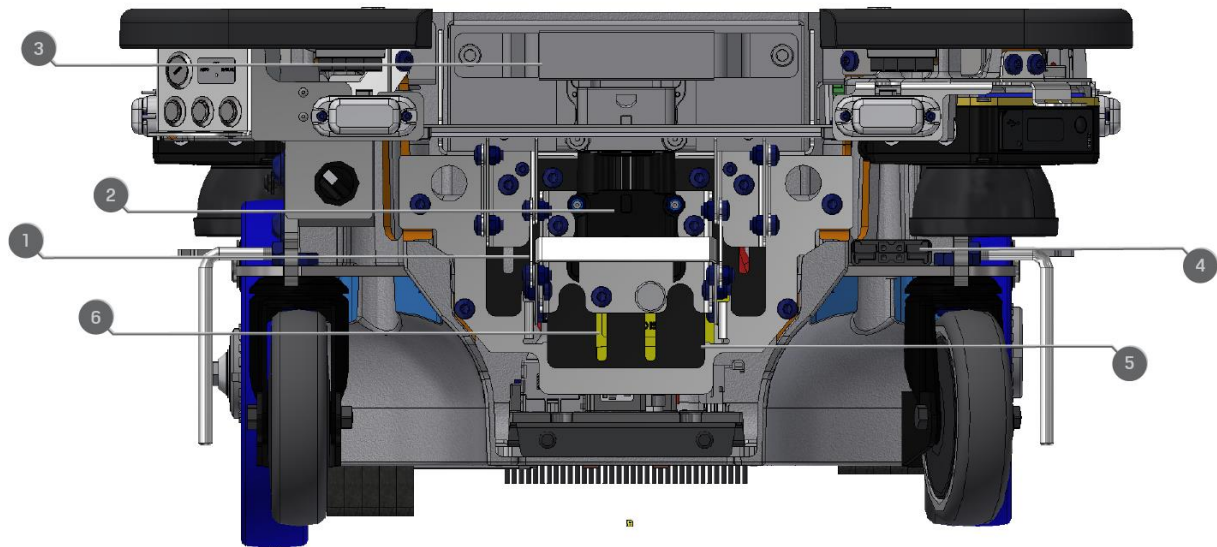


NOTICE

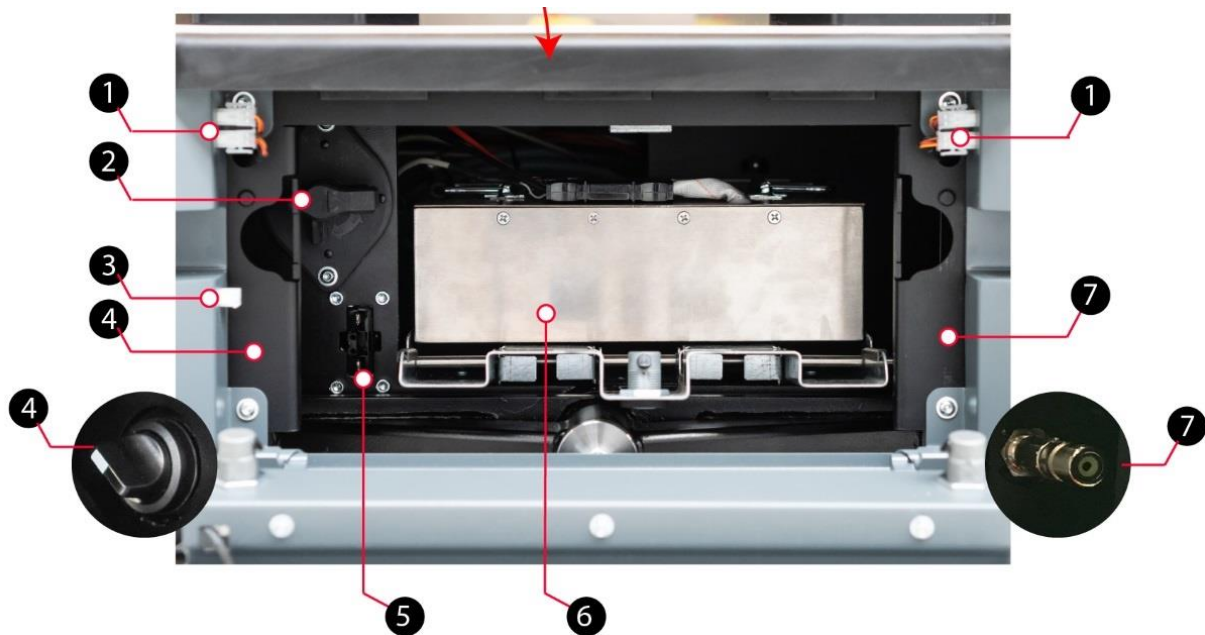
The unique nameplate of your robot is to be placed on the rear compartment cover—see [Mounting the nameplate on page 59](#). Make sure you do not swap the cover with covers from other robots.

Rear compartment components

The rear compartment contains the following main components:



Pos.	Description	Pos.	Description
1	Battery disconnect lever	2	Battery connector
3	Battery	4	Cable charging interface
5	Power board for motor controller, robot computer, and safety PLC	6	Safety PLC



Pos.	Description	Pos.	Description
1	Connectors for proximity sensors	2	Battery disconnect switch, shown in Off position
3	Connector for status light band	4	Brake release switch, shown in On position. When turned off, the brakes are released, and the robot can be pushed manually
5	Charging connection interface, for external charger	6	Battery with connector, main power to the robot
7	Connection interface for MiR Controller		

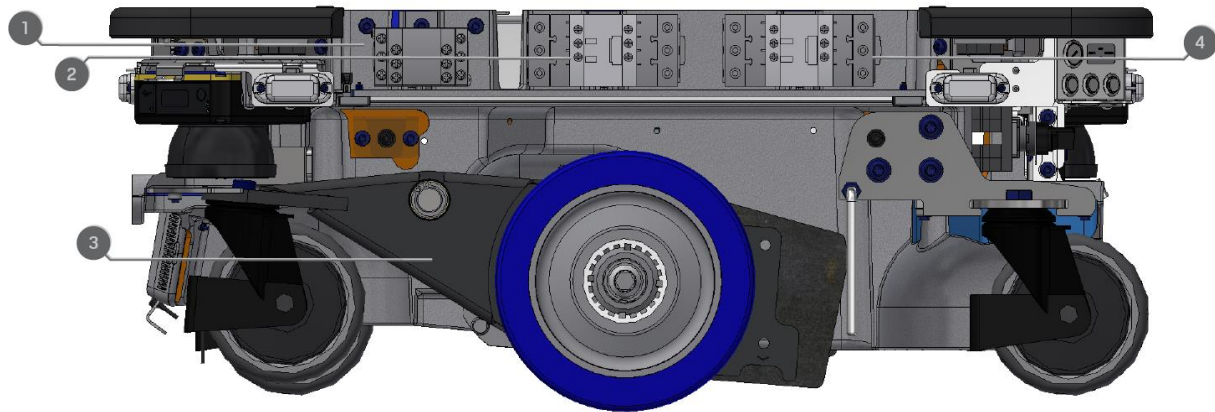
Side compartments

The side compartments contain the bogies, drive wheels, and safety contactors.

To open a side cover, see [Accessing the internal parts on page 30](#)

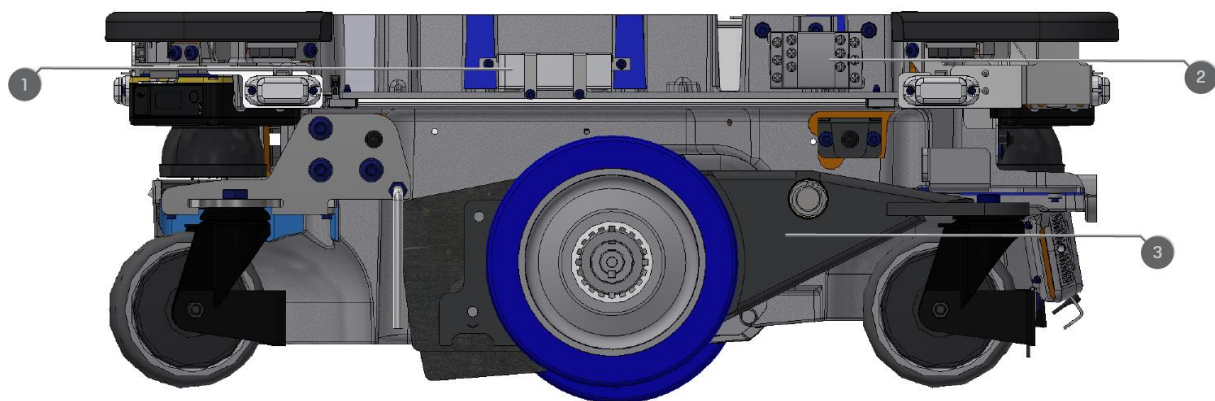
Side compartment components

The left side compartment contains the following components:



Pos.	Description	Pos.	Description
1	Safe Stop 1 contactor	2	Safe Torque Off (STO) contactor
3	Bogie and drivetrain consisting of motor, gearbox, encoder, brake, drive wheel, and assembly parts	4	Safe Torque Off (STO) contactor

The right side compartment contains the following components:



Pos.	Description	Pos.	Description
1	Router	2	Safe Stop 1 contactor
3	Bogie and drivetrain consisting of motor, gearbox, encoder, brake, drive wheel, and assembly parts		

Top compartments

The two top compartments contain electrical interfaces that can be connected to top modules.

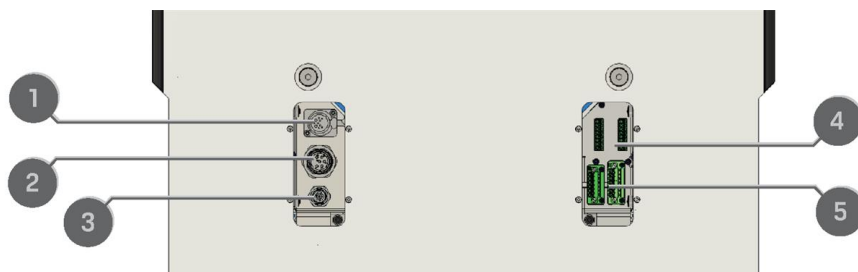


The top compartments are only accessible after the MiR Shelf Carrier 250 top module has been removed—see [Unmounting the top module on page 197](#).



Top compartment components

The top compartments contain the following electrical interfaces for top modules. For detailed information, see [Interface specifications on page 212](#).



Pos.	Description	Pos.	Description
1	Emergency stop	2	Auxiliary power connector
3	Ethernet	4	General purpose I/Os
5	Auxiliary safety functions I/Os		

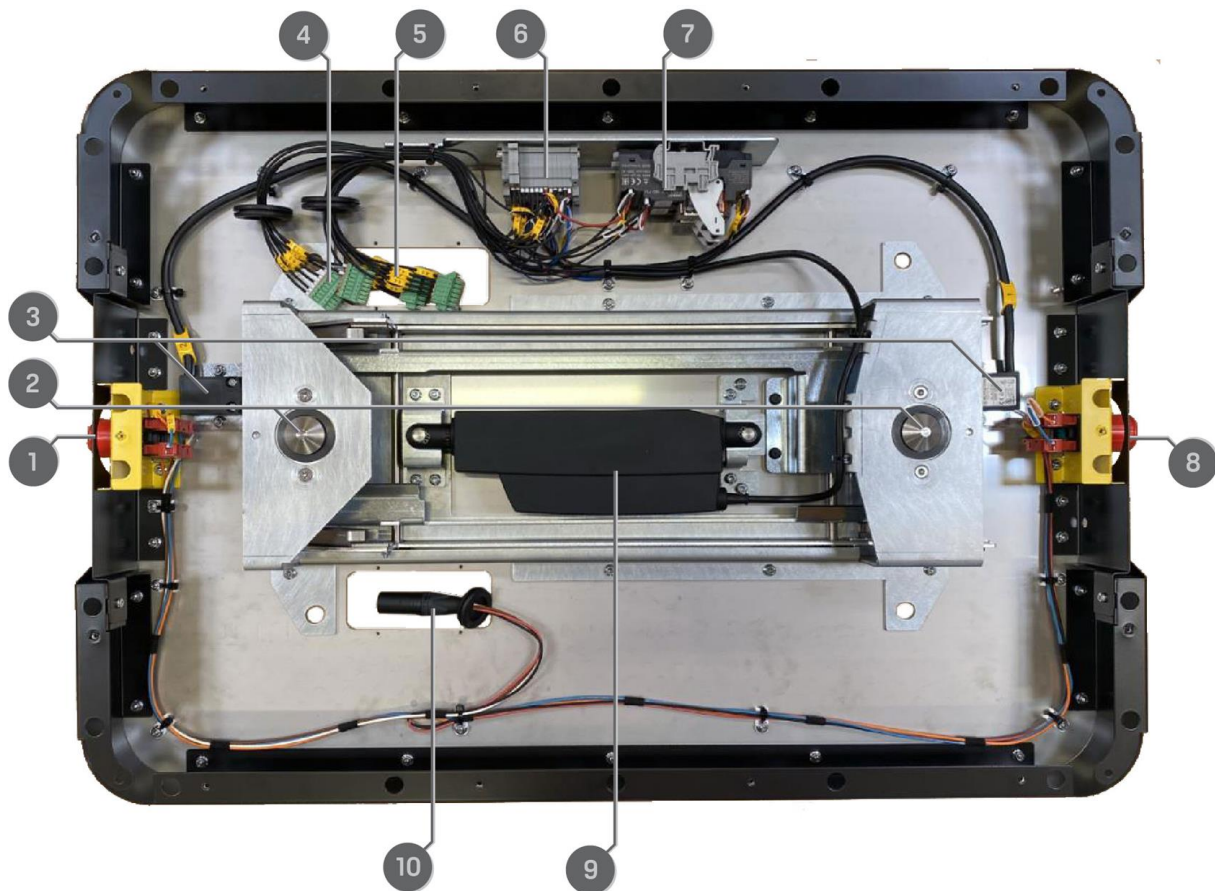
MiR Shelf Carrier 250

Within the shelf carrier top module there is an actuator and a lifting device to raise and lower the pins, sensor switches, and safety contactors.

To access the internal parts of MiR Shelf Carrier 250, see [Accessing the internal parts on page 30](#).

MiR Shelf Carrier 250 components

The MiR Shelf Carrier 250 contains the following components:



Pos.	Description	Pos.	Description
1	Front Emergency stop button	2	Carrier pins
3	Position switches	4	GPIO connectors
5	Auxiliary safety IO connectors	6	Fuse box
7	Safety contactors K1 and K2	8	Rear Emergency stop button
9	Lifting mechanism and actuator	10	Emergency stop connector

2.4 How MiR250 Shelf Carrier works

When MiR250 Shelf Carrier docks to a shelf, the carrier pins can be raised to pick up a shelf and lowered to place a shelf at a shelf position.

MiR250 Shelf Carrier uses I/O modules in the safety PLC to control the carrier pins. The robot uses two inputs and two outputs to communicate with MiR Shelf Carrier 250.

The outputs are used to control the position of the MiR250 Shelf Carrier, and the inputs are used to signal the current position of the MiR250 Shelf Carrier—see [Testing the top application on page 62](#).

To see the menu options for the I/O modules under **Setup > IO modules**, you must enable them first—see [Enable MiR250 Shelf Carrier feature on page 60](#).

Output	Function
2	Lowers the carrier pins when active.

3	Raises the carrier pins when active.
---	--------------------------------------

Input	Function
2	Is active when the carrier pins are down.

3	Is active when the carrier pins are up.
---	---

3. Accessing the internal parts

Most internal parts of MiR250 Shelf Carrier are accessed through covers that open to different compartments:

- Front compartment
- Rear compartment
- Side compartments
- Top compartments



CAUTION

Removing covers from the robot exposes parts connected to the power supply, risking damage to the robot from a short circuit and electrical shock to personnel.

- Disconnect the battery by turning the Battery disconnect switch.

3.1 Front compartment

Follow these steps to open the front compartment:

1. Unscrew the two screws holding the front cover with a Tx30 screwdriver.



2. Pull the front cover off of the robot.



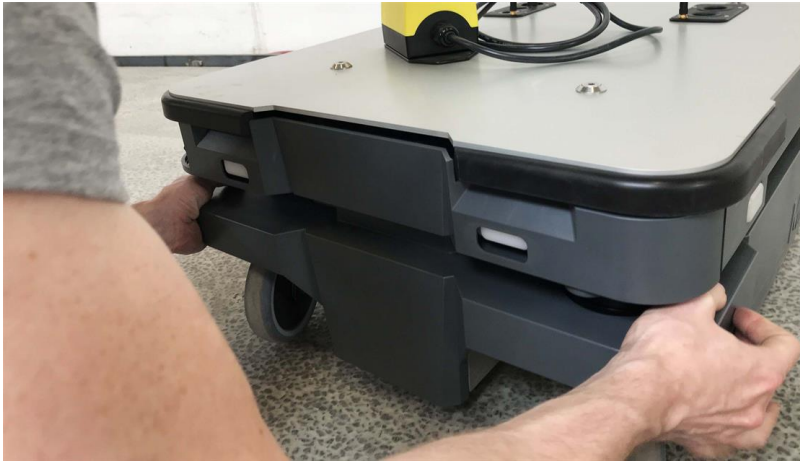
3.2 Rear compartment

Follow these steps to open the rear compartment:

1. Push the two white buttons at the same time.



2. Loosen the cover by wiggling both sides.



3. Pull off the cover.



3.3 Side compartments

Follow these steps to open a side cover:

1. Turn the two screws counterclockwise with a Tx30 screwdriver.



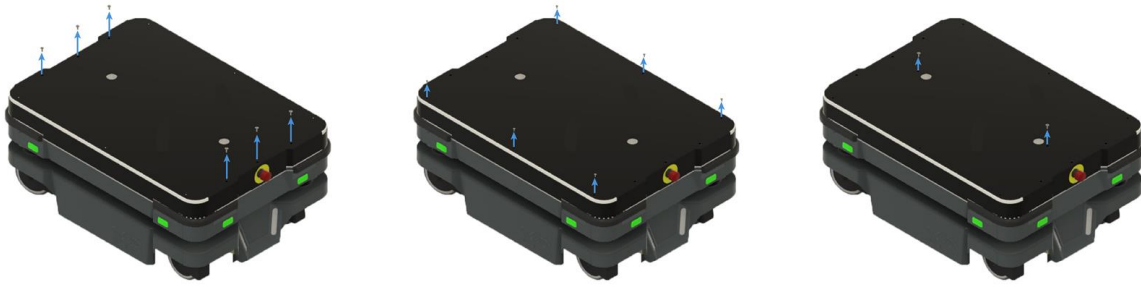
2. Pull the cover off.



The top compartments are only accessible after removing the MiR Shelf Carrier 250 top module—see [Unmounting the top module](#) on page 197.

3.4 MiR Shelf Carrier 250

To access the internal parts of MiR Shelf Carrier 250, remove the top plate of the shelf carrier by unscrewing all 14 screws from the top plate.



4. Safety

Read the information in this section before powering up and operating MiR250 Shelf Carrier.

Pay particular attention to the safety instructions and warnings.



NOTICE

Mobile Industrial Robots disclaims any and all liability if MiR250 Shelf Carrier or its accessories are damaged, changed, or modified in any way. Mobile Industrial Robots cannot be held responsible for any damages caused to MiR250 Shelf Carrier, accessories, or any other equipment due to programming errors or malfunctioning of MiR250 Shelf Carrier.

4.1 Safety message types

This document uses the following safety message types.



WARNING

Indicates a potentially hazardous situation that could result in death or serious injury. Carefully read the message that follows to prevent death or serious injury.



CAUTION

Indicates a potentially hazardous situation that could result in minor or moderate injury. Alerts against unsafe practices. Carefully read the message that follows to prevent minor or moderate injury.



NOTICE

Indicates important information, including situations that can result in damage to equipment or property.

4.2 General safety precautions

This section contains general safety precautions.



WARNING

If MiR250 Shelf Carrier is not running the correct software and is therefore not functioning properly, the robot may collide with personnel or equipment causing injury or damage.

- Ensure that MiR250 Shelf Carrier is always running the correct software.



WARNING

MiR250 Shelf Carrier risks damage and mechanical failure if it is used to transport pallets or anything other than safely commissioned shelves. Nearby equipment and personnel risk damage or injury if payloads fall from the robot.

- Only use MiR250 Shelf Carrier to transport safely commissioned shelves.



WARNING

Using a charging device different from the one supplied by the manufacturer can cause a fire and thereby burn injuries to nearby personnel and damage to the robot and equipment.

- Only use the original charger.



WARNING

MiR250 Shelf Carrier may drive over the feet of personnel, causing injury.

- All personnel must be informed of the side protective fields of MiR250 Shelf Carrier and be instructed to wear safety shoes near an operating robot.



WARNING

Contact with live electrical parts can cause electric shock.

- Do not touch any internal components of MiR250 Shelf Carrier while it is powered.



WARNING

Personnel standing in the blind spot of MiR250 Shelf Carrier when it is pivoting with a shelf risk being struck and injured.

- Ensure that all nearby personnel are instructed not to stand close to MiR250 Shelf Carrier when it is pivoting.
- Inform personnel that the signal lights indicate when the robot is intending to turn or pivot—see [Light indicators and speakers on page 102](#).



WARNING

MiR250 Shelf Carrier may drive into a ladder, scaffold, or similar equipment that has a person standing on it. Personnel risk fall injuries and equipment may be damaged.

- Don't place ladders, scaffolds, or similar equipment in the robot's work environment.



WARNING

The robot may drive down staircases or holes in the floor and cause serious injury to personnel and damage to the robot and to equipment.

- Mark descending staircases and holes as forbidden zones on maps.
- Keep the maps up to date.
- Inform personnel that the robot cannot detect descending staircases and holes in the floor in time to stop.



WARNING

Personnel that are within an operating hazard zone intended for placing and picking up shelves risk colliding with the robot and thereby injury if the robot is operating within the zone.

- Ensure that all nearby personnel are instructed to stay clear of operating hazard zones when MiR250 Shelf Carrier is in the zone.



WARNING

If a load is positioned incorrectly on a shelf, the load may fall off. Nearby personnel or equipment risk injury or damage.

- Ensure that each load is positioned correctly on the shelf. It is the responsibility of the commissioner to determine correct and safe methods of loading shelves.
- Conduct a brake test while the robot is transporting a fully loaded shelf—see [Brake test on page 147](#).



WARNING

If the robot attempts to dock to a shelf and the carrier pins are raised or the robot is misplaced, the robot may push the shelf. The shelf may collide with personnel or equipment, resulting in injury or damage.

- Ensure that docking positions are clearly marked as operating hazard zones with visible tape or similar marking, and that all personnel are instructed not to stand close to the robot when it is docking to a shelf.



WARNING

If the robot does not attach to the shelf correctly due to pins being offset from their correct positions, the shelf can detach at any time. Uncertain control of the shelf may result in the shelf or its load colliding with personnel or equipment resulting in injury or damage.

- Ensure the shelf is designed according to specifications—see [Shelf specifications on page 109](#). The laser scanners will then be able to detect if the shelf is incorrectly positioned and will enter Protective stop before operating with the shelf.



WARNING

If the robot drives on a slope and loses grip of the attached shelf, the shelf or its load may collide with personnel or equipment causing injury or damage.

- Do not operate MiR250 Shelf Carrier on slopes.



WARNING

If a shelf operates with loads that extend the footprint of the robot, the load may collide with personnel or equipment causing injury or damage.

- Do not load the shelves with loads that exceeds the robot footprint.



WARNING

Lithium battery packs may get hot, explode, or ignite and cause serious injury if they are misused electrically or mechanically.

Observe the following precautions when handling and using lithium-ion batteries:

- Do not short-circuit, recharge, or connect with false polarity.
- Do not expose to temperatures beyond the specified temperature range or incinerate the battery.
- Do not crush, puncture, or disassemble the battery. The battery contains safety and protection devices, which, if damaged, may cause the battery to generate heat, explode, or ignite.
- Do not allow the battery to get wet.
- In the event the battery leaks and the fluid gets into one's eye, do not rub the eye. Rinse well with water and immediately seek medical care. If left untreated, the battery fluid could cause damage to the eye.
- Use only the original charger (cable charger or charging station) and always follow the instructions from the battery manufacturer.
- Do not touch damaged batteries with bare hands. Only personnel using suitable Personal Protection Equipment (PPE) and tools should handle damaged batteries.
- Isolate the battery and keep clear if the following conditions are observed:
 - The battery exhibits abnormally high temperatures.
 - The battery emits abnormal odors.
 - The battery changes colors.
 - The battery case is deformed or otherwise differs from the normal electrical or mechanical condition.
- Modifications or manipulations of the battery may lead to considerable safety risks and are therefore prohibited.
- Do not use the battery on anything other than MiR250 Shelf Carrier.



CAUTION

Robot malfunctions can cause an electrical fire, causing damage and injury to equipment and personnel.

- Personnel operating near the robot must be informed on how to use an ABC fire extinguisher to put out an electrical fire should the robot malfunction and catch on fire.



CAUTION

Risk of trapping or injury to personnel if robots malfunction or if personnel enter operating hazard zones.

- Personnel operating near the robot must be informed on how to engage the robot's Emergency stop function in emergency situations.

4.3 Intended use

MiR250 Shelf Carrier is intended to be commissioned and used in indoor industrial environments where access for the public is restricted. For details about the environmental conditions in which MiR250 Shelf Carrier should operate, see specifications for MiR250 Shelf Carrier on our website.

MiR250 Shelf Carrier is intended to be commissioned according to the guidelines in [Commissioning on page 106](#). This is a prerequisite for safe usage of MiR250 Shelf Carrier.

MiR250 Shelf Carrier is equipped with safety-related features that are purposely designed for collaborative operation where the robot operates without a safety enclosure or together with people.

MiR250 Shelf Carrier is designed for and all risks are considered when it is used to transport shelves that fulfill the specification and design requirement described in [Shelf specifications on page 109](#).

MiR250 Shelf Carrier is a completed MiR application that consists of a MiR250 with a mounted MiR Shelf Carrier 250. The application is CE marked as long as it is not modified or altered. However, a CE marked application does not guarantee a CE marked setup. It is the responsibility of the commissioner to commission MiR250 Shelf Carrier safely.



NOTICE

A safe machine does not guarantee a safe system. Follow the guidelines in [Commissioning on page 106](#) to ensure a safe system.

4.4 Users

MiR250 Shelf Carrier is only intended to be used by personnel that have received training in their required tasks.

There are three types of intended users for MiR250 Shelf Carrier: commissioners, operators, and direct users.

Commissioners

Commissioners have thorough knowledge of all aspects of commissioning, safety, use, and maintenance of MiR250 Shelf Carrier and have the following main tasks:

- Commissioning of the product. This includes creating maps and restricting the user interface for other users and making brake tests with a full payload.
- Conducting the risk assessment.
- Determining the payload limit, weight distribution, safe fastening methods, safe loading and unloading of loads on MiR250 Shelf Carrier, and ergonomic loading and unloading methods if relevant.
- Ensuring the safety of nearby personnel when the robot is accelerating, braking, and maneuvering.
- Marking operating hazard zones.

Operators

Operators have thorough knowledge of MiR250 Shelf Carrier and of the safety precautions presented in this User guide. Operators have the following main tasks:

- Servicing and maintaining MiR250 Shelf Carrier.
- Creating and changing missions and map features in the robot interface.

Direct users

Direct users are familiar with the safety precautions in this user guide and have the following main tasks:

- Assigning missions to MiR250 Shelf Carrier.
- Fastening loads to MiR250 Shelf Carrier securely.
- Loading and unloading from a paused robot.

All other persons in the vicinity of MiR250 Shelf Carrier are considered indirect users and must know how to act when they are close to the robot. For example, they must be aware that visibly marked operating hazard zones must be respected.

4.5 Foreseeable misuse

Any use of MiR250 Shelf Carrier deviating from the intended use is deemed as misuse. This includes, but is not limited to:

- Using MiR250 Shelf Carrier to transport people
- Using MiR250 Shelf Carrier on steep surface grades, such as ramps
- Using the wrong SICK configuration
- Driving MiR250 Shelf Carrier on cross slopes
- Exceeding the total payload
- Using the Emergency stop button for anything other than emergency stops
- Positioning or fastening loads incorrectly according to the specifications
- Driving MiR250 Shelf Carrier with anything other than safely commissioned shelves
- Using MiR250 Shelf Carrier in medical and life critical applications
- Operating MiR250 Shelf Carrier outside the permissible operating parameters and environmental specifications
- Using MiR250 Shelf Carrier in potentially explosive environments
- Using MiR250 Shelf Carrier outdoors
- Using MiR250 Shelf Carrier in hygiene zones

4.6 Warning label

MiR250 Shelf Carrier is supplied with a warning label that specifies that it is strictly prohibited to ride on the robot.

The label must be placed on the robot or top module so that it is clearly visible.



4.7 Residual risks

Mobile Industrial Robots has identified the following potential hazards that commissioners must inform personnel about and take all precautions to avoid:

- You risk being run over, drawn in, trapped, or struck if you stand in the path of MiR250 Shelf Carrier or walk towards MiR250 Shelf Carrier or its intended path while it is in motion.
- You risk being run over, drawn in, trapped, or struck if you stand in the path of the robot or walk towards it while it is driving in reverse. It will only drive in reverse when undocking from a marker such as a charging station or load transfer station.
- You risk being crushed or trapped if you touch MiR250 Shelf Carrier while it is in motion.
- You risk being run over, drawn in, trapped, or struck if you stand in the path of MiR250 Shelf Carrier or walk towards it while it is docking to a shelf.
- You risk being crushed, run over, drawn in, or trapped if the robot places a load outside a designated drop-off area due to faulty localization.
- You risk losing control of MiR250 Shelf Carrier if it is accessed by unauthorized users. Consider increasing the IT security of your product—see [IT security on page 73](#).



NOTICE

Other significant hazards may be present in a specific robot installation and must be identified during commissioning.

5. Getting started

This section describes how to get started with MiR250 Shelf Carrier.

5.1 In the box

This section describes the contents of the MiR250 Shelf Carrier box.



The box contains:

- The MiR250 Shelf Carrier robot
- A MiR250 Shelf Carrier document folder containing a USB flash drive and the following printed documents:
 - *MiR250 Shelf Carrier Quick Start*
 - The CE declaration of Conformity for your application
 - *Getting the robot online*
 - *Passwords*
 - The unique nameplate for your application

- The USB flash drive in the document folder has the following content:
 - This user guide
 - *MiR250 Shelf Carrier Quick Start*
 - *MiR Network and WiFi guide*
 - *MiR Robot Reference guide*
 - *MiR Robot REST API Reference*
 - *Getting the robot online*

5.2 Unpacking MiR250 Shelf Carrier

This section describes how to unpack MiR250 Shelf Carrier.



Keep the original packaging for future transportation of the robot.

1. Place the box with the robot so that there is three meters of free space at the front or the back of the box. This is necessary as the robot drives out of the box on a ramp.
2. Cut the protective straps surrounding the box.



3. Remove the lid from the box.



4. Take the folder with the printed documents and the USB flash drive out of the box.

5. Remove the walls of the box and the protective foam blocks.



6. Place the lid of the box so that you can use it as a ramp. Align the lid so that it is flush with the base of the box.



5.3 Connecting the battery and powering up

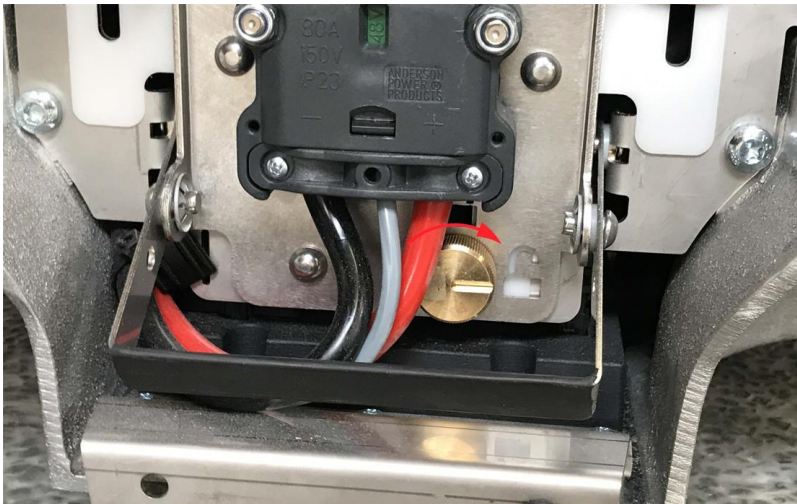
You must connect the battery before powering up the robot.

Connecting the battery

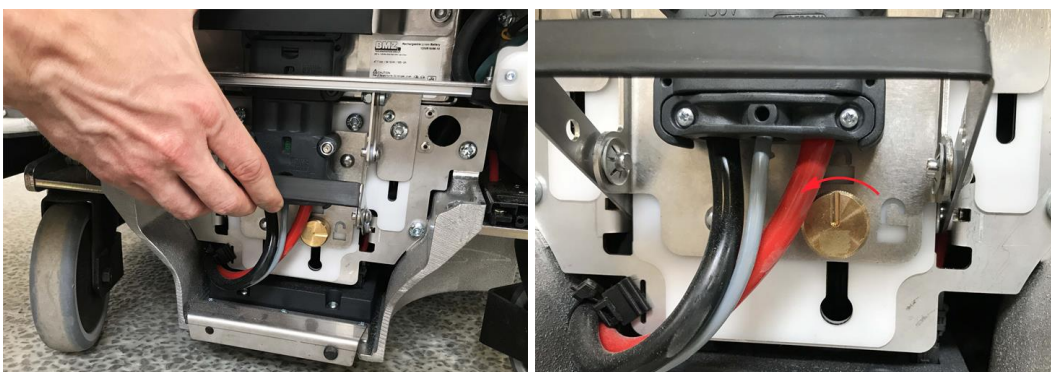
To connect the battery to the robot, you need to open the rear compartment—see [Accessing the internal parts on page 30](#).

Follow these steps to connect the battery to the robot:

1. Turn the battery lever lock clockwise to unlock the battery lever.



2. Pull up the lever to connect the battery connector to the battery. Then turn the battery lever lock counterclockwise to secure the battery lever.



3. Reattach the rear cover by inserting it into the two attachment sockets. When attaching the cover to the robot, press the two white buttons, and don't tilt the cover.



4. Click the cover in place.



Powering up

Follow these steps to power up the robot:

1. Press the Power button for three seconds to turn on the robot.



The status lights waver yellow, and the robot starts the software initialization process.



When the initialization process ends, the robot goes into Protective stop.



2. Press the Resume button to clear the Protective stop. The robot is now ready for operation.



5.4 Connecting to the robot interface

When the robot is turned on, it enables the connection to its WiFi access point. The name of the access point appears in the list of available connections on your PC, tablet, or phone.



NOTICE

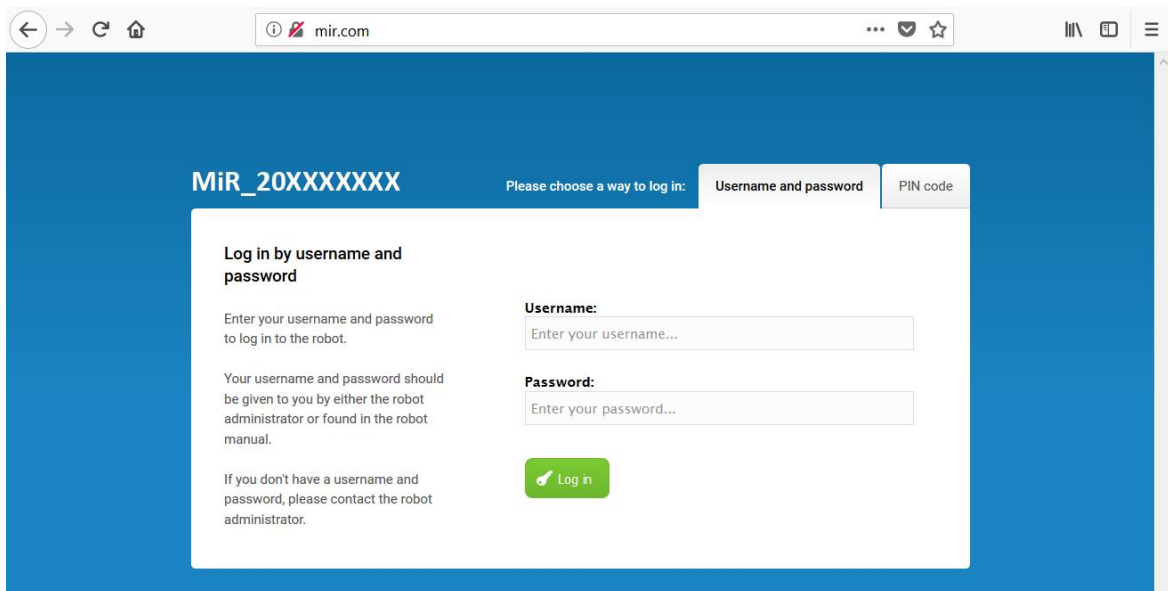
The username and password for the robot's WiFi access point and for accessing the web interface are in the MiR username and passwords document. The document is in the box with the robot.

Follow these steps to connect to the robot interface:

1. Using your pc, tablet, or phone, connect to the WiFi access point of the robot. The access point name has the following format: MiR20XXXXXXX



2. In a browser, go to the address mir.com and sign in.



3. Switch to Manual mode, and drive the robot down the ramp—see [Driving the robot in Manual mode on the next page](#).

5.5 Driving the robot in Manual mode



CAUTION

When driving the robot in manual mode, it is possible to mute the personnel detection means and drive the robot into Forbidden zones and Unpreferred zones in the map. This means that the robot will only stop when very close to an obstacle and will not respond to zones on the map. This can result in injury to personnel or damage to equipment if the robot is not driven carefully.

- Drive carefully to avoid collisions with any personnel or objects when driving the robot in Manual mode.
- Avoid driving the robot manually without a clear visual of the robot.



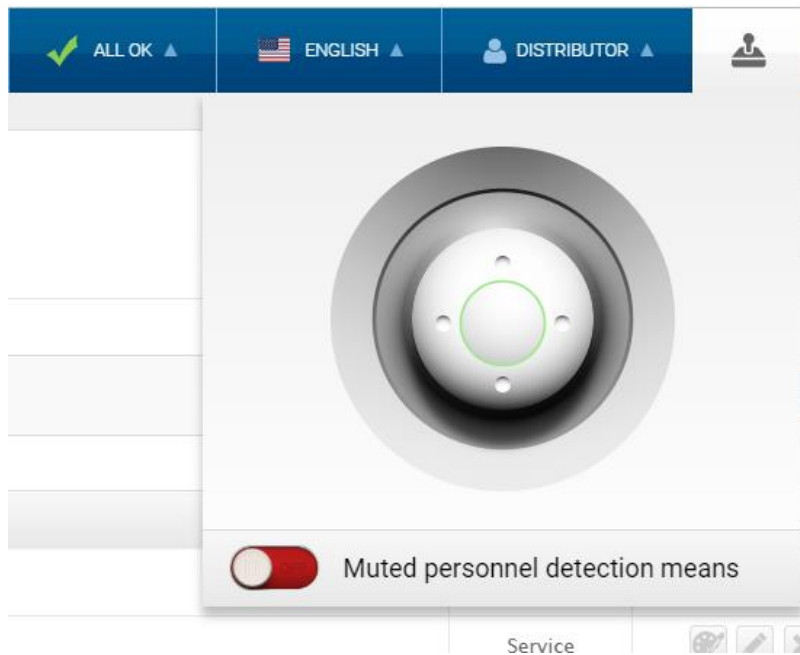
NOTICE

Place your foot in front of the ramp while the robot drives on it to keep the ramp from slipping.

To drive the robot in Manual mode, follow these steps:

1. On the robot, turn the Operating mode key into Manual mode (turn it to the right).
2. In the robot interface, select **Manual control**. The Resume button on the robot starts blinking.

3. In the robot interface, select the joystick icon. The joystick control appears.



4. On the robot, press the Resume button. The status lights turn blue, indicating that the robot is in Manual mode.



5. Drive the robot off the ramp using the joystick.



5.6 Moving the robot by hand

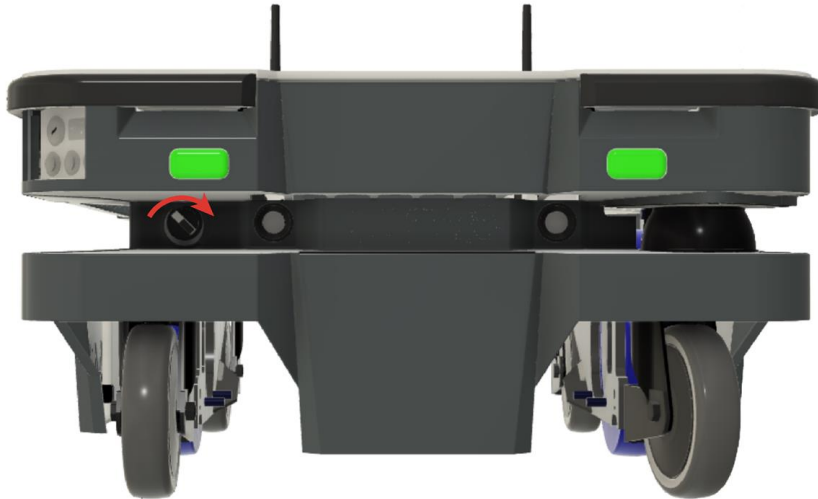
You should generally avoid moving the robot by hand, but if for example the robot gets stuck near an obstacle and cannot be moved by manual control, it is possible to do so.

Before moving the robot by hand, make sure the mechanical brakes are released.



To release the brakes, the robot must be turned on—see [Connecting the battery and powering up](#) on page 49.

Release the brakes by turning the Manual brake release switch located below the control panel clockwise.



To move the robot by hand either push or pull it.

When pushing or pulling the robot, grip the MiR Shelf Carrier 250 top module.



You can also pull the robot using the designated pull handles beneath the front and rear covers.



NOTICE

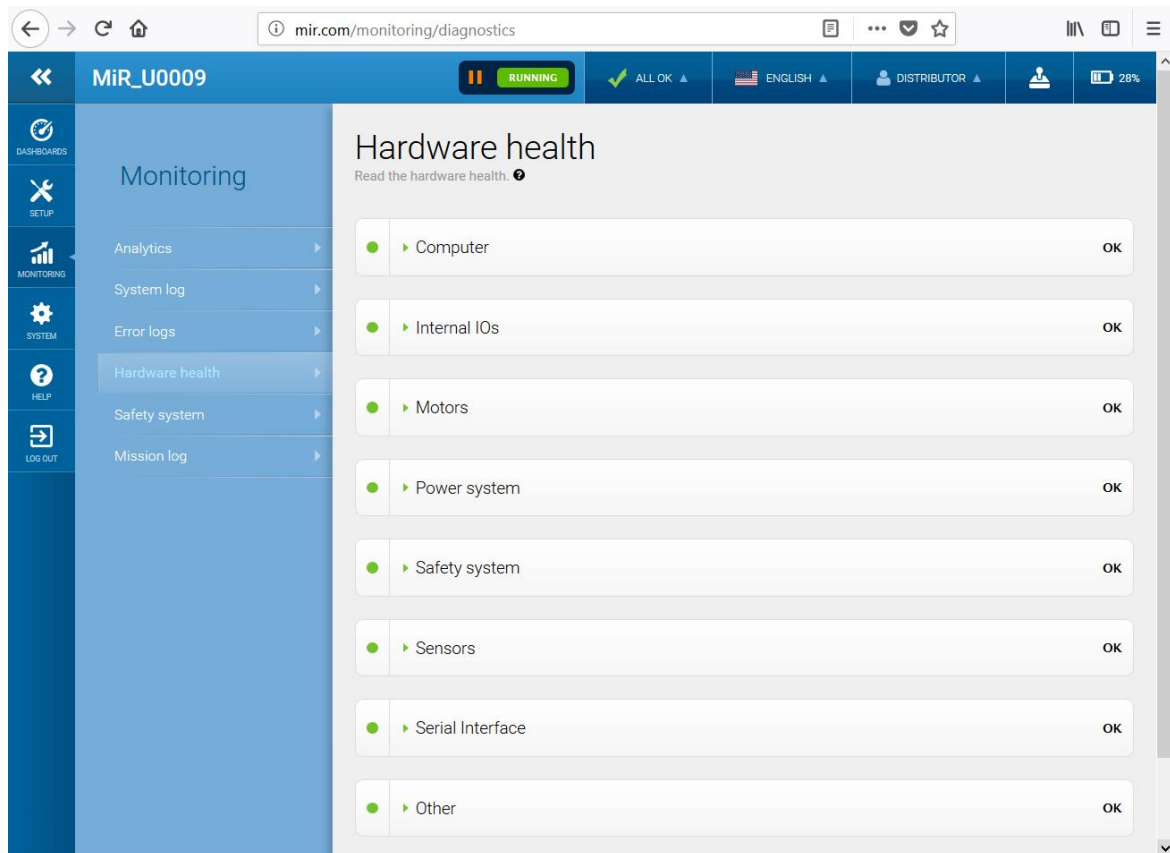
When handling the robot, do not push or pull the robot sideways, and do not use the covers for pushing or pulling. Only use the designated pull handles or the top module.

5.7 Checking the hardware status

To check that all hardware components work as intended, follow these steps:

1. Sign in to the robot interface—see [Connecting to the robot interface on page 52](#).
2. Go to **Monitoring** > **Hardware health**.

3. Check that all elements on the page have the OK status and that they have green dots on the left.



For more information, see [Hardware health](#) in *MiR Robot Interface 2.0 Reference Guide* on the MiR website.

5.8 Mounting the nameplate

Before using MiR250 Shelf Carrier, you must mount its unique nameplate to it. The nameplate contains information specific to your MiR application—see [Nameplate on page 15](#).



NOTICE

The nameplate must be mounted as described in the following steps. If mounted incorrectly, the CE mark is invalid.

The following steps describe how to mount the nameplate correctly:

1. Locate the rear cover—see [External parts on page 13](#).
2. Clean the area marked in the image below with a degreasing agent.



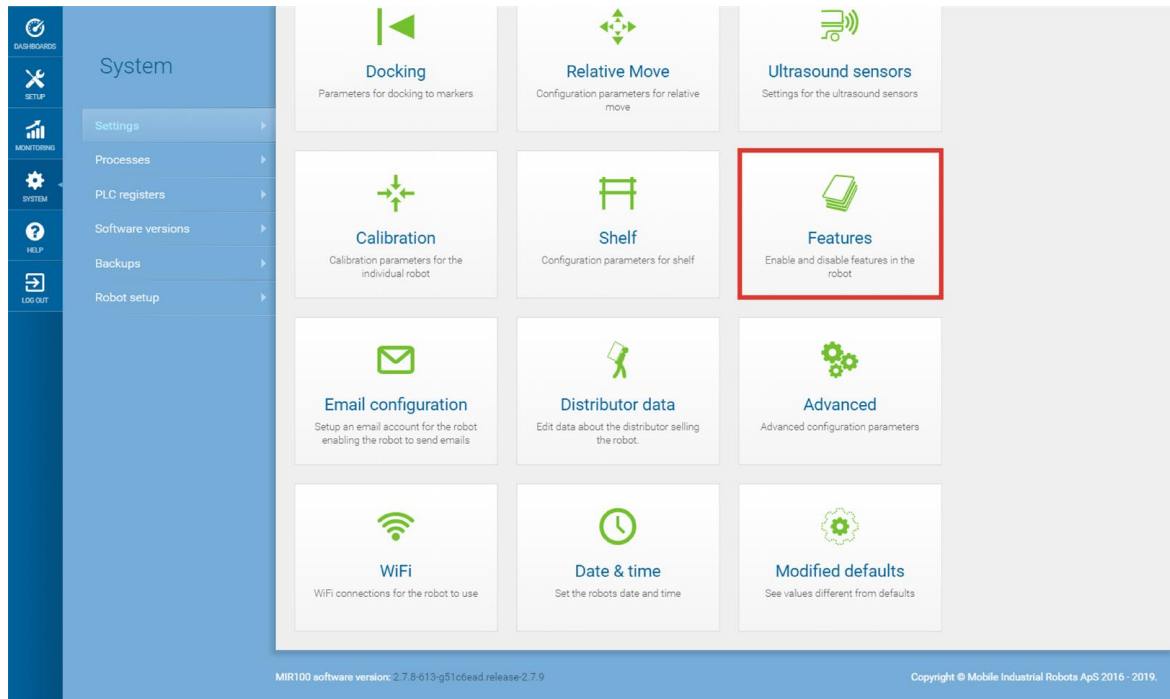
3. Mount the nameplate on the cleaned area.



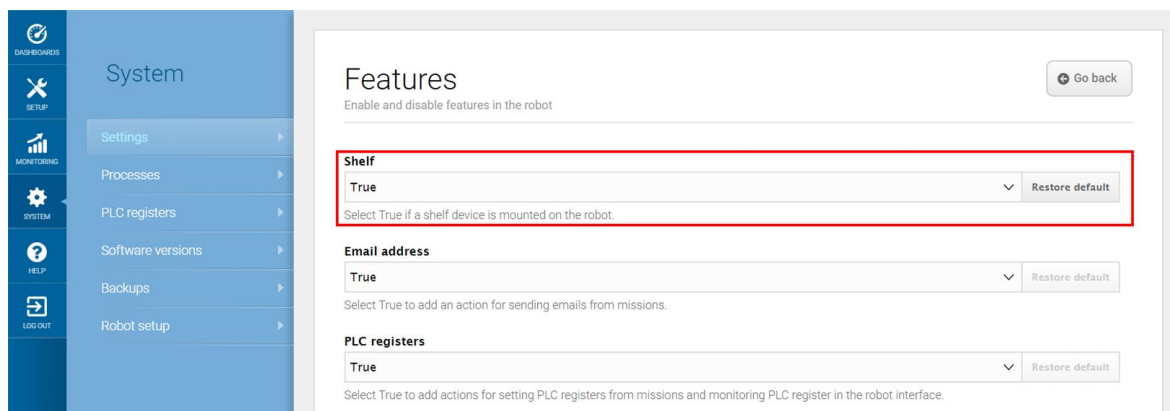
5.9 Enable MiR250 Shelf Carrier feature

To access the MiR250 Shelf Carrier settings and mission menus, the MiR250 Shelf Carrier features must be enabled. Follow these steps to check that they are enabled:

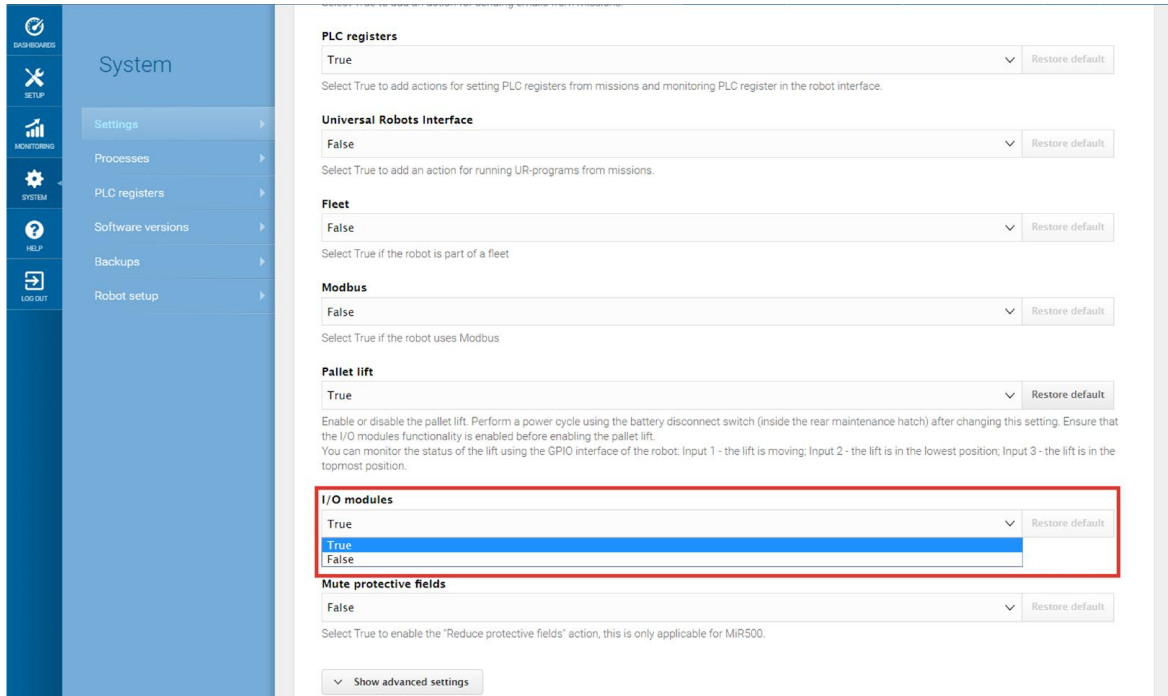
1. Sign in to the robot interface, and go to **System > Settings > Features**.



2. Under **Shelf**, select **True**.



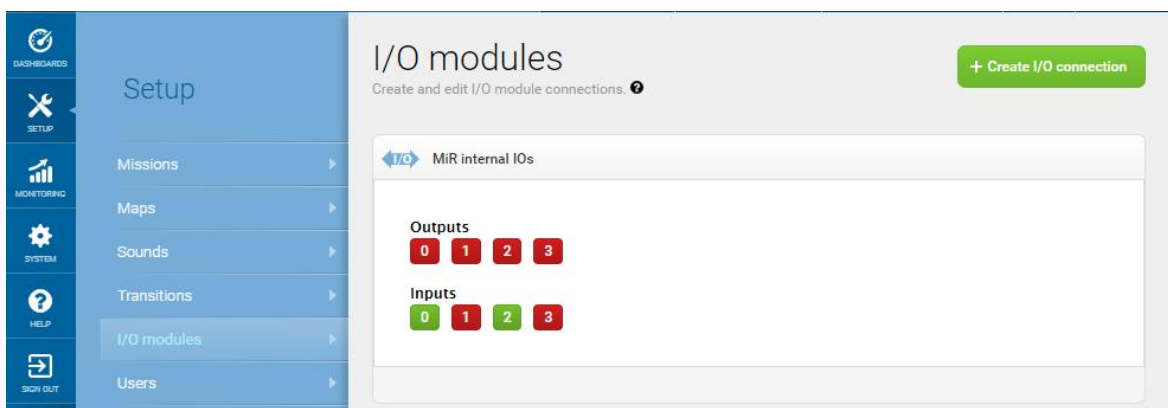
- Under **I/O modules**, select **True**. The MiR Shelf Carrier 250 top module communicates with the robot through I/O modules, so they must be activated for the shelf carrier to work.



5.10 Testing the top application

To test that the top application of MiR250 Shelf Carrier is configured and connected correctly, follow these steps:

- Sign in to the robot interface, and go to **Setup > I/O modules**.



2. Under **MiR internal I/Os**, complete the following sequence, and verify that the robot executes the expected action:
 - a. Under **Outputs**, select **3**. Verify that the carrier pins rise up.



- b. Once the pins are raised, verify that **3** under **Inputs** is green.



- c. Under **Outputs**, select **2**. Verify that the carrier pins lower into the robot.



- d. Once the pins are lowered, verify that **2** under **Inputs** is green.



If the pins were raised and lowered as expected and the correct input feedback was received, the MiR Shelf Carrier 250 is correctly installed.

If the shelf carrier did not operate correctly, verify that you have enabled the feature as described in [Enable MiR250 Shelf Carrier feature on page 60](#). If the shelf carrier continues to fail, contact your distributor.

5.11 Shutting down the robot

To shut down MiR250 Shelf Carrier:

1. Ensure that the robot is not moving or executing an action.
2. Press the Power button for three seconds.



3. The robot starts the shutdown process. The status lights waver yellow, and the Power button blinks red.



4. When the robot finishes the shutdown process, the status and the signal lights go off, and the Power button turns blue.



When you shut down the robot for transportation, service, or repair, the battery must be disconnected—see [Enabling fast swap and swapping out the lithium-ion battery on page 67](#).

6. Battery and charging

The robot is powered by a fast swap lithium-ion battery that can be charged both inside and outside of the robot.

6.1 Charging the robot

This section describes how to charge MiR250 Shelf Carrier using a MiR cable charger.



A MiR cable charger is not part of the MiR250 Shelf Carrier standard delivery. Contact your distributor for more information.



The robot is delivered fully charged.

The rear compartment holds the robot's battery. To access the rear compartment, see [Accessing the internal parts on page 30](#).

To charge MiR250 Shelf Carrier using the cable charger, connect the cable charger to the charging interface on the robot in the bottom-right corner.





If the robot has been inactive for more than a week or if its battery percentage has been below 5% for more than four hours, the battery goes into Power save mode, which disables the power to the robot.

To disable Power save mode, disconnect and connect the battery connector, or connect a MiR cable charger to the robot.

For information about the charging time, see specifications on the MiR website.

6.2 Enabling fast swap and swapping out the lithium-ion battery

MiR250 Shelf Carrier is supplied with a fast swap removable lithium-ion battery. The battery can be charged both inside and outside of the robot with a MiR cable charger.



The robot is delivered with one lithium-ion battery. Contact your distributor if you need more batteries.

The rear compartment holds the robot's battery. To access the rear compartment, see [Accessing the internal parts on page 30](#).

Enabling fast swap

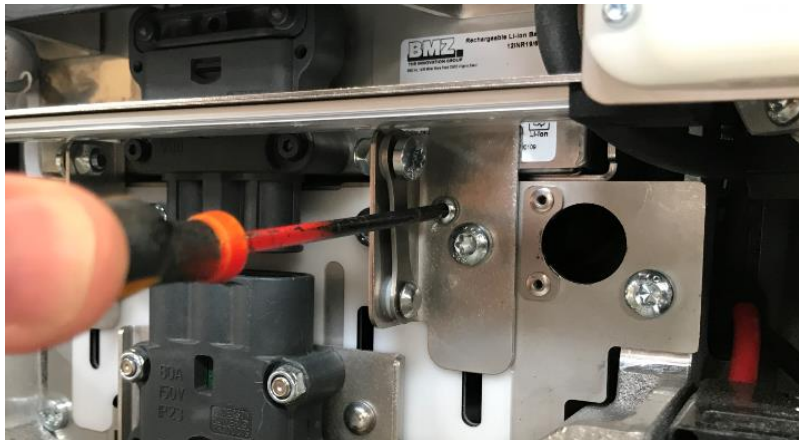
If you wish to enable the fast swap-option on the robot, you must first unscrew the plate holding these levers from the robot and then the levers themselves and fasten them to the levers controlling the connector. You only need to do this once.



The levers holding the battery in place are fastened with screws from the factory to ensure that the battery stays disconnected during transportation.

Follow these steps to enable the fast swap-option on the robot:

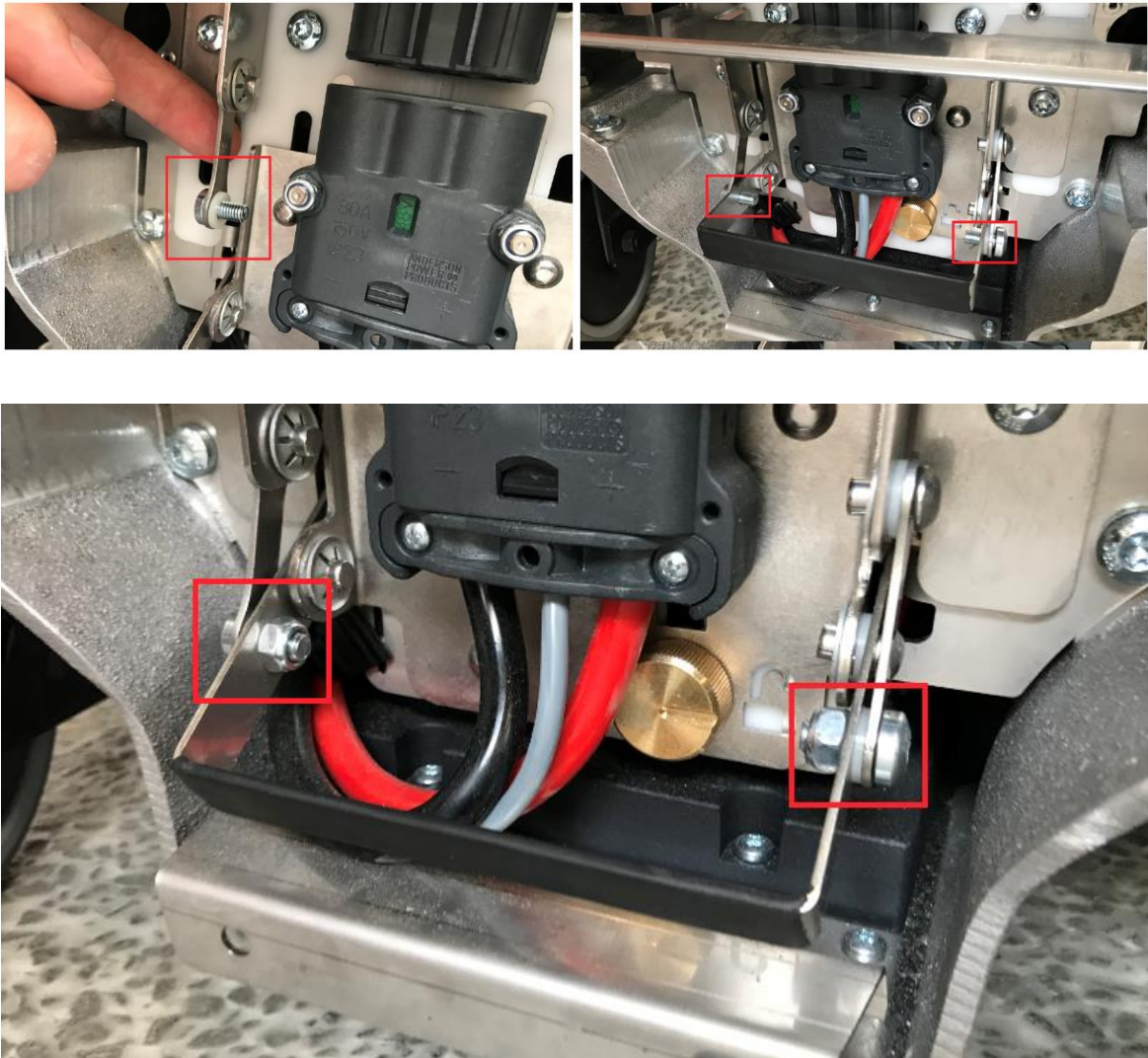
1. Unscrew this screw with a Tx20 screwdriver.



2. Unscrew this screw with a 10 mm hex key.



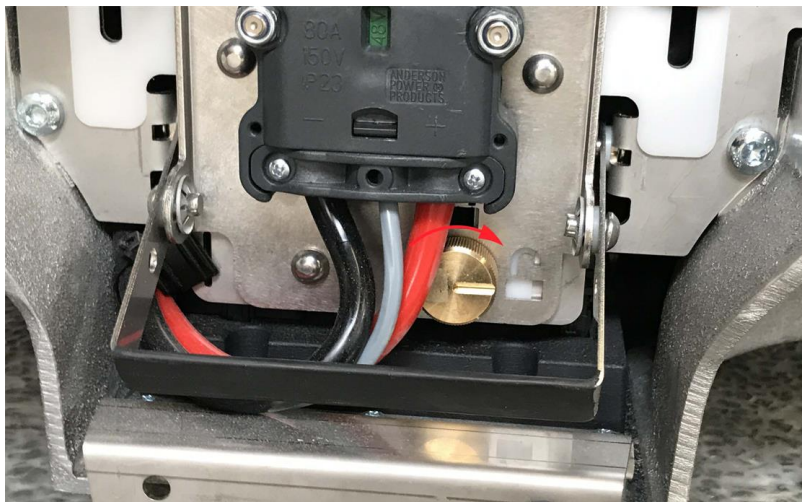
3. Fasten the two levers to the lever controlling the connector.



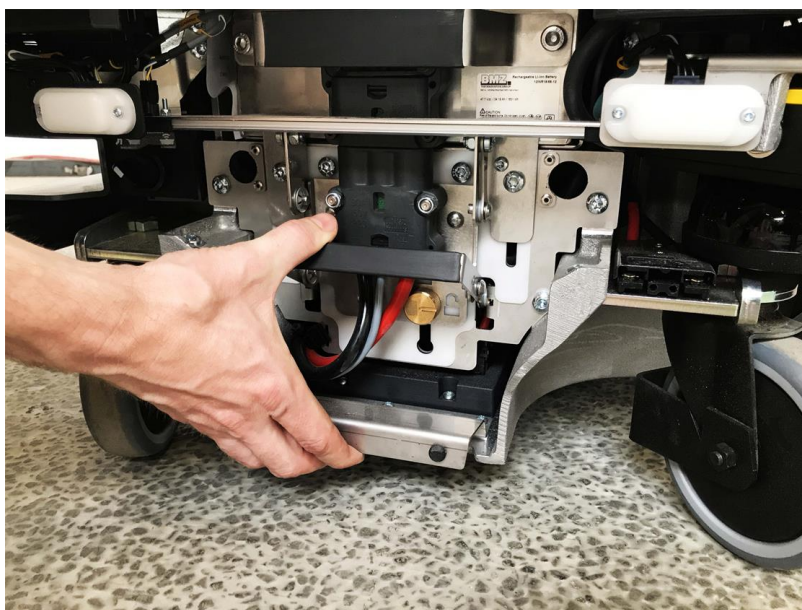
Swapping out the lithium-ion battery

Follow these steps to swap out the battery:

1. Turn the battery lever lock clockwise to unlock the battery lever.



2. Press down on the battery lever.



3. Pull out the battery.



You can now replace the battery.

4. Do the steps in reverse order when putting in the battery.

6.3 Battery storage and disposal

Battery storage

The battery should be stored in an area at room temperature—see specifications on the MiR website. Temperatures below or above room temperature will shorten the service life of the battery.

The battery should be stored in an area with a non-condensing relative air humidity within specifications to preserve the service life of the battery—see specifications on the MiR website.

The battery should not be exposed to nor submerged in any liquid as this may damage the battery.

Charge the battery before storage to preserve the service life of the battery. A 30% charged battery can be stored for seven months.

To preserve the battery, disconnect the battery from the robot before storing the robot.

Battery disposal

Return unserviceable batteries to relevant facilities in accordance with local statutory regulations.

A crossed-out wheeled bin indicates that the product needs to be disposed separately and not as municipal waste.

You are legally obliged to return used batteries and rechargeable batteries. Disposing used batteries in the household waste is prohibited. Batteries/Rechargeable batteries containing hazardous substances are marked with the crossed-out wheeled bin. The symbol indicates that it is forbidden to dispose the product via the domestic refuse. The chemical symbols for the respective hazardous substances are Cd= Cadmium, Hg = Mercury, Pb = Lead.



Figure 6.1. Battery disposal symbols.

7. IT security

IT security is a set of precautions you can take to prevent unauthorized personnel from accessing MiR250 Shelf Carrier. This section describes the main IT-security related risks and how to minimize them when commissioning MiR250 Shelf Carrier.

MiR250 Shelf Carrier communicates all data over the network that it is connected to. It is the responsibility of the commissioner to ensure that it is connected to a secure network. MiR recommends creating an IT-security risk assessment before commissioning the robot.

7.1 Managing users and passwords

Managing your users and passwords is the main way you can control access to MiR250 Shelf Carrier.

There are three default users with predefined passwords for you to start using. These are described in the *MiR Robot Interface Reference guide* along with instructions to create new users, user groups, and passwords. MiR advises you to:

- Change the default password for all predefined users if you choose to continue to use them. Make sure to choose a strong password since MiR250 Shelf Carrier does not enforce any password rules nor expire the password.
- Create new user groups if more levels of access are necessary.
- Create dedicated user accounts under the relevant user group for each person accessing MiR250 Shelf Carrier, and ensure that the users change the password on their first sign-in. It is not recommended to have several users share the same account.
- Only enable users with a minimum level of access to use a pin code to sign in. Users with a higher level of access are recommended to use a strong password to sign in instead.

7.2 Software security patches

To improve the security of MiR250 Shelf Carrier, MiR supplies security patches to the operating system in new MiR software update files. When you install a security patch, it takes approximately 10-15 minutes longer to update a MiR product.

Understanding MiR software versions

MiR uses the **Major.Minor.Patch.Hot fix** format to version software. For example, 2.8.1.1 means that the software is based on the second major release, the eighth minor release of the major version, the first patch release of the minor version, and in this example a single hot fix is included too.

- **Major releases** include the most significant changes that affect the entire robot software.
- **Minor releases** often include new features and smaller changes that only affect parts of the software.
- **Patch releases** focus on fixing small issues in the software and introducing quality improvements.
- **Hot fix releases** are only created when a patch release has introduced a critical issue that needs to be fixed immediately.

Security patch policy

MiR applies the following policy when supplying security patches:

- New security patches are distributed per every minor release.
- All patch releases under a minor release include the security patches also. In other words, if you chose not to install the first software version in a minor release, such as version 2.9.0, the security patches will still be installed when you update to 2.9.1 or higher.
- Whenever there is a new minor release with new security patches, the security patches are also made available in a separate file. In this way, you are not required to update to the latest software to apply the security patches. You can use any lower software version and just install the security patches to that software instead.

7. Navigation and control system

The navigation and control system is responsible for driving the robot to a goal position while avoiding obstacles. This section describes the processes and components involved in the robot's navigation and control system.

7.3 System overview

The purpose of the navigation and control system is to guide the robot from one position on a map to another position. The user provides the map and chooses the goal position the robot must move to. The diagram in *Figure 7.1* describes the processes in the navigation and control system. The main processes involved in the navigation system are:

- **Global planner**
The navigation process starts with the global planner determining the best path for the robot to get from its current position to the goal position. It plans the route to avoid walls and structures on the map.
- **Local planner**
While the robot is driving along the path made by the global planner, the local planner continuously guides the robot around detected obstacles that are not included on the map.
- **Obstacle detection**
The safety laser scanners, 3D cameras, and proximity sensors are used to detect obstacles in the work environment. These are used to prevent the robot from colliding with obstacles.
- **Localization**
This process determines the robot's current position on the map based on input from the motor encoders, inertial measurement unit (IMU), and safety laser scanners.
- **Motor controller, motors, and brakes**
The motor controller determines how much power each motor must receive to drive the robot along the intended path safely. Once the robot reaches the goal position, the brakes are engaged to stop the robot.

Each part of the process is described in greater detail in the following sections.

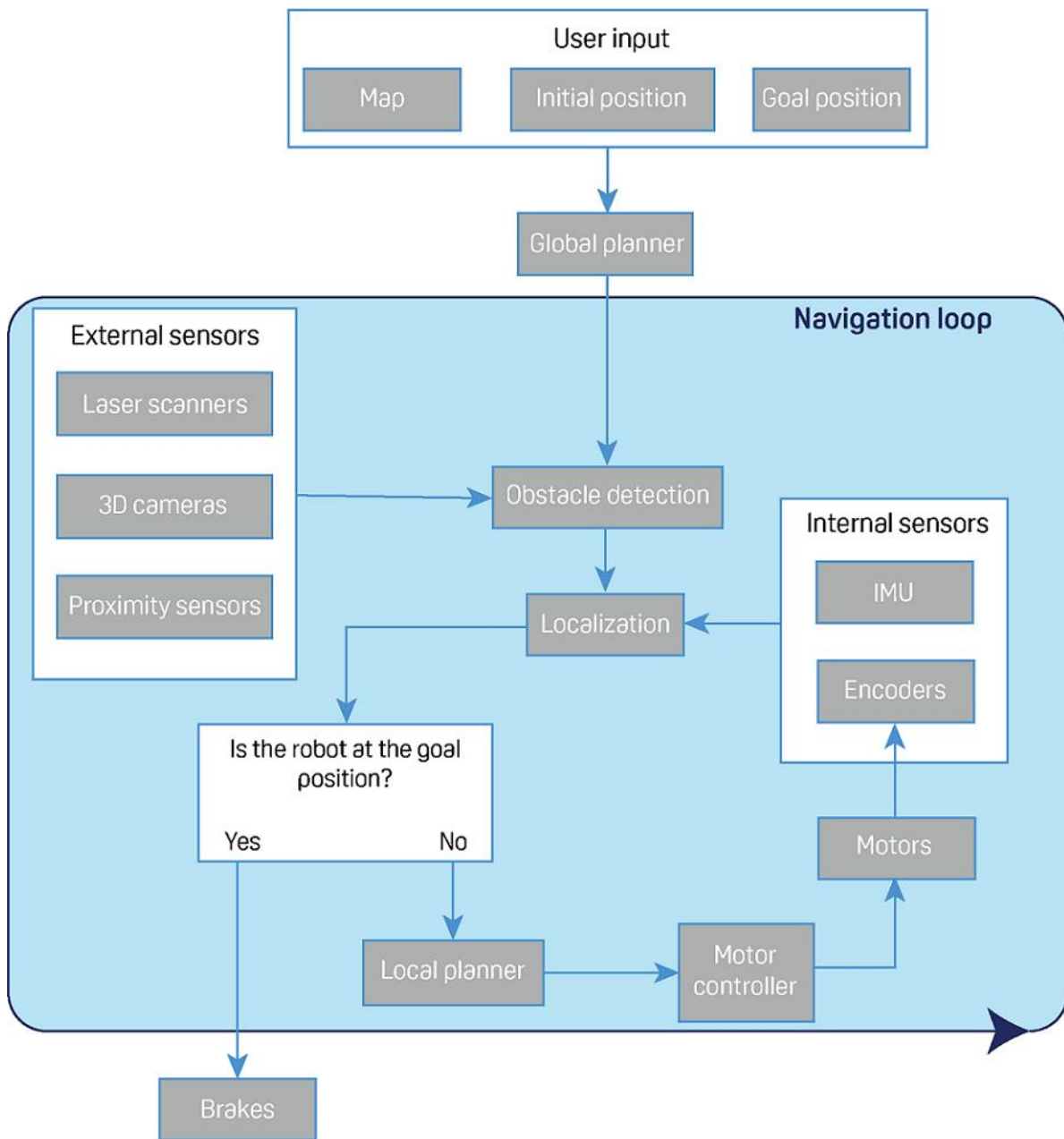


Figure 7.1. Flow chart of the navigation and robot system. The user provides the necessary input for the robot to generate a path to the goal position. The robot executes the steps in the navigation loop until it reaches the goal position and stops by engaging the brakes.

7.4 User input

To enable the robot to navigate autonomously, you must provide the following:

- A map of the area, either from a .png file or created with the robot using the mapping function—see [Creating and configuring a map on page 112](#).
- A goal destination on that map—see [Creating markers and positions on page 126](#).
- The current position of the robot on the map. This usually only needs to be provided when a new map is activated.

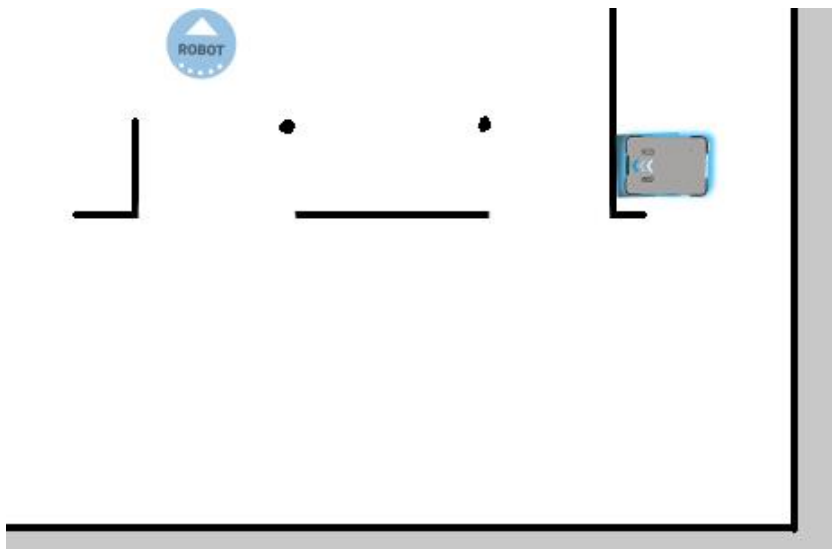




Figure 7.2. On the map, the current position of the robot is identified by the robot icon , and the goal destination is the robot position . The robot computer now determines a path from the current position to the goal position.

Once the robot computer has a map with the robot's current position and a goal destination, it begins planning a route between the two positions on the map using the global planner.

7.5 Global planner

The global planner is an algorithm in the robot computer that generates a path to the goal position. This path is known as the global path.

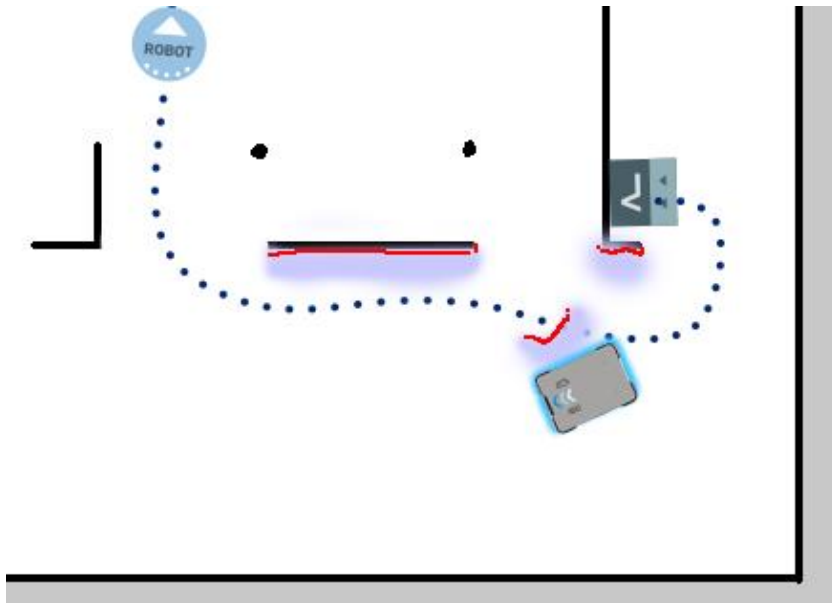


Figure 7.3. The global path is shown with the blue dotted line that leads from the start to the goal position.

The global path is created only at the start of a move action or if the robot has failed to reach the goal position and needs to create a new path. The generated path only avoids the obstacles the robot detected when the path was made and the obstacles marked on the map. The global path can be seen in the robot interface as a dotted line from the robot's start position to goal position.



Figure 7.4. The dotted line from the start position of the robot to the goal position is the global path generated by the robot computer.

7.6 Local planner

The local planner is used continuously while the robot is driving to guide it around obstacles while still following the global path.

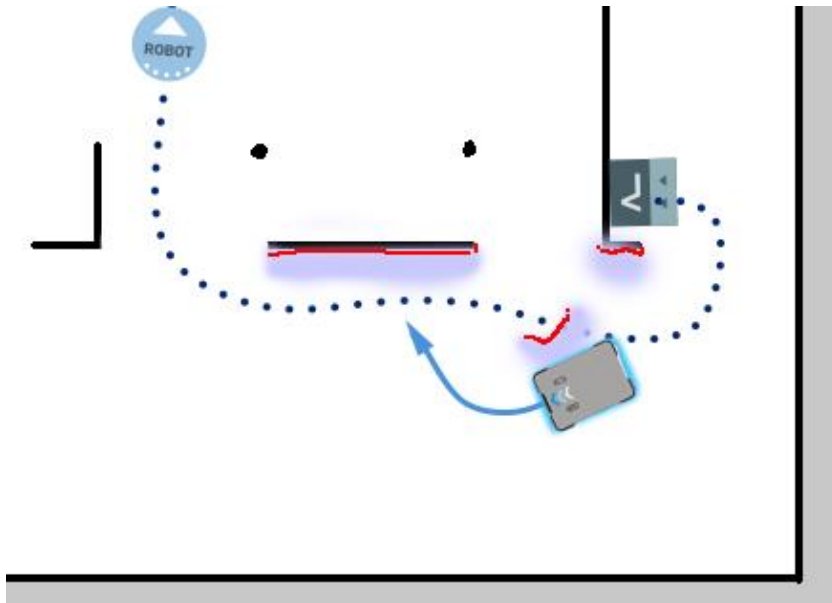


Figure 7.5. The global path is indicated with the dotted blue line. The local path is indicated with the blue arrow, showing the robot driving around a dynamic obstacle.

Whereas the global planner creates a single path from start to finish, the local planner continues to create new paths that adapt to the current position of the robot and the obstacles around it. The local planner only considers the area that is immediately surrounding the robot, using input from the robot sensors to avoid obstacles.

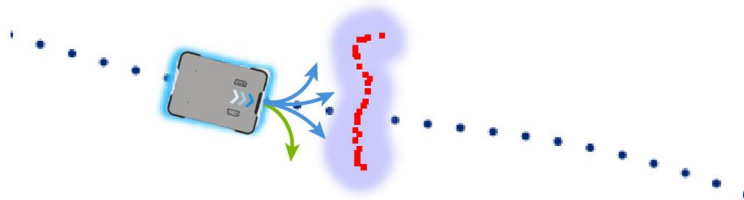


Figure 7.6. The local planner usually follows the global planner, but as soon as an obstacle gets in the way, the local planner determines which immediate path will get the robot around the obstacle. In this case, it will likely choose the path indicated with a green arrow.

Once the local path is determined, the robot computer derives a desired velocity, and acceleration that it sends to the motor controller—see [Motor controller and motors on page 88](#).


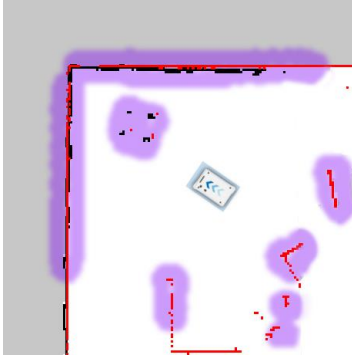
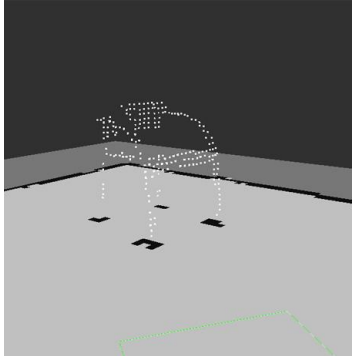
7.7 Obstacle detection

The robot continuously detects obstacles while driving. This enables it to use the local planner to drive around the obstacles and to determine its current position on the map.

There are three sensors that are responsible for detecting obstacles:

- The safety laser scanners
- The 3D cameras
- The proximity sensors

The following illustrations show how the robot sees the surrounding environment and how it is portrayed in the robot interface.

What a human sees	What the laser scanners see	What the 3D cameras see
		
A chair placed in the corner of a room is detectable by the robot.	In the robot interface, the red lines on a map are obstacles detected by the laser scanners, and the purple clouds are an aggregate of the 3D camera and laser scanner data. The scanners only detect the four legs of the chair.	The 3D cameras detect more details of the chair when the robot gets close enough to it. This view cannot be seen in the robot interface.

Safety laser scanners

Two safety laser scanners, diagonally placed on front and rear corners of the robot, scan their surroundings. Each safety laser scanner has a 270° field of view, overlapping and thus providing a full 360° visual protection around the robot.

When in motion, the safety laser scanners continuously scan the surroundings to detect objects.

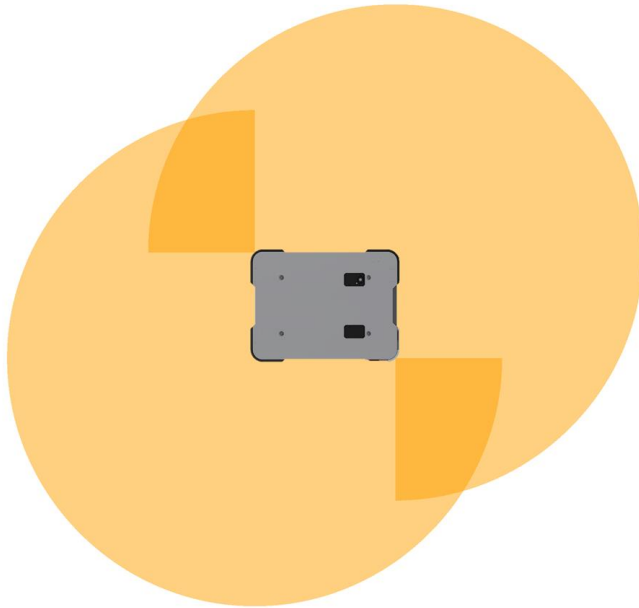


Figure 7.7. The two safety laser scanners together provide a full 360° view around the robot.

The laser scanners have the following limitations:

- They can detect only objects that intersect a plane at 200 mm height from the floor.
- They do not detect transparent obstacles well.
- The scanner data can be inaccurate when detecting reflective obstacles.



If you are using the robot in an area with walls made of glass or reflective material, mark the wall as a forbidden zone on the map and not as a wall—see [Creating and configuring a map](#) on page 112.

3D cameras

Two 3D cameras positioned on the front of the robot detect objects in front of the robot. The 3D cameras detect objects:

- Vertically up to 1800 mm at a distance of 1200 mm in front of the robot.
- Horizontally in an angle of 114° and 250 mm to the first view of ground.

The 3D cameras are only used for navigation. They are not part of the robot's safety system.



The camera readouts are used as 3D point cloud data. They are not recording recognizable objects or people.

The following illustration shows the field of view of the cameras.

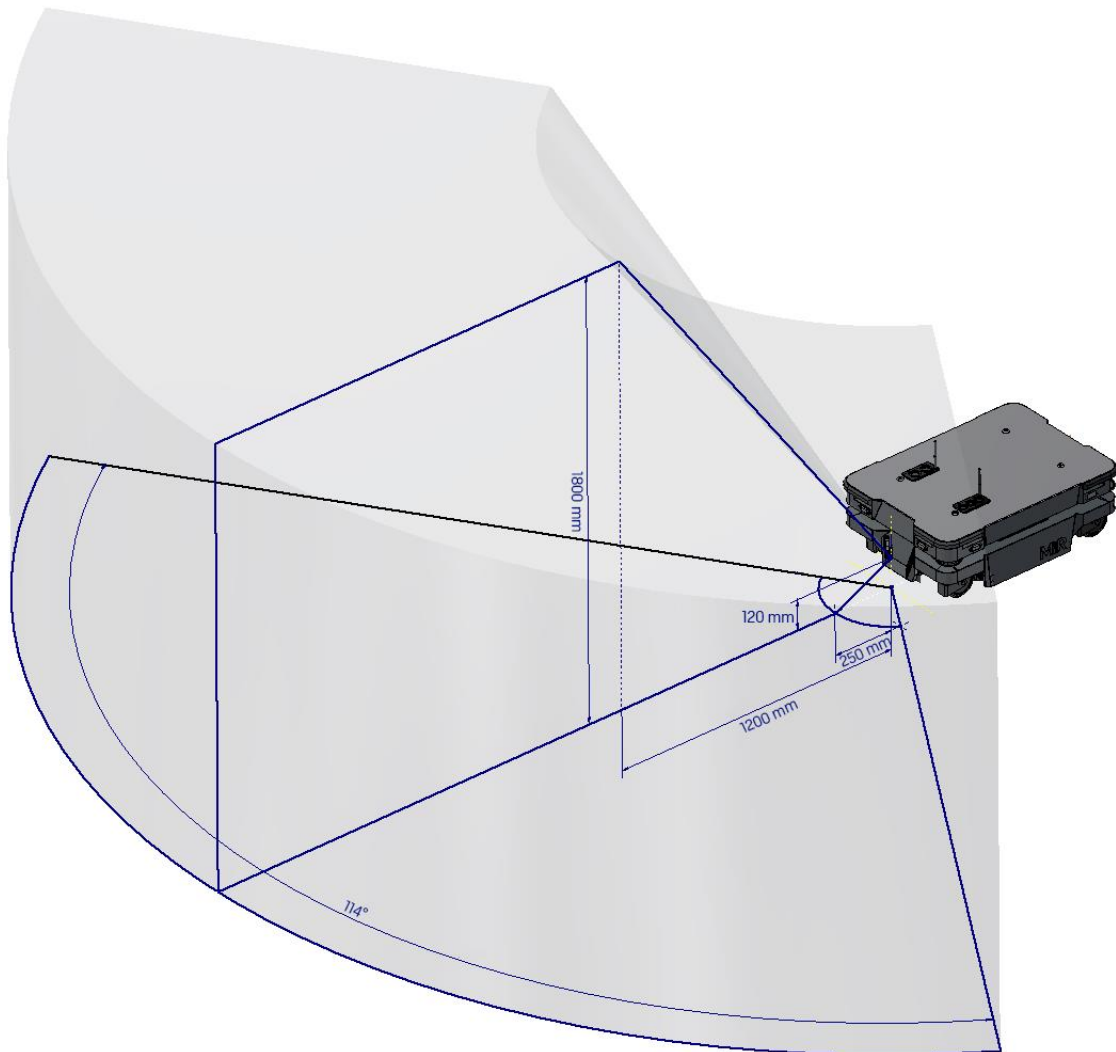


Figure 7.8. The two 3D cameras can see objects up to 1800 mm above floor height at a distance of 1200 mm in front of the robot and have a horizontal field of view of 114°.

The 3D cameras have the following limitations:

- They can only detect objects in front of the robot, unlike the full 360° view of the laser scanners.
- They do not detect transparent or reflective obstacles well.
- They do not detect holes or descending stairways.
- The cameras are not reliable at determining depth when viewing structures with repetitive patterns.

Proximity sensors

Proximity sensors placed in all four corners of the robot detect objects close to the floor that cannot be detected by the safety laser scanners.

Using infrared light, the proximity sensors point downwards and make sure that the robot does not run into low objects, such as pallets and forklift forks.

Because of the proximity sensor's limited range, the data from them is only useful when the robot is standing still or moving at reduced speeds.

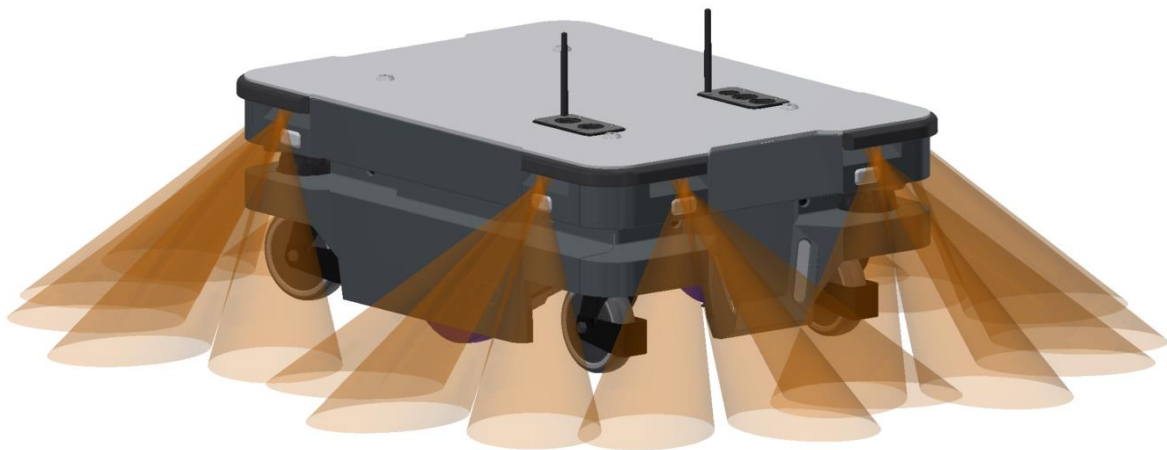


Figure 7.9. The proximity sensors in the corners of the robot detect objects below the safety laser scanners plane of view.

The proximity sensors have the following limitations:

- They do not have a long range and are only used to detect obstacles missed by the laser scanners and cameras.
- When the robot is driving fast, obstacles detected by the proximity sensors are too close for the robot to stop or avoid them.

7.8 Localization

The goal of the localization process is for the robot to determine where it is currently located on its map. The robot has three inputs for determining where it is:

- The initial position of the robot. This is used as a reference point for the methods used to determine the robot position.
- The IMU and encoder data. This is used to determine how far and fast the robot has traveled from the initial position.
- The laser scanner data. This is used to determine the likely positions of the robot by comparing the data with nearby walls on the map.

This data is used by a particle filter to determine the most likely position of the robot on the map.

IMU and motor encoders

Both the data from the IMU (Inertial Measurement Unit) and motor encoders is used to derive where and how fast the robot has traveled over time from its initial position. The combination of both sets of data makes the derived position more accurate.



If the drive wheels are worn down significantly or the robot is running with an incorrect gear ratio, the robot will miscalculate how far it has traveled based on the encoder data.

Laser scanners and particle filtering

The robot computer compares the input from the laser scanners with the walls on the map to try to find the best match. This is done using a particle filter algorithm. The robot computer only compares with the area where it expects the robot to be based on the encoder and IMU data. This means it is important that the initial position of the robot is correct.

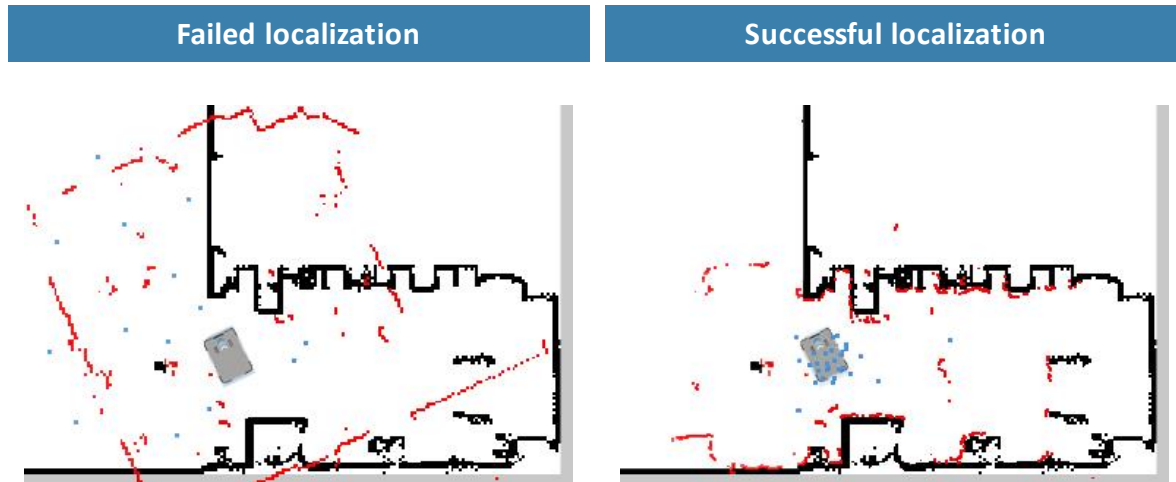
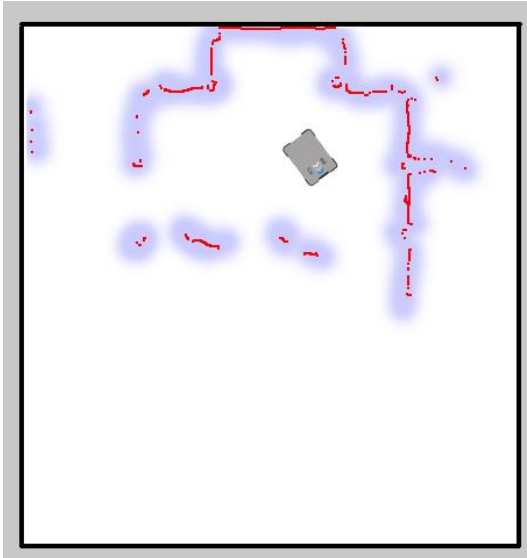


Figure 7.10. In a failed localization, the robot cannot determine a position where the red lines (laser scanner data) align with the black lines on the map. When the robot can localize itself, it determines a cluster of likely positions, indicated in the images above as blue dots.

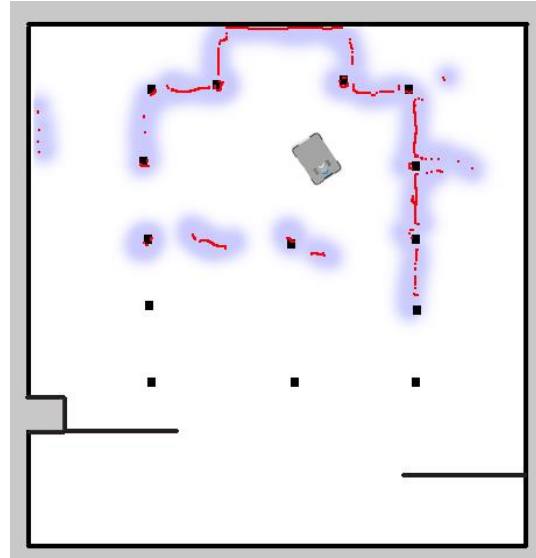
To make sure the robot can localize itself well using particle filtering, consider the following when creating a map:

- There must be unique and distinguishable static landmarks on the map that are easily recognizable. A landmark is a permanent structure that the robot can use to orient itself, such as corners, doorways, columns, and shelves.

No distinguishable landmarks

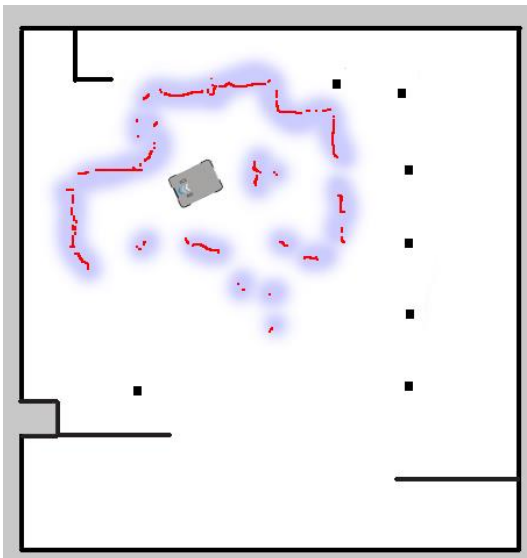


Many distinguishing landmarks

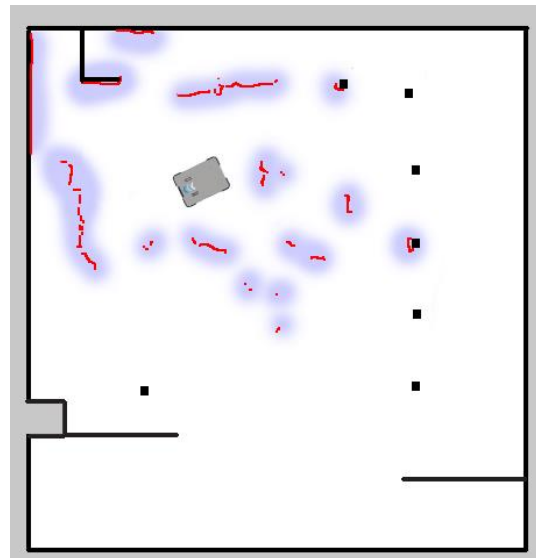


- The robot must be able to detect the static landmarks that are marked on the map to be able to approximate its current position.

Cannot detect any landmarks



Can detect enough landmarks



- The robot does not compare the laser scanner data with the entire map, but only around the area that it expects to be close to based on the IMU and encoder data and its initial position. This is why it is important that the initial position you place the robot at on the map is accurate.
- The robot can drive for a short distance without being correctly localized. As it drives, the estimated positions should converge to a small area, indicating the robot has determined an accurate estimate. If this does not occur within a set time limit, the robot reports a localization error.

7.9 Motor controller and motors

The robot keeps adjusting how much power is sent to each motor based on sensory input. This means the robot can correct its speed when going up slopes or when carrying a heavier payload, and it can change its driving direction to avoid moving obstacles.

7.10 Brakes

Once the approximated position of the robot determined from localization is the same as the goal position calculated by the global planner, the robot stops by using the dynamic brake function.

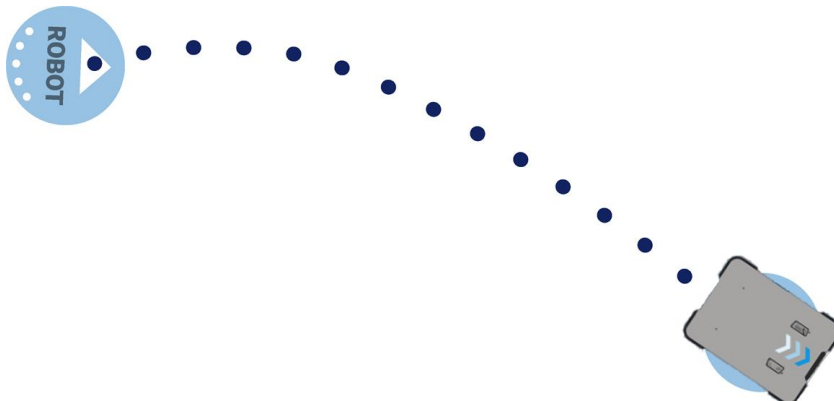


Figure 7.11. The robot has reached the goal position and stops by engaging the brakes.

The dynamic brake function stops the robot by short circuiting the power that was used to rotate the motor. When this happens, the power that was used to drive the robot forward is now reversed to stop the rotation of the drive wheels

Once the robot has stopped, the mechanical brakes are enabled. These brakes are used to keep the robot in place once it has stopped. You can compare it with the parking brake or hand brake in a car.



The mechanical brakes are only used to stop the robot when in motion in emergency situations triggered by the safety system.

The mechanical brakes are automatically released again when the robot receives a new order requiring it to move.

7. Safety system

The robot's safety system is responsible for stopping or slowing down the robot and its top module in situations where personnel are at risk of injury.

MiR250 Shelf Carrier is equipped with a range of built-in safety-related functions. Each safety function is designed according to the standard ISO 13849-1. The safety-related functions are selected to support compliance with EN 1525 and ISO 3691-4.

7.11 System overview

The safety system is controlled mainly by the safety PLC. The PLC regulates inputs and outputs from safety-related functions or interfaces involved with ensuring the safety of personnel working nearby the robot.

If a safety function is triggered, the robot uses its STO (Safe Torque Off) contactors to bring the robot to a category 0 stop (stopping by “immediate removal of power to the machine actuators” according to IEC 60204-1) followed by a controlled brake using an SS1 (Safe Stop 1) function. This is known as bringing the robot into Emergency stop or Protective stop, depending on the function—see [Types of stop below](#).

Types of stop

There are four different stopped states:

- Operational stop
- Protective stop
- Emergency stop
- Manual stop

The last three types of stop are monitored by the safety PLC.

Operational stop

The robot is in Operational stop when it is stopped through the robot interface either through a mission action or by pausing the mission. The top module and all moving parts are still connected to a power supply.

Protective stop

The robot enters Protective stop automatically to ensure the safety of nearby personnel. When the robot enters Protective stop, internal safety contactors are switched so the robot's top application and all moving parts of the robot do not receive power. You can hear the safety contactors emit audible clicks when they are switched.

When the robot is in Protective stop, the status lights of the robot turn red, and you are not able to move the robot or send it on missions until you bring the robot out of the Protective stop. The following cases describe the various Protective stops and how to bring the robot out of Protective stop:

- **A safety laser scanner detects an object in its active protective field**
Remove the object from the active protective field—see [Safety system on the previous page](#). The robot will resume its operating state after two seconds.
- **The robot finishes the startup process**
The Resume button will flash after startup. Press the flashing Resume button to bring the robot out of Protective stop.
- **Switching between Manual mode and Autonomous mode**
After turning the Operating mode key to switch operating modes, the robot enters Protective stop, and the Resume button flashes. Press the Resume button to bring the robot out of Protective stop.
- **The safety system detects a fault, or the motor control system detects a discrepancy**
To bring the robot out of Protective stop, resolve the fault causing the error. Use information regarding the error from the robot interface to determine the fault. For further guidance, see the troubleshooting guides on the Distributor site.

Emergency stop

The robot enters Emergency stop when an Emergency stop button has been pressed physically. When you press the Emergency stop button, internal safety contactors are switched so the robot's top application and all moving parts of the robot do not receive power. You can hear the safety contactors emit audible clicks when they are switched.

When the robot is in Emergency stop, the status lights of the robot turn red, and you are not able to move the robot or send it on missions until you bring the robot out of the Emergency stop. To do this, you must release the Emergency stop button and then press the Resume button. The Resume button begins flashing blue after you have released the Emergency stop button. If the robot is in Emergency stop, it will immediately resume an operating state after you press the flashing Resume button.

MiR250 Shelf Carrier has two Emergency stop buttons located at the rear and front of the robot.



NOTICE

Only press the Emergency stop buttons in emergency situations. They are not designed for frequent use.

Manual stop

The robot enters Manual stop when the red Manual stop button in the control panel is pressed. Manual stop brings the robot into the same state as a Protective stop where it can only be brought to an operational state by pressing the Resume button.



Safety-related functions

The following functions are integrated within the robot itself and cannot be modified or used with other applications freely. The following list introduces the main safety-related functions integrated in MiR250 Shelf Carrier:

- **Collision avoidance**

This function ensures that the robot stops before it collides with personnel or an object. If the laser scanners detect an object or person within a defined protective field, the robot is brought to a stop. The function determines the speed of the two drive wheels using motor encoder data and switches between predefined protective fields accordingly. The faster the speed, the larger the protective field is.

- **Overspeed avoidance**

The safety system monitors if the motor encoder data indicates that the speed of each motor is above the limits for maximum rated speed. If the limit is exceeded, the robot enters Protective stop.

- **Stability**

The safety system monitors if the motor encoder data indicates that the speed difference between the two motors are above predefined limits. If the limit is exceeded, the robot enters Protective stop.

- **Emergency stop buttons**

The MiR Shelf Carrier 250 has two Emergency stop buttons. When one of the buttons is pressed, the robot goes into Emergency stop.

- **MiR Shelf Carrier 250 safety functions**

MiR Shelf Carrier 250 uses the electrical interfaces between the top module and the robot to communicate safety related information that is used for additional safety features. This includes monitoring the pin positions and safety contactors to make sure the pins are in the right position and that they do not change positions without other safety functions being in place.

These functions are described in further detail in the following sections.

The diagram in *Figure 7.12* shows the inputs to these functions and how they are all connected and monitored in the safety PLC. The safety PLC is able to switch the contactors to cut off power to the robot motors and the top module. Also, the safety PLC sends information to the robot computer to be displayed in the robot interface and to indicate the robot's status through the indicator lights and the speaker.

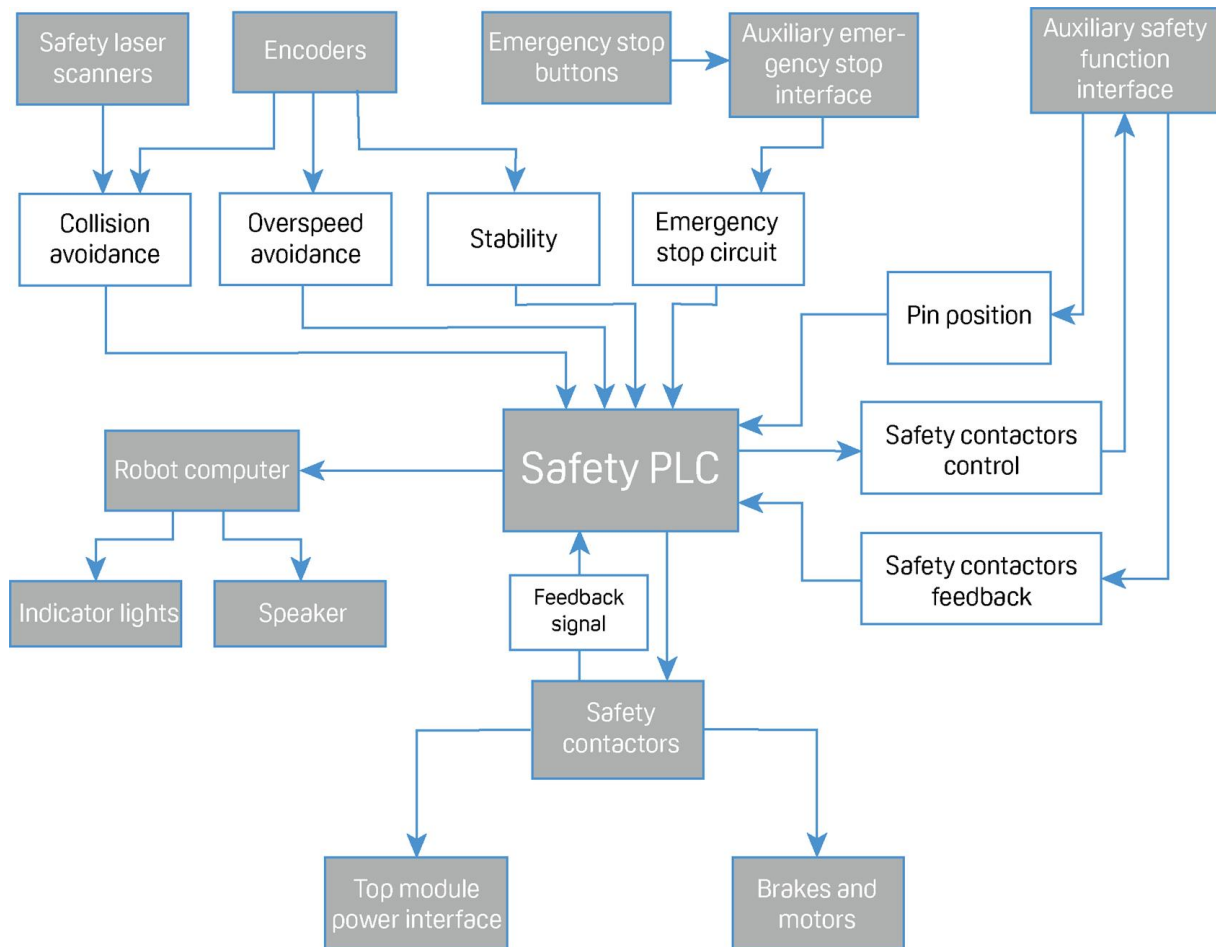


Figure 7.12. Overview of components involved in each safety function and interface. When a safety function is triggered, the safety PLC switches the STO and brake contactors so the brakes, motors, and safe power supply to the top module no longer receive power.

7.12 Collision avoidance

The collision avoidance function prevents the robot from colliding with personnel or obstacles by stopping it before it collides with any detected obstacles. It does this using the safety laser scanners.

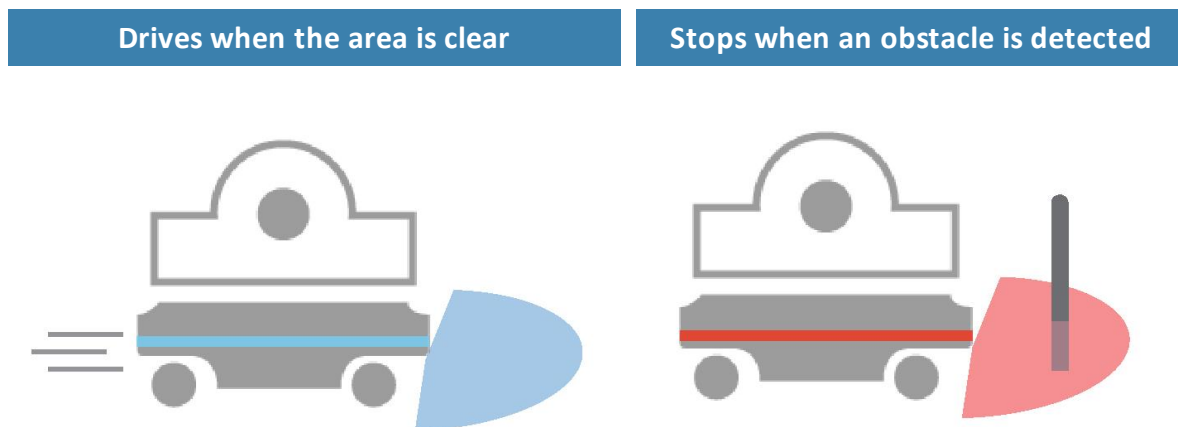


Figure 7.13. Collision avoidance ensures that the robot drives when its path is clear and stops if an obstacle is detected within its protective field.

The safety laser scanners are programmed with two sets of protective fields. One field is used when the robot is driving forward and another when it is driving backward. The protective field sets are part of the robot's personnel detection means. The protective field sets consist of individually configured contours around the robot. The robot activates the correct field set based on the speed. If a person or object is detected within the active protective field set, the robot enters Protective stop until the protective field set is cleared of obstacles for at least two seconds.

The tables in the following sections show the sizes of the protective field sets at given speeds. The faster the robot moves, the larger the scanners' field set. The speed of the robot is determined based on the encoder data.



The field sets on each side of MiR250 Shelf Carrier are 210 mm at all speeds.



WARNING

The protective field sets are configured to comply with the safety standards of MiR250 Shelf Carrier. Modifications may prevent the robot from stopping in time to avoid collision with personnel and equipment. Any modifications of the configuration file in the safety software will void the CE mark and compliance to all safety standards listed in the specification of the application and in other way declared.

- Do not modify the safety system without a competent third party to evaluate the safety of the design and performance of the robot after the modification are applied.

Field sets when driving forward

The following table shows speeds and field sets when driving forward. The table describes the length of the field set in front of the robot in different cases. Each case is defined by a speed interval that the robot may operate at. The colors and cases in the table correspond to the field set shown in the illustration below.

Case	Speed	Protective field range	Comments
1	0.0 to 0.10 m/s	80 mm	When pivoting
2	0.10 to 0.30 m/s	180 mm	
3	0.10 to 0.50 m/s	360 mm	
4	0.50 to 0.90 m/s	780 mm	
5	0.90 to 1.30 m/s	1350 mm	
6	1.30 to 1.70 m/s	2100 mm	
7	1.70 to 2.10 m/s	2850 mm	Forward at max. speed



Figure 7.14. The illustration shows the field set contours when driving forward. The range of the field set changes with the robot's speed.

Field sets when driving backward

The field sets for driving backward are the same as the field sets for driving forward. However, the robot is limited to a top speed of 1.0 m/s when driving backward.

Case	Speed	Protective field range	Comments
1	0.0 to 0.10 m/s	80 mm	When pivoting
2	0.10 to 0.30 m/s	180 mm	
3	0.10 to 0.50 m/s	360 mm	
4	0.50 to 0.90 m/s	780 mm	
5	0.90 to 1.00 m/s	1350 mm	Backward at max. speed

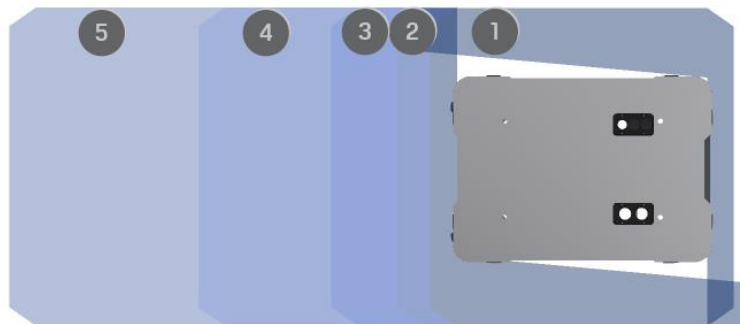


Figure 7.15. The illustration shows the field set contours when driving backward. The range of the field set changes with the robot's speed. The illustration also shows how the front scanner reduces its protective field sets to a minimum when the robot moves backward.



NOTICE

Protective field tolerances

Scanners measure distances to diffuse reflections, which means that a tolerance is added to the protective field sets to secure a safe detection of persons crossing the protective field sets. The tolerance distance is 65 mm.

Muted personnel detection means

When performing tasks that require the robot to move very close to surrounding objects, the robot mutes the personnel detection means.



CAUTION

When the robot has muted personnel detection means, it may not stop in time to avoid collisions with obstacles or personnel in its path.

- Mark areas where the robot mutes its personnel detection means as operating hazard zones, and inform personnel not to enter the zone while the robot is operating in it.

When muting the personnel detection means, the robot does the following:

- Reduces the size of the field sets
- Turns off Collision detection
- Decreases the speed
- Flashes the yellow indicator lights

You can also mute the personnel detection means using the robot interface:

1. Put the robot into Manual mode—see [Driving the robot in Manual mode on page 54](#).
2. In the robot interface, select **Muted personnel detection means** in the joystick control.
3. In the dialog, select **Yes** to acknowledge the muting of personnel detection means.

The status and the signal lights start flashing yellow, and the robot is ready to drive with muted personnel detection means.

7.13 Overspeed avoidance

The overspeed avoidance function prevents the robot from driving if the motor encoders measure that the robot is driving faster than the predefined safety limit. This can occur if there is a hardware error in the robot, or if it drives down a steep slope.

If the robot is driving faster than the predefined safety limit, it is immediately brought into a Protective stop. This ensures that the robot cannot drive if its speed cannot be controlled.

7.14 Stability

The stability function prevents the robot from driving if the motor encoders measure that the expected difference between how fast each wheel turns is outside the predefined safety limits. This indicates that the robot is not driving as intended, for example, if one of the wheels loses traction.

If the robot detects instability, it is immediately brought into a Protective stop. This ensures that the robot cannot drive if it has lost control of the speed of each drive wheel.

7.15 Emergency stop buttons

There are two Emergency stop buttons on MiR250 Shelf Carrier. When one of the buttons is pressed, it breaks the Emergency stop circuit triggering an Emergency stop. The Emergency stop circuit runs through both of the Emergency stop buttons and connects to the safety PLC through the Auxiliary emergency stop interface—see *Figure 7.16*.

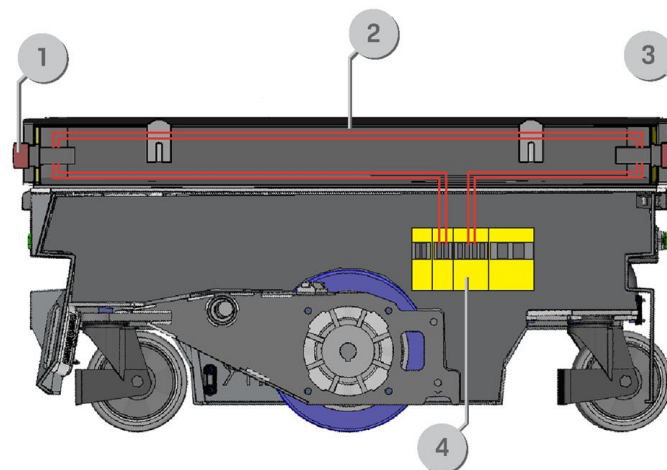


Figure 7.16. The Emergency stop circuit in MiR250 Shelf Carrier.

Pos.	Description	Pos.	Description
1	Front Emergency stop button	2	Emergency stop circuit
3	Rear Emergency stop button	4	Safety PLC

7.16 MiR Shelf Carrier 250 safety functions

When MiR Shelf Carrier 250 is mounted to MiR250, the electrical top interfaces are no longer accessible. The interfaces are used to communicate the position of the carrier pins and the state of the safety contactors in MiR Shelf Carrier 250. This information is used for integrated safety functions that are specific to MiR Shelf Carrier 250.

Shelf specific protective field sets

When the safety PLC registers that the carrier pins are raised, it is assumed that the robot is carrying a shelf. When the robot is carrying a shelf, its personnel detection means are reduced due to the legs of the shelf creating blind spots. To accommodate this, the protective field sets are changed automatically to a set that is specifically used when the robot carries shelves. These protective field sets include blind spots in the positions where legs of the shelf block the safety laser scanners.

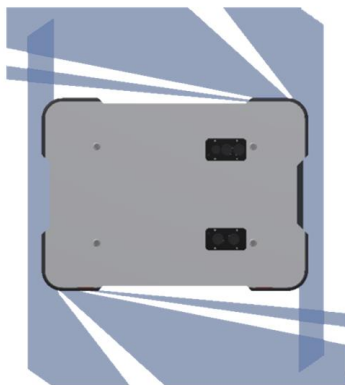


Figure 7.17. The illustration shows the blind spots introduced in the protective fields when the robot is carrying a shelf.

By default, the shelf specific protective field sets are designed for shelves with dimensions and specific asynchronous leg positions supported by MiR—see [Shelf specifications on page 109](#). This design minimizes the blind spots at the most critical areas. If you are using shelves that are not supported by MiR's design guidelines, the protective field sets must be changed and the safety system recertified—see [MiR Shelf Carrier 250 safety functions above](#).

Motion monitoring when picking up or placing shelves

When the safety PLC registers that the carrier pins are about to be raised or lowered, it is assumed that the robot is either picking up or placing a shelf. It changes into a state where the safety PLC only allows very slow driving. This prevents the robot from driving too fast in case the pins do not insert correctly into the shelf or that the shelf is placed inaccurately.

Should the robot move too fast while lowering or raising the carrier pins, a Protective stop is triggered, and you must press the Resume button to bring the robot back to an operational state.

If the shelf is incorrectly placed, once the robot begins to move, the legs will obstruct the active protective field and trigger a Protective stop. It is not possible to lift the shelf to a position where the legs are not detectable by the laser scanners.

Safety contactors

There are two safety contactors inside the top module. These contactors are used to cut the power to the carrier pin lifting mechanism. The safety PLC controls the contactors to ensure that power is only delivered to the lifting mechanism when it is safe for the carrier pins to change positions. There is also a feedback circuit through the safety contactors which the safety PLC monitors to make sure that the contactors are working correctly.

7.17 Light indicators and speakers

The robot uses two types of light indicators to let people in the environment know what the robot is currently doing or planning to do.

- **Status lights**

An LED light band on all four sides of the robot uses colors and light motion patterns to signal the current status of the robot.

- **Signal lights**

The signal lights at the front and back of the robot show if the robot is about to turn a corner or go backwards. Front lights are white and rear lights are red. Right and left turns are indicated by blinking.



Pos.	Description	Pos.	Description
1	Status lights	2	Signal lights

Status lights

The LED light band running all the way around the robot indicates the robot's current operational state. Colors may also be used as part of missions, but as standard, the robot is delivered with the following setup.

Red	Emergency stop
Green	Ready for job
Cyan	Drives to destination
Purple	Goal / Path blocked
White	Planning / Calculating
Yellow	Mission Paused
Yellow wavering	Startup signal before PC is active
Yellow fade	Shutting down robot
Yellow blinking	Relative move, ignoring obstacles
Purple - yellow	General error e.g. hardware, localization
Blue	Manual drive joystick
Blue wavering	Mapping
Contracting white	Charging: Charging station
White wavering	Prompt user / Waiting for user's response



NOTICE

When the robot's battery reaches a critically low level of power (0-1%), the ends of the status lights flash red.

Signal lights

Signal lights are used to indicate the robot's immediate motion plans by signaling forwards-backwards-braking and left-right turns.

The signal lights work similarly to lights used on cars; white at the front, red at the back, and indicating a left or right turn by blinking.

When the robot drives with muted personnel detection means, for example when docking to a marker, all signal lights blink yellow.

Speakers

When the robot drives with muted personnel detection means it emits a warning sound. In **System > Settings > Safety system**, you can choose which sound the robot makes and the volume of the sound.



CAUTION

Changing the safety system can cause the robot to not comply with safety standards.



NOTICE

It is the responsibility of the commissioner that the warning sounds are audible in the robot's work environment.

8. Commissioning

This section describes how to commission MiR250 Shelf Carrier.

Commissioning should be done without payload, except when doing brake tests where the robot should have a payload equaling the heaviest load it will be driving with.

Only persons assigned with the commissioning task should be present during commissioning.

It is the responsibility of the commissioner to:

- Analyze the work environment.
- Make a risk assessment of the full installation.
- Create and configure the site.
- Configure audio and light signals according to the environment.
- Create operating hazard zones.
- Make a brake test.
- Create user groups and users.
- Create dashboards.
- Update robot software.
- Change the relevant system settings.

8.1 Analysis of the work environment

The work environment of the robot must fulfill a number of requirements for the robot to function properly and safely. This section describes the factors that must be considered when the robot is being commissioned to function in a work environment.

Surfaces

The floor surface of the work environment must be dry. MiR250 Shelf Carrier functions on many different types of surfaces, but some materials can affect the performance and safety of the robot, such as very thick carpets or slippery floors.

It is the responsibility of the commissioner to test the performance and safety of the robot on the surfaces in the work environment—see [Brake test on page 147](#).

Light, reflections, and materials

Bright sunlight and reflective or transparent objects can affect the performance of the robot's laser scanners and cameras. This can result in the robot detecting nonexistent objects or failing to detect real objects.

Likewise, docking to markers such as shelves, pallet racks, and VL-markers, made in very high gloss or transparent materials can reduce the effectiveness of the robot's scanners, hindering a successful docking.

It is the responsibility of the commissioner to test if sunlight, reflections from high gloss materials, and transparent objects affect the robot's performance or safety.

Temperature and humidity

Temperatures outside of the approved temperature range can affect the performance and durability of the robot—see specifications on the MiR website. This is especially relevant for the robot's battery—see [Battery storage and disposal on page 71](#).

Inclines, doorways, gaps, and sills

The robot must operate within the approved specifications for driving on inclines, through doorways, and over gaps and sills—see specifications on the MiR website. Operating in areas that do not meet the specifications may result in the robot failing the complete missions or losing control of its load.

Space

The robot must have sufficient space to operate efficiently. Determine during commissioning if the robot has sufficient space to drive, dock, turn, and perform other tasks. Make sure to test each mission under the most likely operating conditions to determine if there is enough space for the robot to maneuver.



CAUTION

Driving in environments with no escape routes can lead to hazardous situations. There is a risk of damage to equipment or injury to personnel.

- At all times there must be at least 0.5 m wide and 2.1 m high pedestrian escape routes on each side of the robot, also in operating hazard zones.

Dust

Dusty environments can affect the performance and durability of the robot. Dust can get into the robot computer and mechanical parts affecting their performance and durability, and it can obstruct the view of the robot's sensor system. Make sure the environment MiR250 Shelf Carrier operates in is suitable for its IP rating—see specifications on the MiR website.

Static landmarks and dynamic obstacles

Be aware of both static landmarks and dynamic objects in the robot's work environment—see [Navigation and control system on page 1](#).

8.2 Risk assessment

To achieve a safe installation, it is necessary to make a risk assessment of MiR Shelf Carrier 250 in the environment it will be used in. This is the responsibility of the commissioner.

The risk assessment must cover not only MiR250 Shelf Carrier itself, but also take into account potential load transfer stations, work cells, and the work environment.



NOTICE

Mobile Industrial Robots does not take any responsibility for the performance of the risk assessment, but we provide information and guidelines that may be used in this section.



CAUTION

Changing the SICK configuration on the robot requires a new CE certification. Mobile Industrial Robots does not take any responsibility for the safety of the robot if the SICK configuration is changed.

It is recommended that the commissioner follows the guidelines in ISO 12100, EN ISO3691-4, EN 1525, ANSI B56.5, or other relevant standards to conduct the risk assessment.

In EN 1525, clause 4, there is a list of possible significant hazards and hazardous situations.

A risk assessment of the application must be used to determine the adequate information for users. Special attention to at least the following Essential Health and Safety Requirements (EHSR) must be taken:

- 1.2.2 Unexpected start for potential exposed persons
- 1.3.7 Risk related to moving parts
- 1.7.1 Information and warning on the machinery
- 1.7.2 Warning of residual risks
- 1.7.3 Marking of the machinery
- 1.7.4 Instructions

The risk assessment will lead to new instructions that shall be written by the party who draw up the CE marking. The instructions must at least include:

- Intended use and foreseeable misuse.
- A list of residual risks.
- Training required for personnel.

MiR has taken worst case scenarios into account in the design of MiR Shelf Carrier 250.

8.3 Shelf specifications

MiR does not provide any standard shelves for MiR250 Shelf Carrier. You must create and design your own shelf type or purchase suitable shelves that meet the design requirements. The shelves must have a set of at least four wheels that enable MiR250 Shelf Carrier to transport the shelf without lifting it. It is required that the shelf fulfills the design specifications described in this section.

Dimensions

Figure 8.1 illustrates the dimensions that must be within a certain range. The blue shaded area indicates where the shelf must be placed. MiR250 Shelf Carrier can accommodate shelves with the following dimensions:

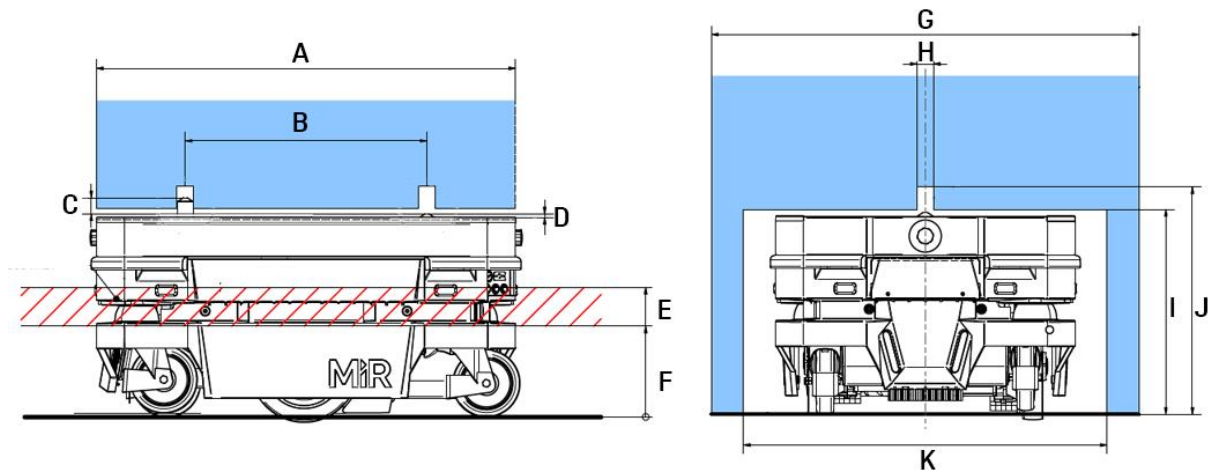


Figure 8.1. Side view (left) and front view (right) of shelf dimensions. The red hatched area is the scanner zone. Only the legs of the shelf may be located in this area.

Pos.	Description	Pos.	Description
A	Shelf length: maximum 790 mm	B	Distance between centers of pins: 450 mm (± 1)
C	Pin height when raised: 36.4 mm	D	Pin height when lowered: 6.5 mm
E	Distance from ground to upper boundary of scanner view: 216 mm (+5/-0)	F	Distance from ground to lower boundary of scanner view: 175 mm (+0/-5)
G	Shelf width: maximum 800 mm	H	Pin hole diameter: 30.9 mm (± 0.1)
I	Leg height: 383 mm (+3/-0)	J	Pin hole height from ground: minimum 425 mm
K	Distance between legs: minimum 680 mm		



The red hatched area marks the scanner zone. Only the shelf legs may be positioned in this area. Any other objects in the scanner zone will trigger a Protective stop.



WARNING

If any of the dimensions above are exceeded, the shelf is not supported by MiR. MiR take no responsibility if the shelf or its load collides with personnel or equipment if the shelf specifications are not met.

- Ensure that the shelves MiR250 Shelf Carrier transports meet the shelf specifications provided in this section.

Leg dimensions and positions

MiR supports only shelves made with four asymmetrical legs. Each leg must be 20 mm in diameter (+1/-0) and positioned as shown in *Figure 8.2*. If the legs are placed outside the described positions, the safety system will trigger a Protective stop each time it tries to drive with the shelf.

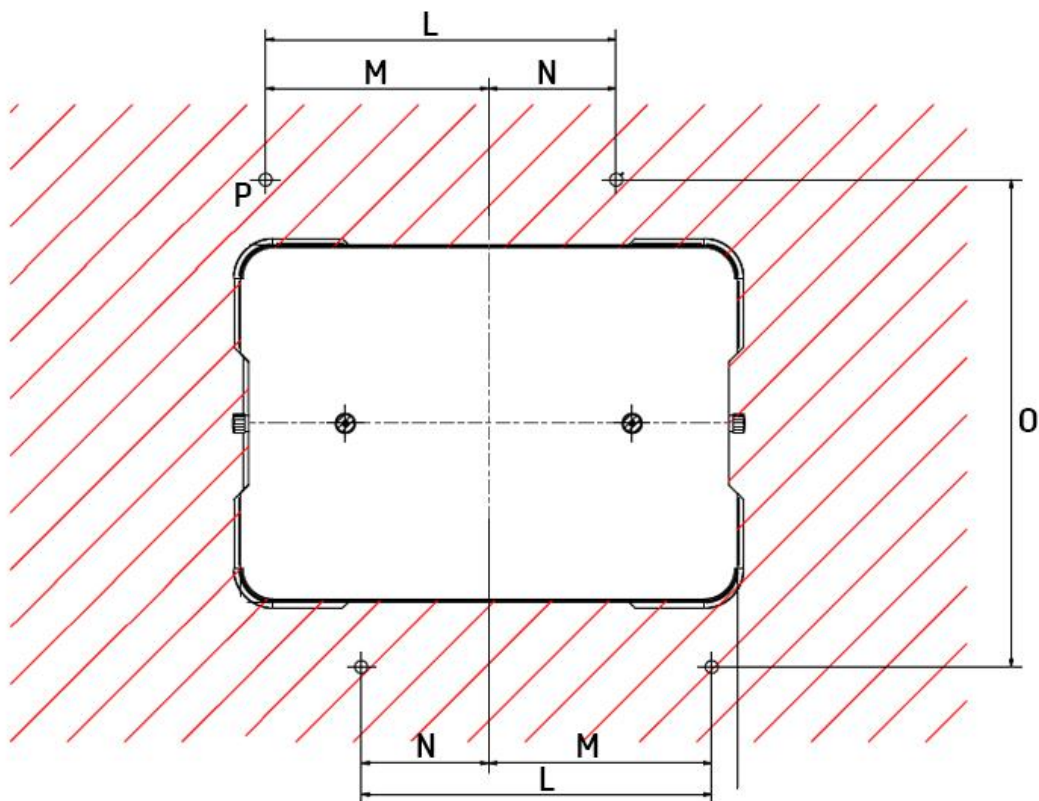


Figure 8.2. Top view of the robot. The red hatched area marks the scanner zone. Only the four legs indicated with circles can be placed in the zone at the defined positions.

Pos.	Description	Pos.	Description
L	Distance between legs on side: 550 mm	M	Displacement from robot's center: 350 mm
N	Displacement from robot's center: 200 mm	O	Distance between legs on opposite sides: 765 mm
P	Leg diameter: 20 mm (+1/-0)		

The robot uses the legs as markers to dock to the shelf correctly. It is therefore important that the legs are correctly placed and that the legs are made of a material that the safety laser scanners can detect reliably.



NOTICE

The inside of the legs must be coated with a non-reflective material that has a light, neutral color. We recommend using a matte light gray.

8.4 Creating and configuring a map

The map is visible in the robot interface and is the basis for the robot's ability to navigate its surroundings safely and efficiently. The map illustrates the physical area in which the robot operates.

By placing features such as positions and markers—see [Creating markers and positions on page 126](#)—, zones—see [Adding zones to the map on page 120](#)—, and walls in the map, you enable the robot to perform missions—see [Creating a mission on page 135](#).

It is important to create a robust, reliable map for the robot to perform effectively and safely.

To create a new map, you drive the robot around its intended work environment while its sensors gather data to generate a map from. This process is known as mapping.

As the robot moves during mapping, the laser scanners detect physical obstacles that are recorded on the map as walls. In the editing afterward, you can remove all obstacles that should not stay on the map, for example carts or boxes that were present at the time of recording but will not stay permanently.



You can also import a .png image of the map, for example extracted from a CAD drawing of the site.



For more information on creating a map, see *MiR Robot Reference Guide* and the *Creating your first map*-course in MiR Academy.

Creating the map

Before you map a new location, be sure to do the following preparations:

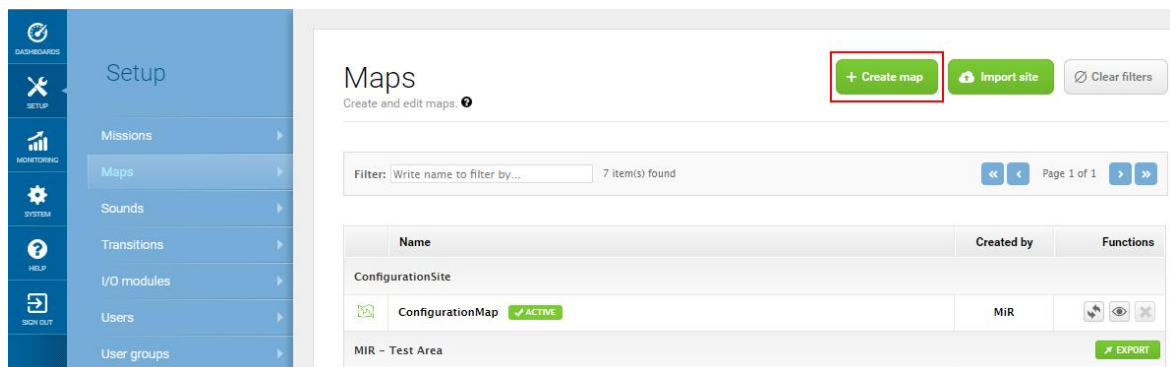
- Clearing the area of dynamic obstacles, such as empty pallets and carts. Dynamic obstacles can also be deleted from the map later.
- Ensuring that all doors and gates that the robot should be able to go through are opened before mapping.

Avoid doing the following:

- Starting the mapping with the robot in a very open space.
- Getting the robot stuck close to walls or objects as you will have to push it away manually.

To create a new map using the robot's mapping function, follow these steps:

1. Sign in to the robot interface, and go to **Setup > Maps**.
2. Select **Create map**.

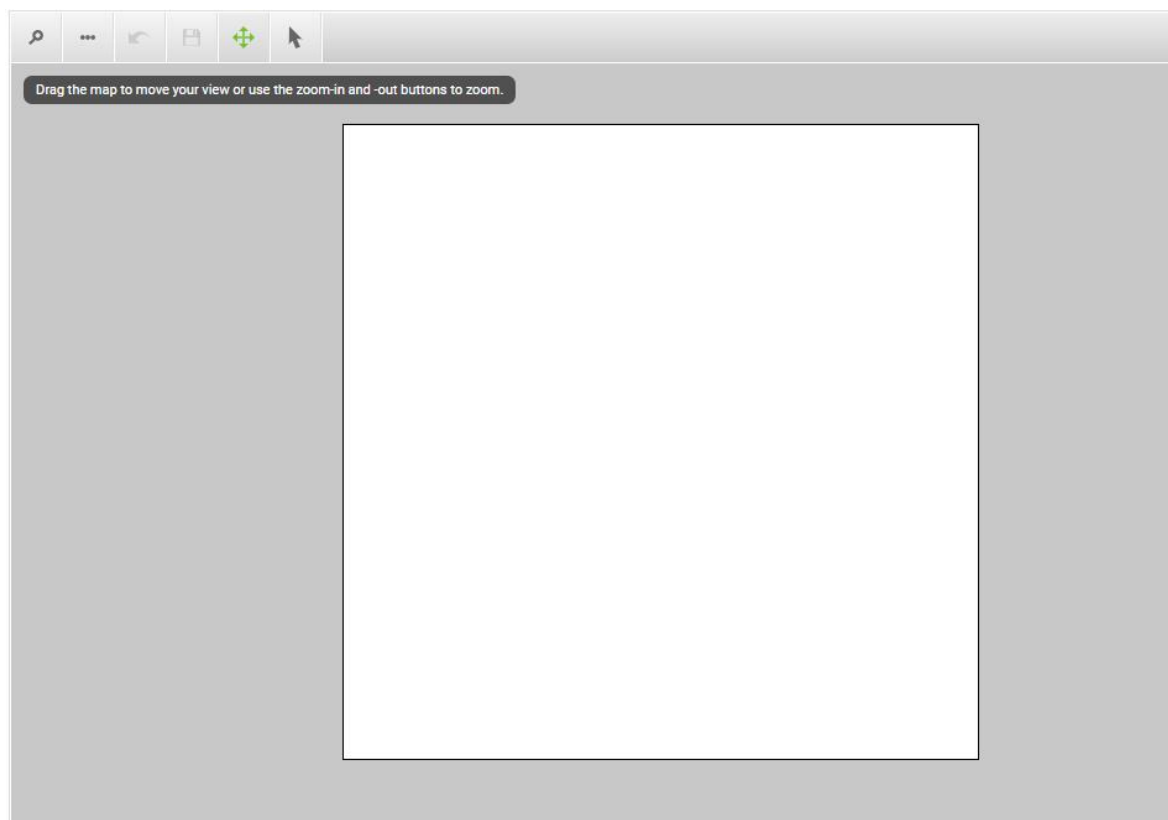


3. Name the map, and choose a site for the map in the drop down menu.

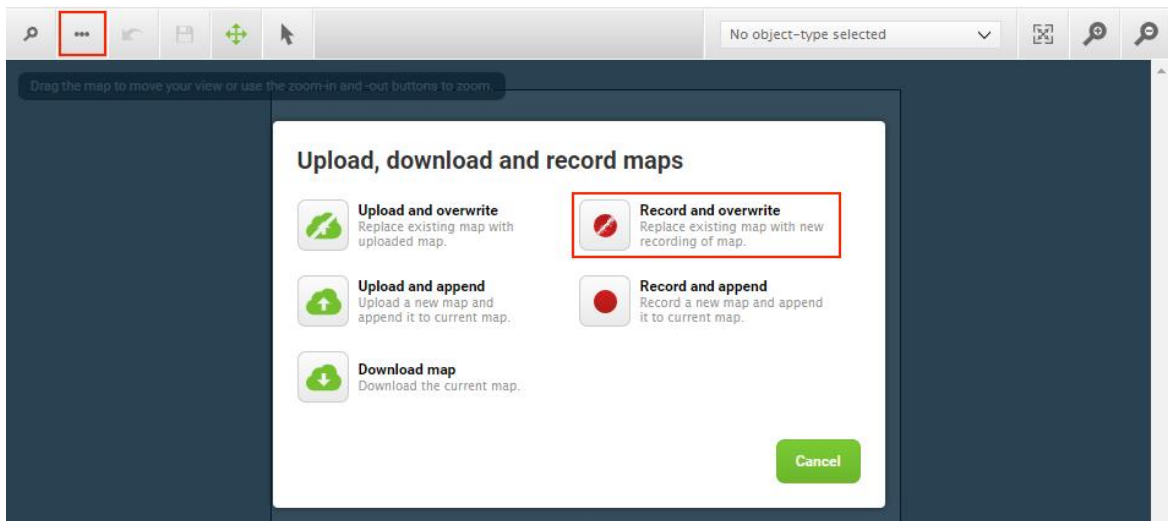


A site is a collection of information. It stores maps and all related information in a package that can be shared between robots. Ensure that maps for the same facility are in the same site. In **Setup > Maps**, you can import sites.

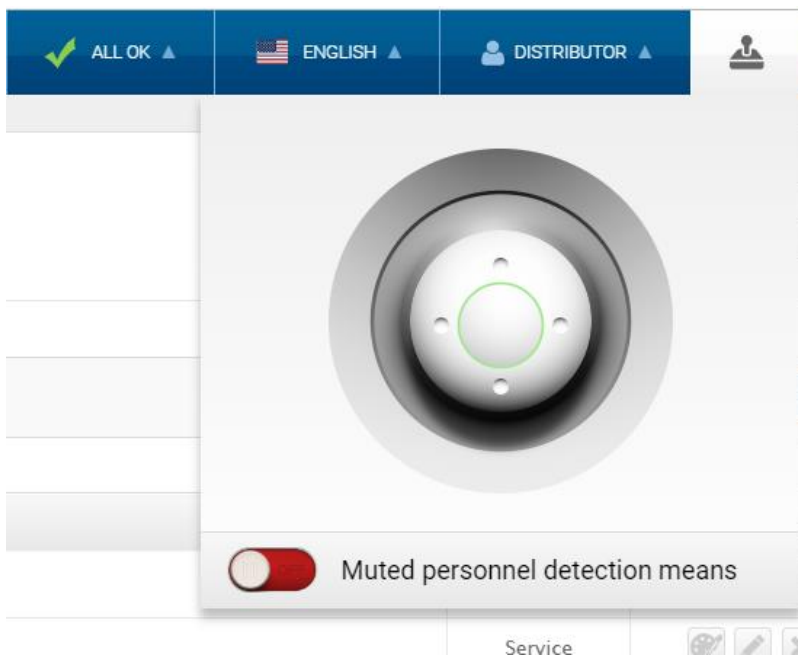
4. Wait until the white square appears (3-5 seconds). This is a blank map.




5. Select the three dots in the top left corner and start mapping by selecting **Record and overwrite**.



6. In the upper right corner, select the joystick icon. Select **Manual control**.

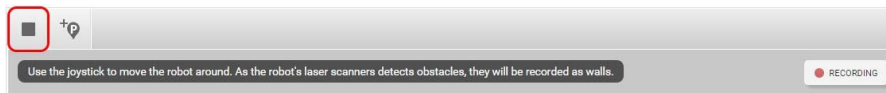


7. A blinking recording icon  indicates that the mapping has started.
 - a. Drive the robot around manually with the joystick—see [Driving the robot in Manual mode on page 54](#). The mapping window will update with new objects continuously.
 - b. Focus on mapping in a circular pattern around the perimeter of the working environment.
 - c. When reaching long corridors with few obstacles, let the robot stay in position for approximately five seconds before moving down the corridor.
 - d. Walk behind the robot as you map.
 - e. End the mapping in the same place you started it.



The joystick switches to medium speed during mapping. This ensures better coverage of the mapped area.

8. When the map looks complete, select **Stop**  in the upper-left corner of the mapping window.



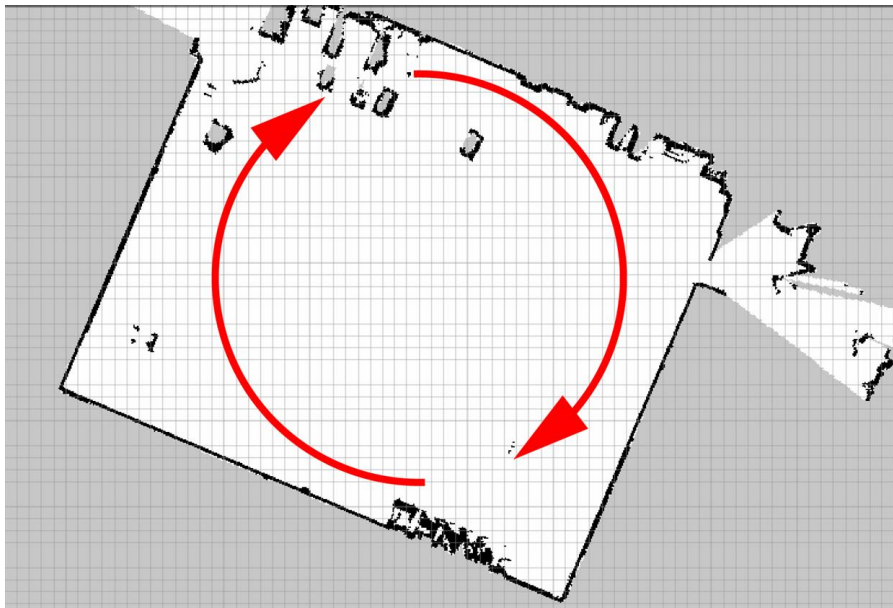
Configuring the map

Once the mapping engine stops, the interface will show the newly recorded map on a grid background.

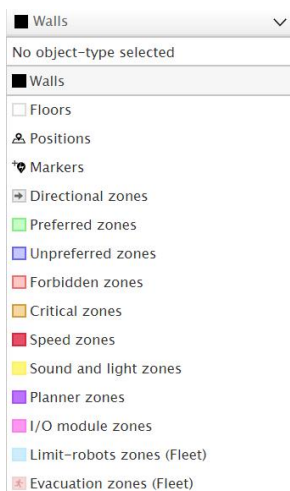
To configure the map, follow these steps:

1. Align the map so the walls are parallel to the grid lines behind it. Maps should be aligned along the X-Y axis because the robot uses the X-Y axis to plan its routes.

Drag the map to rotate it. On desktop computers, holding the Shift key when dragging the map rotates the map in increments of 11.25 degrees.



2. When the map is aligned, select **Ok** ✓ in the upper left corner of the mapping window.
3. Clean the map by drawing walls and floors and by erasing dynamic obstacles.
In the drop down menu, go to the walls layer by selecting **Walls**.



4. Select **Draw a new line** ✎, and mark on the map where there are walls or other static landmarks. It is a good idea to draw walls on top of all the walls and static objects the robot has recorded with its laser scanners. This will help the robot's localization and make the map more clean. Select **Finish current line** ✓ to finish a wall.




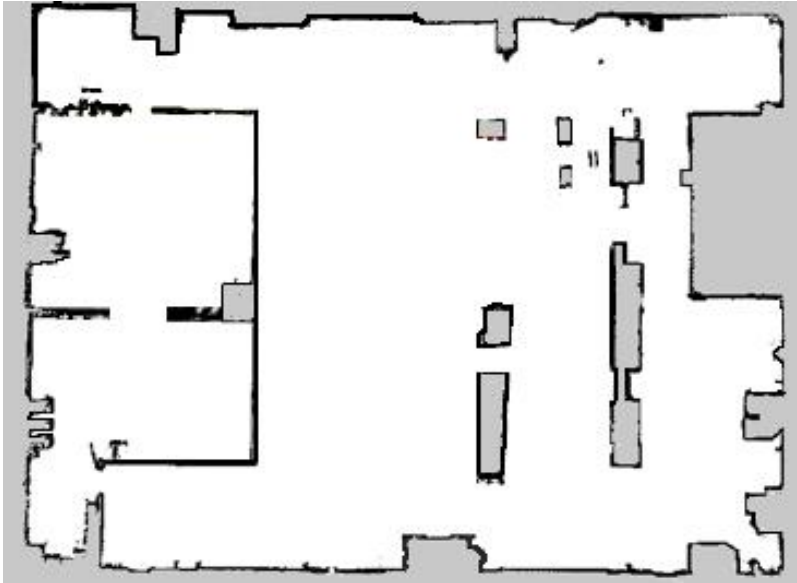
5. Select the erase tool ✎. Use the tool to erase all unwanted objects on the map. The erase tool will only erase walls when you are on the walls layer. Select the check mark ✓.



6. In the drop down menu, go to the floors layer by selecting **Floors**. The gray areas on the map is where the floor is missing, but often the easiest thing to do is to add a whole new floor on top of the mapped floor. Because you are on the floors layer, the new floor will not have an effect on objects on the walls layer. Draw the floor area on the map. Select **Finish current shape** ✓ to finish a floor.

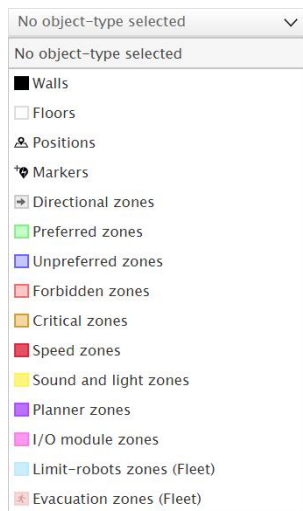


7. Once you've cleaned the map, it should look neat and only contain static landmarks. Select **Save current map**  to save the map.



Adding zones to the map

Adding zones to the map helps organize robot traffic. There are several different zones that can optimize the preferred paths and driving behavior of the robot.





NOTICE

All zones are ignored when you drive the robot in manual mode and if you use a relative move action.

- **Directional zones**

Lets you organize the motion of robots by specifying the directions in which the robots can move in specific zones.

- **Preferred zones**

The robot tries to run within a Preferred area, taking dynamic obstacles into account.

- **Unpreferred zones**

The robot tries to avoid Unpreferred zones, but may go into it them if there are no other possibilities.

- **Forbidden zones**

The robot will never enter a forbidden zone, with three exceptions: making a relative move, if a critical zone is on top of the forbidden zone, and if you drive the robot in Manual mode. Then the robot is allowed to make a plan through it, as described under Critical zones below.

- **Critical zones**

The global planner of the robot is allowed to make a path through a critical zone with complete disregard for other related zones, path guides, and obstacles.

Obstacles are not ignored by the local planner, and the robot will therefore not drive into obstacles, even though it has a global plan through them, but will try a few times to follow the plan before making a new global plan.

This zone is especially useful for driving on ramps and through automatic doors that both can seem like obstacles at a distance. It can also be useful in narrow doorways as the robot will have a global plan through it. The size of the zone should be kept to an absolute minimum, even 1 pixel wide is enough in most cases. This helps the global planner to make a simple plan through a critical fixed point in the environment.

- **Speed zones**

The robot changes its speed when driving in the zone. However, the robot will not drive faster than the limit set in **System > Settings > Planner > Maximum allowed speed**—see [System settings on page 157](#).

- **Sound and light zones**

The robot blinks and/or makes a sound to catch attention.

- **Planner zones**

Zone with six different setting options:

- **No localization**

The robot ignores data from the laser scanners and uses encoders only to localize. Useful for special driving, for example on ramps.

- **Look-ahead**

Look-ahead is used to define a decreased field of view for the robot's cameras and laser scanners.

- **Path timeout**

Maximum amount of time the robot keeps trying to complete its path if the route is blocked. It will deviate from the path unless path deviation is set to 0.

- **Path deviation**

Maximum allowed distance the robot can deviate from its path.

- **Ignore obstacles**

The robot ignores all obstacles detected with the 3D cameras with this action. This is useful if you experience problems with the robot stopping in front of windows because of sunlight.

- **Obstacle history clearing**

Selects how the robot will clear its obstacle history while driving. **No clearing:** the robot remembers all obstacles and only clears those in the field of view of cameras and laser scanners. **Clear in front of robot:** the robot only clears its memory of obstacles that it detects in a cone shape in front of it. The cone starts with the width of the robot footprint and increases by 0.3 m per meter. **Clear all:** the robot disables obstacle history altogether and only avoids obstacles that it detects with its sensors while driving.

- **I/O module zones**

The robot activates an I/O module when entering the zone. An I/O module zone may be used instead of controlling I/O modules through a mission.

- **Limit-robots zones**

Only applies when robots are controlled by MiR Fleet. The zone is used to keep an area clear of robots by setting a limit for the number of robots allowed in the zone at the same time. Additional robots will wait outside the zone for fleet permission to enter.

- **Evacuation zones**

Applies only when robots are controlled by MiR Fleet. The zone makes it possible to evacuate all robots in case of an emergency situation. Evacuation zones are inactive until activated by an operator on MiR Fleet.

Examples of when and how to use zones:

Descending staircases

Issue: The 3D cameras cannot detect descending staircases. Marking a staircase as a wall on the map will only confuse the robot as it will try to navigate from a wall that is not there.

Solution: Mark staircases and areas surrounding staircases or holes in the floor as Forbidden zones on the map.

Low hanging fixtures

Issue: If a low hanging fixture is installed that is outside of the robot sensors' range, the robot may try to travel beneath it. This can be dangerous if the robot is carrying a tall top module or load that can collide with the fixture.

Solution: Mark the area where the low hanging fixture is located as a Forbidden zone.

Highly dynamic areas

A highly dynamic area is an area where objects are moved frequently. This could be a production area where pallets and boxes are often moved back and forth.

Issue: MiR250 Shelf Carrier will stop if a person steps out in front of it. In a transient work flow area, the robot will stop and reassess its paths many times a day, thereby wasting valuable time.

Solution: Mark highly dynamic areas on the map with for example Unpreferred zones or Forbidden zones, depending on the environment. Directional zones can also be used here to guide the robot in a specific direction.

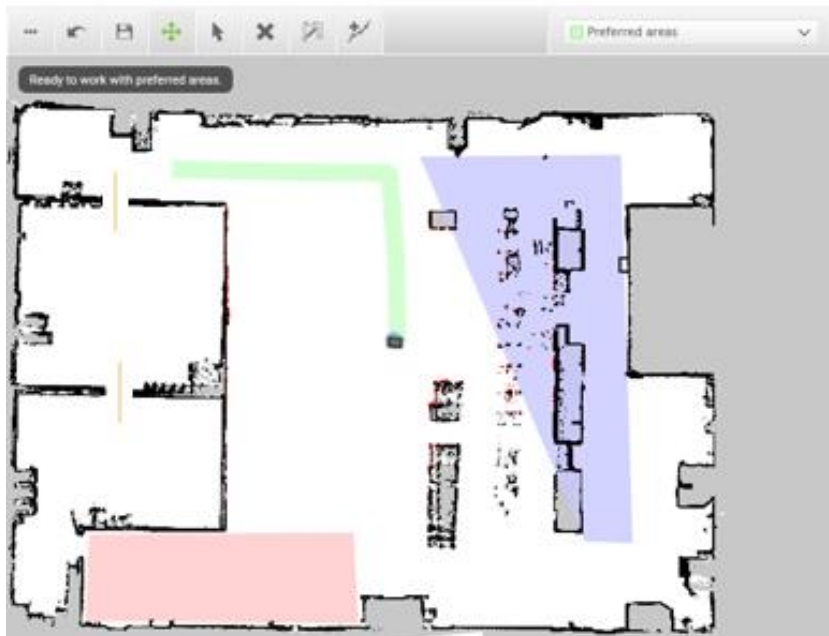


Figure 8.3. Unpreferred zones (marked with purple) can be used in highly dynamic areas to solve issues with re-planning of paths.

Doorways and ramps

Going through narrow doorways can cause problems for the robot or for the people working near the robot, as they might not see the robot coming. Going up a ramp can cause similar problems because of the upwards angle.

Issue: The robot stops because a narrow doorway is seen as an obstacle. Due to sensor input, the robot will not plan a path through a narrow doorway if it has an alternative path. The robot will always stop if a person steps out in front of it.

Solution: Add a Critical zone to the narrow doorway to force the global planner to make a path through the corridor. Place the zone right at the edges of the doorway, but don't place it on top of a wall, as this indicates to the robot that the wall isn't there. Add Sound and light zones in narrow doorways to attract attention. This will warn people near the doorway that the robot is coming through.



Figure 8.4. Narrow doorways can be marked with a Sound and light zone (marked with yellow) to warn people that it is coming through. A Critical zone (orange) can be placed on the narrow doorway to force the global planner to make a path through the corridor.

Shelves

Shelves are often placed in a certain height above the floor on four (or more) posts and will often appear as dots on a map for the robot. This may cause the robot to believe that there is enough space (if the posts are far enough apart) below the shelf to pass through. MiR250 Shelf Carrier will then plan a path underneath the shelves, but when it comes closer, the camera will see the obstacle. This could result in re-planning paths several times a day, thereby wasting valuable work time for the robot.

Issue: The robot will only see shelves as dots on the map and believe that it can make a global plan underneath the shelves.

Solution: Add a Forbidden zone (marked red in the image) around the shelves.

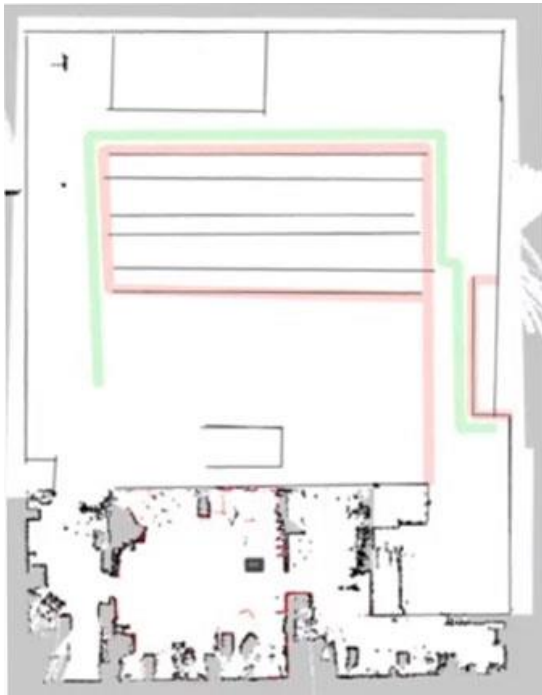


Figure 8.5. The shelves are marked as a Forbidden zone in the map.

Glass

Some types of glass cannot be detected by the safety laser scanners.

Issue: MiR250 Shelf Carrier will not stop before driving into a glass window, door, or other glass objects.

Solution: Make the glass visible to the safety laser scanners by gluing window film on the glass in the scanner height, 150 to 250 mm, or mark the area as a Forbidden zone.

8.5 Creating markers and positions

Markers and positions are defined as X-Y coordinates on a map that mark locations where you want the robot to travel to. Markers are used to indicate positions where the robot must position itself relative to a physical object making it more accurate, whereas positions mark a point on the map the robot travels to based on the robot's location on the map determined from localization—see [Navigation and control system on page 1 REF-FAIL](#).

Markers

Markers are points on the map that mark a physical entity, such as a charging station or a pallet rack. Markers enable the robot to position itself accurately relative to a physical object.

Markers require the robot to do a docking sequence. When the robot is docking, it uses its safety laser scanners to detect the marker and drives itself to the correct position relative to the detected marker. The robot begins docking to a marker from the marker's entry position. The entry position is automatically created approximately one meter in front of the marker and can be moved in the map editor.

There are three standard marker types that all MiR robots can use: V, L, and VL-markers.

A **V-marker** is a small, V-shaped marker. The V-marker is the simplest marker available to the robot. It consists of a V shape with an interior angle of 120° and sides of 150 mm.



A **VL-marker** is a larger marker that generally enables the robot to dock more accurately than V-markers. It consists of a V-marker with a 300 mm plate attached to the right of the V shape.



An **L-marker** makes it possible for the robot to dock sideways. It is shaped liked an L, and the dimensions are 400 mm x 600 mm. The outside have a clearly defined angle of 90°.



A few centimeters between markers should make docking possible. Determine during commissioning if more space is required.



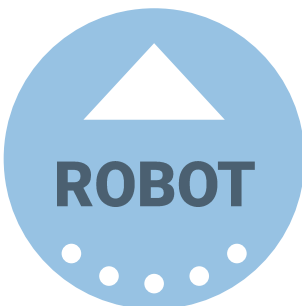
For further information on markers, see the how-to guide *Create and dock to V-, L-, and VL-markers*. Contact your distributor.

Positions

Positions are used either as destination positions or as waypoints on a route that you want to use in missions. The robot only uses its position determined from localization to drive to the position making them less accurate than markers.

The final orientation of the robot is indicated by the arrow on the position image.

There are different types of positions depending on whether the robot is part of a fleet or drives with top modules, but the standard position that is available in all MiR applications is the **Robot position**. This position has no special features, it simply marks a location where you want to be able to send the robot to.

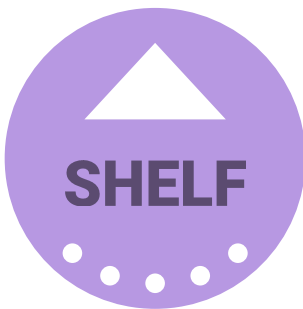


MiR250 Shelf Carrier uses **Shelf positions** to mark points where it can pick up and place shelves.



MiR250 Shelf Carrier can place shelves on other positions also, but then it cannot pick up the shelf again autonomously.

Shelf positions act both as markers and positions. When there is a shelf on the position, the robot uses the shelf as a marker to dock to. When there are no shelves on the position, the robot treats the position like a robot position since there is nothing physical to dock to.



When the robot docks to a shelf on a shelf position, you must select a marker type that describes the dimensions of the shelf the robot is docking to—see [Creating a marker type on page 153](#).

Creating a marker

Before creating a marker, you must ensure that the robot is localized correctly on an active map. If in doubt, you can check if the red lines representing the laser scanner line match the black lines on the map, as shown in *Figure 8.6*.

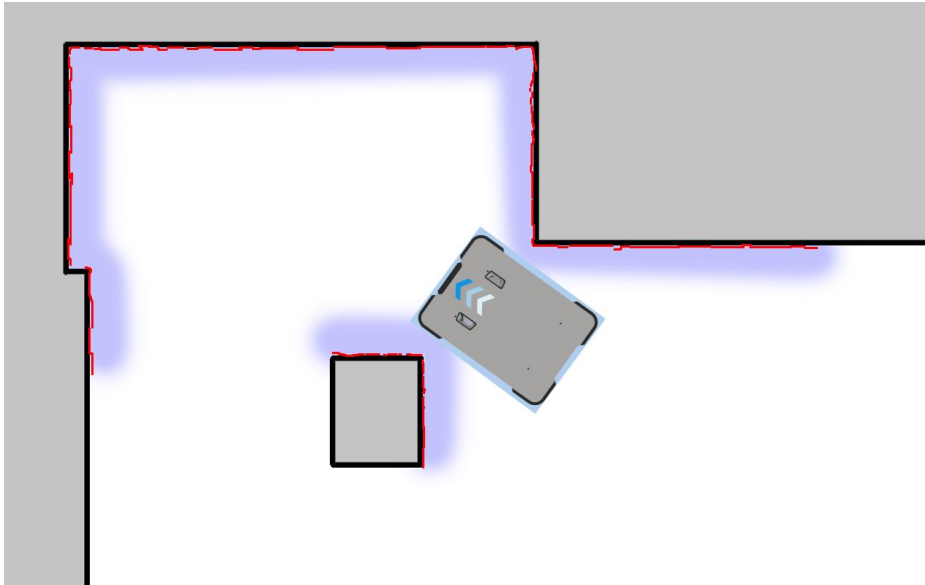


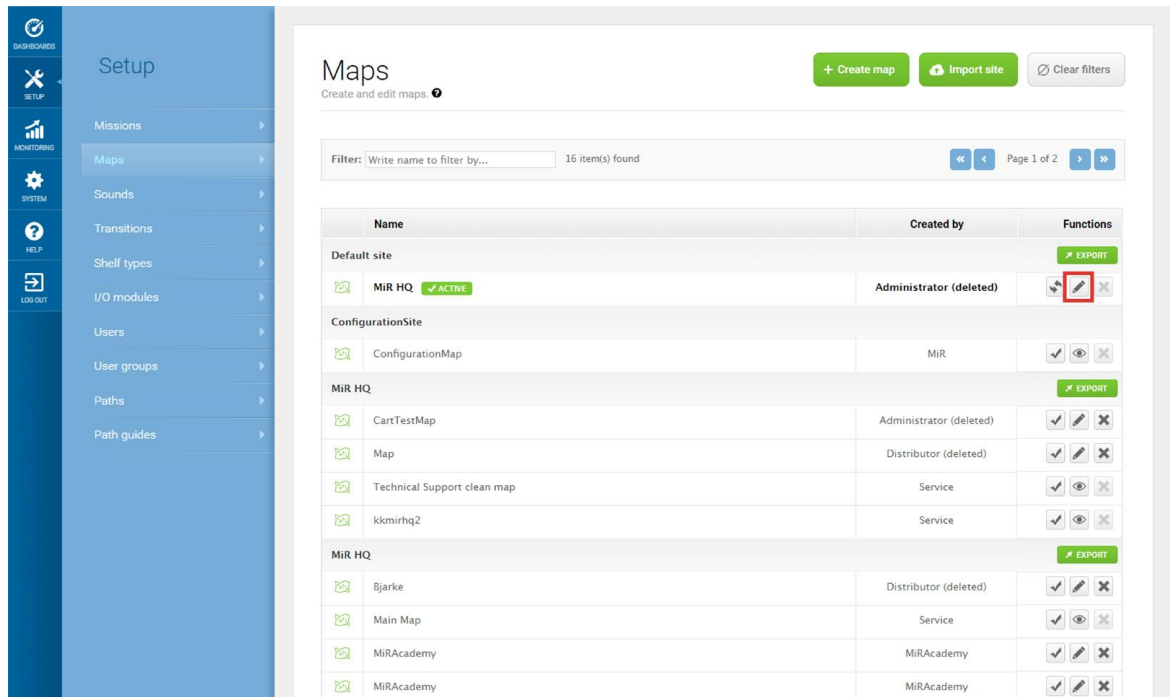



Figure 8.6. The red lines represent the obstacles the laser scanners detect. The robot is localized correctly when the red lines align with the black lines that represent walls.

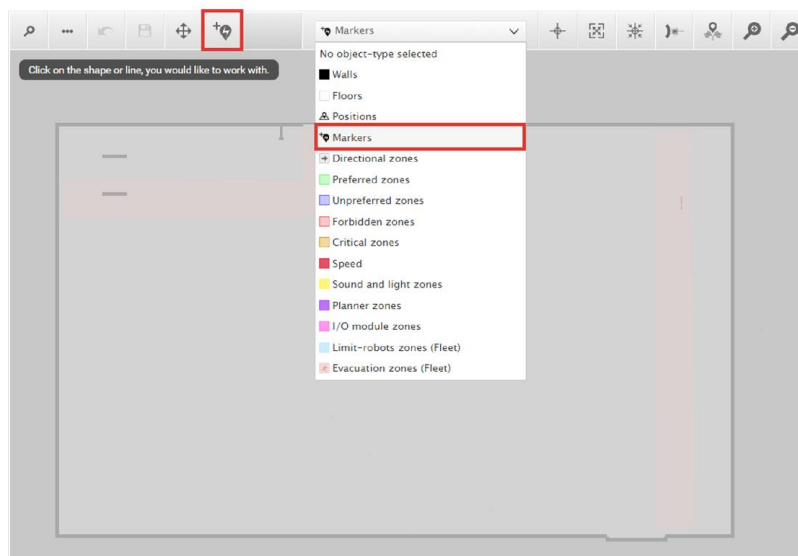
Once the robot is localized, you can insert a marker on the map. In this example, we are using a VL-marker .

1. Place your physical marker where you want the robot to dock.
2. Manually drive the robot to the marker so the robot is facing the marker.

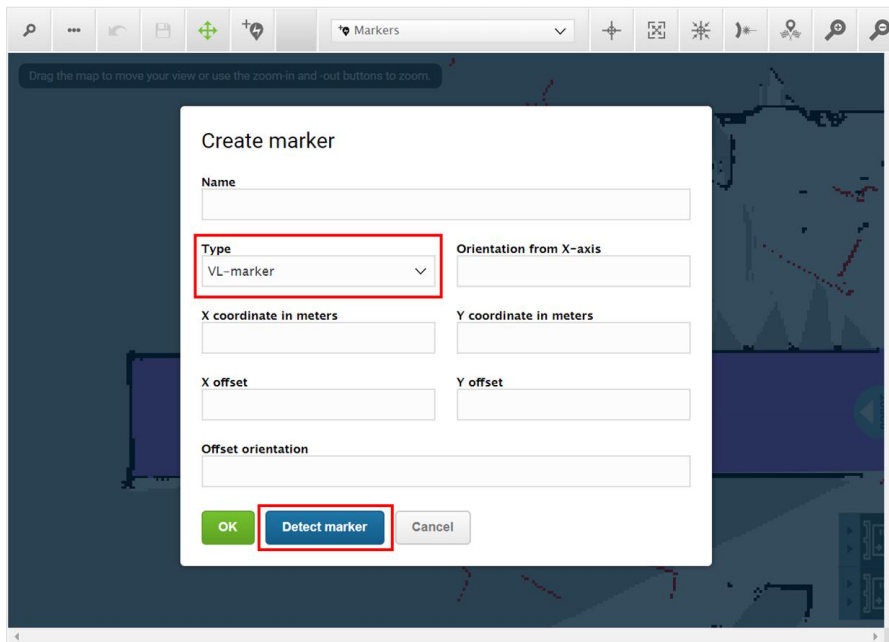
- Go to **Setup > Maps** and select **Edit**  for the active map.



- Within the editor, select **Markers** in the **Object-type** drop down menu, and then select **Draw new marker**  in the editor tools.



5. In the **Create marker** dialog box, name the marker. Under **Type**, select your marker type. In this case, a **VL-marker** is used. Then select **Detect marker**.



The X, Y, and orientation values will automatically be filled out with the current position of the robot. Set the offsets to 0. If you want to dock to the marker in reverse, set the **Offset orientation** to 180.



If the robot is too far from the VL-marker, a message that the robot failed to locate the marker is displayed. Try moving the robot closer, and ensure that the front safety laser scanner is positioned in front of the VL-marker.

6. Select **OK** to create the marker. The marker is now visible on the map.



7. The marker can be docked to by selecting it on the map and selecting **Go to**. It can also be used in missions.


GO TO	Send robot to this position.
EDIT	Edit this position's name and parameters.
DELETE	Delete this position from the map.
SHOW ENTRY POSITION(S)	Show entry position(s) for this position.
CANCEL	Close this dialogue.



To change the final position of the robot, you can select **Edit** to adjust the x or y offsets. These are valued in meters and are based on the centerpoint of the robot towards the marker.

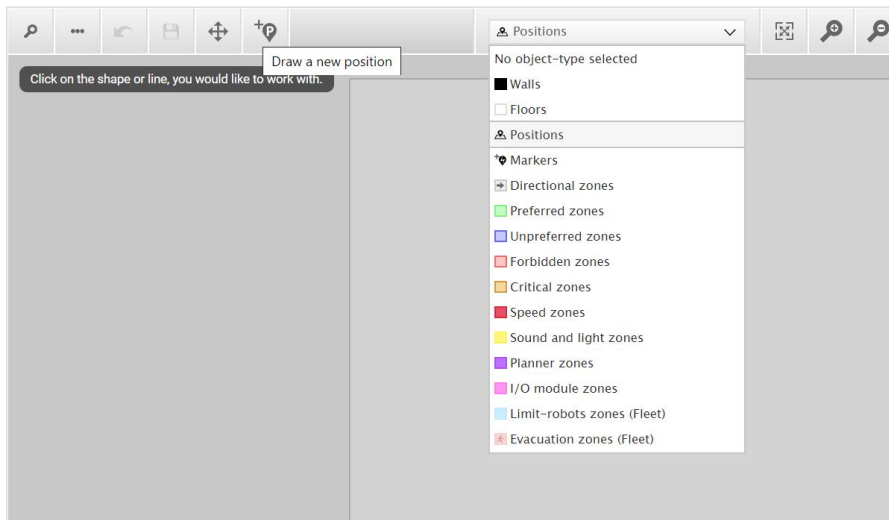
Edit marker

Name ROEQ_Docking yoyo cart	
Type VL-marker	Orientation from X-axis -91.612
X coordinate in meters 26.152	Y coordinate in meters 18.196
X offset -0.51	Y offset 0.04
Offset orientation 0	
<div> <div>OK</div> <div>Detect marker</div> <div>Cancel</div> </div>	

Creating a position

The following steps describe how to create a position on a map. In this example, we are creating a robot position .

1. In the robot interface, enter the map editor of the map where you want to create a position. This is done by navigating to **Setup > Maps** and selecting **Edit**  next to the map you would like to work on.
2. In the Object-type drop-down menu, select **Positions**, and then select **Draw a new position** .

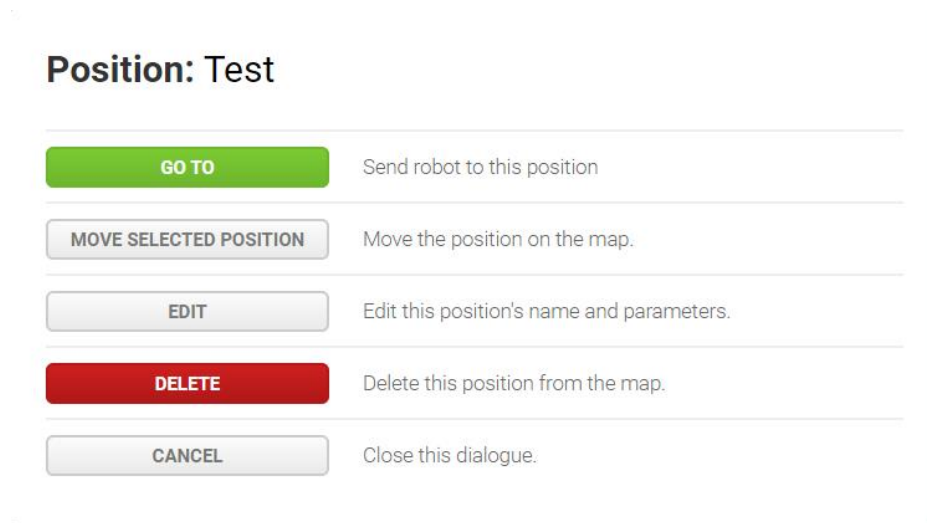


3. Select where on the map where you want the position to be, and choose in which direction you want it to face.
4. Name the position. Under **Type**, you can select which type of position you want to make. In this example we are making a robot position. Select **OK**. You have now created a robot position.

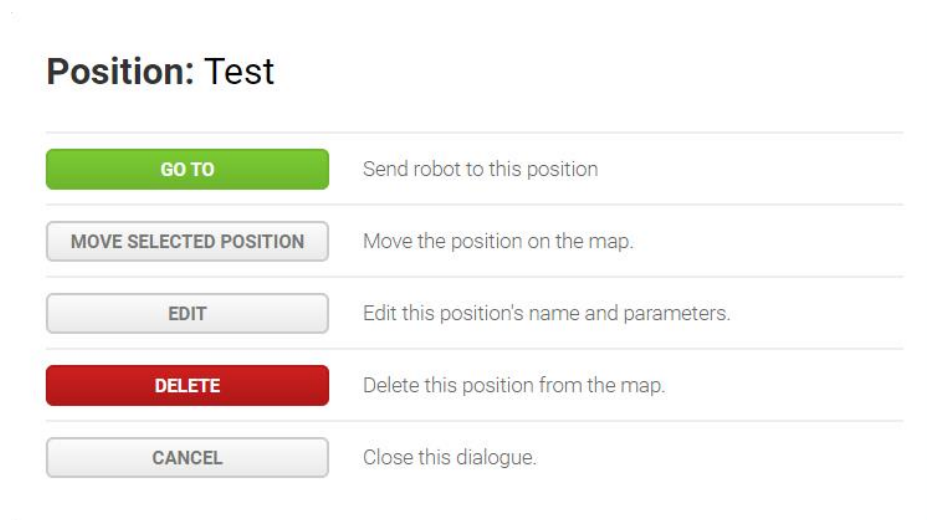
Create position

Name <input type="text" value="Test"/>	
Type <input type="text" value="Robot position"/>	Orientation from X-axis <input type="text" value="-74.604"/>
X coordinate in meters <input type="text" value="6.950"/>	Y coordinate in meters <input type="text" value="11.250"/>
<div style="display: flex; justify-content: space-around; margin-top: 10px;"> OK Cancel </div>	

You can always edit a position or send a robot to the position by selecting it in the map.



You can always edit a position or send a robot to the position by clicking on it in the map.

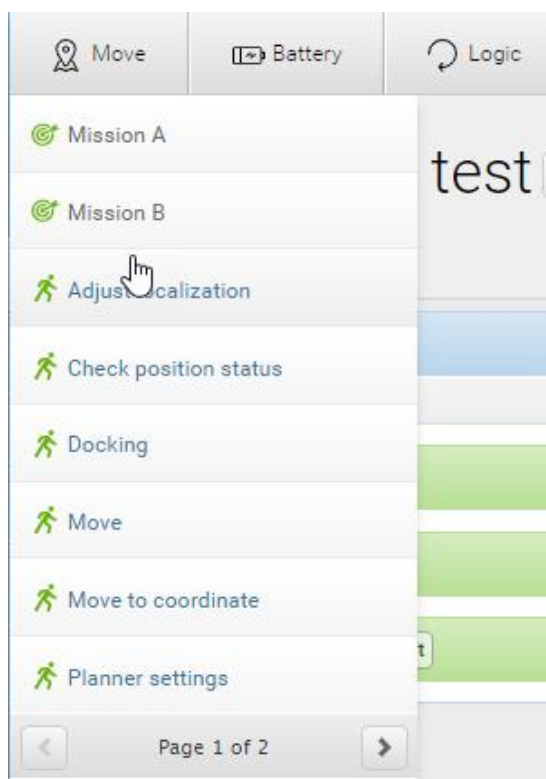


8.6 Creating a mission

MiR robots function through missions that you create. A mission is made up of actions, such as: move actions, logic actions, docking actions, and sounds, which can be put together to form a mission with as many actions as needed. Missions themselves can also be embedded into other missions.

Most actions have adjustable parameters, for example which position to go to. Most actions can also use variables, enabling the user to choose the value of a parameter each time the mission is added to the mission queue. This can be practical in cases where the robot performs the same series of actions in different areas of the site that require different parameter settings in the mission actions.

When you create a mission, you can save it in the default **Missions group**, or you can choose to save it in any of the available actions groups. The actions groups are found in the top bar of the mission editor window, and you can distinguish missions from actions by the small icons shown next to their names: missions have a target icon 🎯, and actions have a running-man icon 🚶.



You can find more information about mission groups in [Mission groups on page 138](#).

The **Mission** section also comes with a set of template missions that you can use and/or modify.

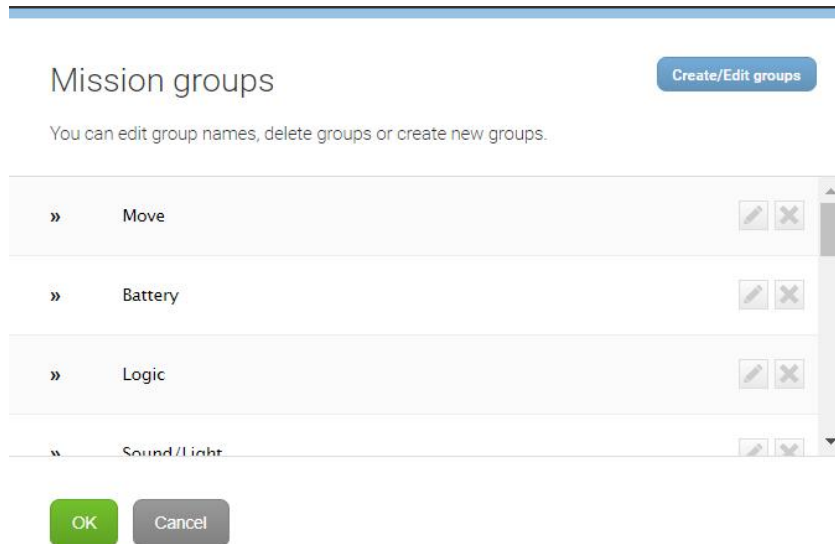
When you create a mission, you must fill in the following information:

- **Name**
The name must be unique and is used to identify the mission. For example, *Go to charging station*, *Deliver spare parts* or *Warehouse to production line 1*.
- **Mission group**
Select which group you want the mission to be part of.
- **Site**
If you are using more than one site, select which site you want the mission to belong to.

Select **Create mission** to create a new mission that you can add actions to.

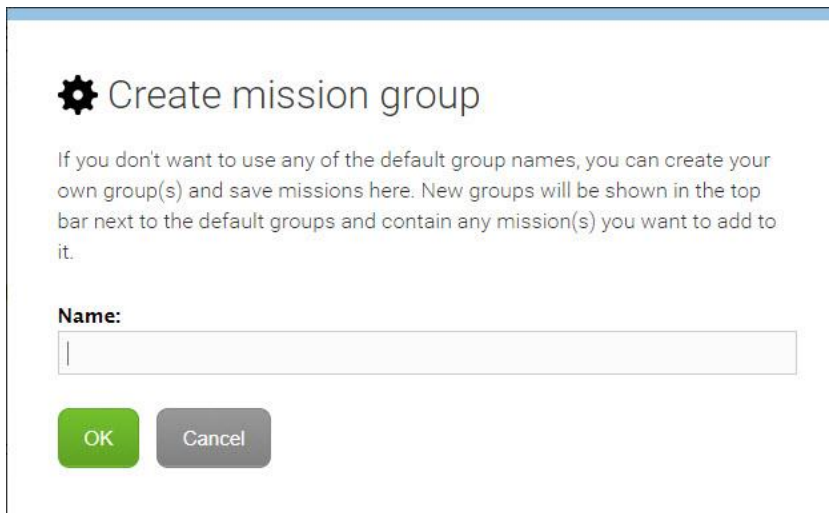
Mission groups


Each mission group has a number of predefined actions that can be selected when you build the mission. One mission can contain actions from several groups. When you save the new mission, it will be placed in the selected group and can be used as a separate mission or as an embedded mission in other missions.



Create mission group

If you don't want to use any of the default group names, you can create your own group(s) and save missions here. New groups will be shown in the top bar next to the default groups and contain any mission(s) you want to add to it.



 **Create mission group**

If you don't want to use any of the default group names, you can create your own group(s) and save missions here. New groups will be shown in the top bar next to the default groups and contain any mission(s) you want to add to it.

Name:

OK **Cancel**

8.7 Creating a footprint



When a MiR robot carries a shelf, the footprint of the robot increases to the dimensions of the shelf. For the robot to be able to plan its route so the shelf does not collide with obstacles, it is important to define a new footprint that includes the dimensions of the shelf that exceed the dimensions of the robot.

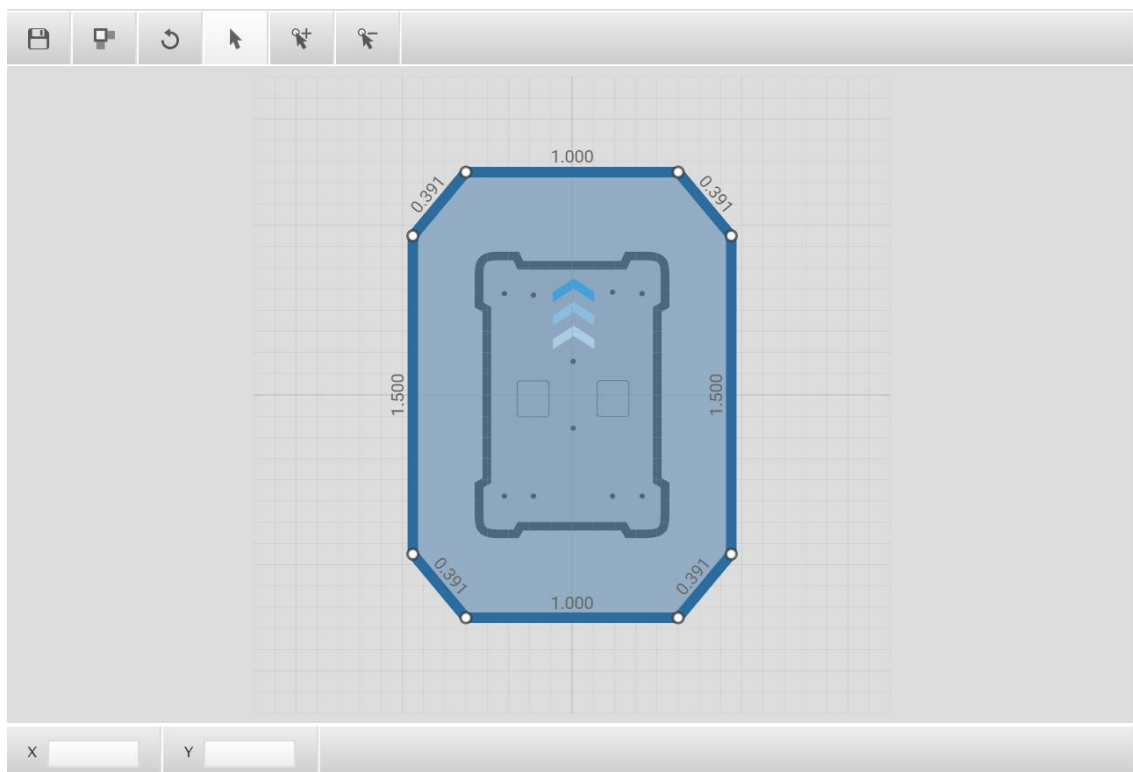
In the footprint menu, you can create and edit footprints to use in missions.



For a more thorough guide to creating footprints, contact your distributor to see the guide *How to change the robot footprint*.

Follow these steps to create your own footprint:

1. In **Setup > Footprints**, select **Create footprint**, and name the footprint.
2. Drag the points to change the footprint.
 - You can choose to drag the points in simple mode for a rectangular footprint, or in advanced mode for a footprint defined with four or more points. To toggle between modes, select **Toggle mode**  .
 - In each editor mode you can change the position of a point by either dragging it or by inserting X and Y values for that point in meters in the text box in the bottom-left corner.

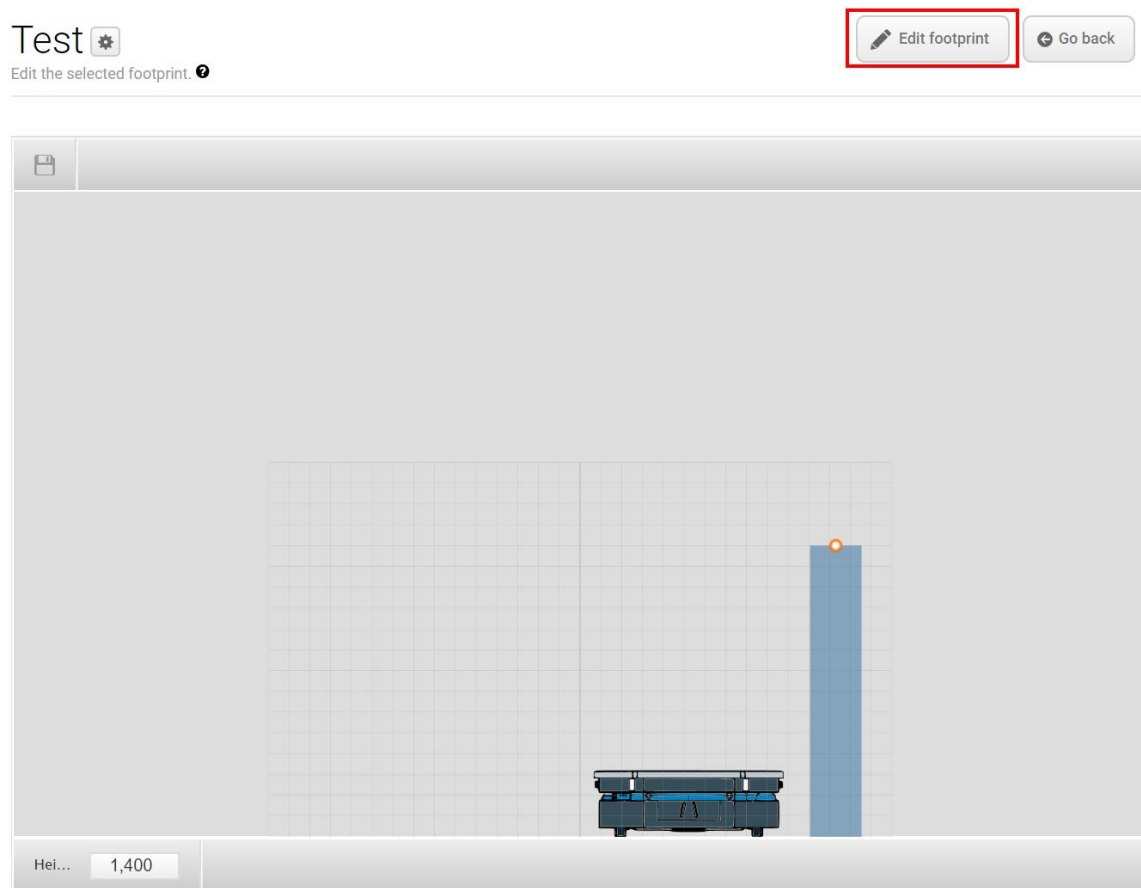


The values displayed along the lines are the distances between points in meters.



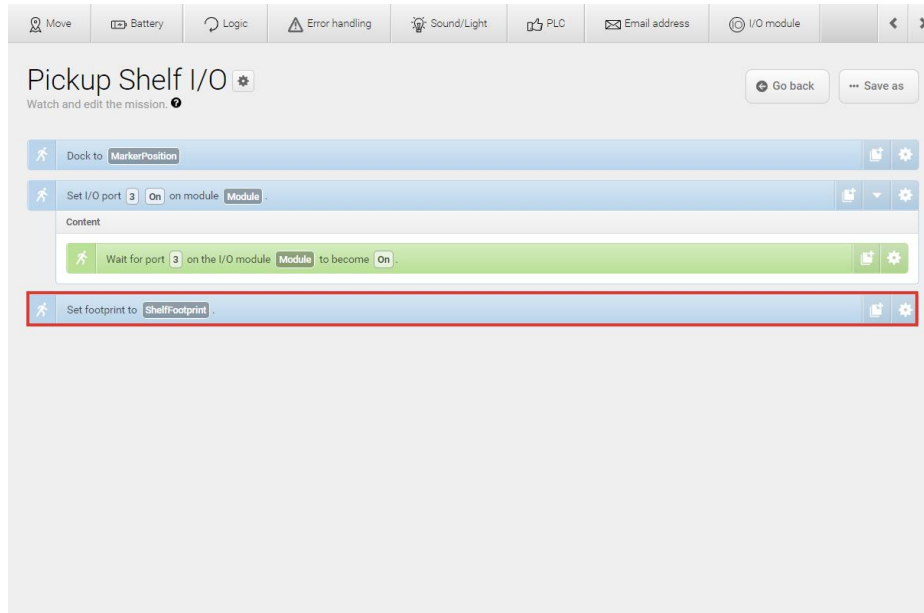
The maximum footprint is 3x3 m, and the maximum footprint height is 1.8 m.

3. Select **Edit height/Edit footprint** if you need to change the height of the footprint. You can either drag the column to the right of the robot, or insert a value in meters in the text box in the bottom-left corner.

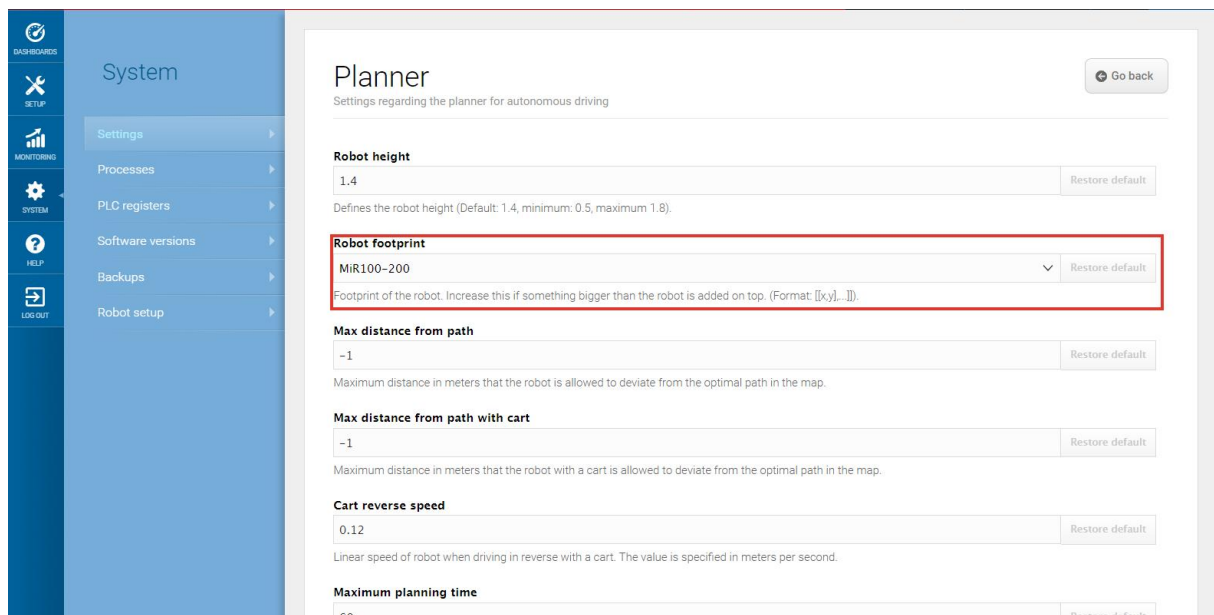


4. When you are done, select **Save**  to save the footprint.

If you want to change the footprint in a mission, for example if the robot picks up a shelf, use the Set footprint action or a shelf template mission where the Set footprint action is already implemented.



If you want to edit the default footprint of the robot, for example if the top application is larger than the robot, go to **System > Settings > Planner**, and select a new footprint under **Robot footprint**.



8.8 Operating hazard zones

Operating hazard zones are areas that must be visibly marked to comply with safety standards in EN 1525 and ISO 3691-4. Personnel must be instructed to stay clear of operating hazard zones when a robot is approaching.

Areas where the robot drives with muted personnel detection means and areas with inadequate clearance must be marked as operating hazard zones with signal tape or similar marking material.

To create a sufficiently large operating hazard zone, the marking must be at least one meter away from the potentially hazardous area in all directions.

It is not allowed to have work stations in operating hazard zones.

You can add zones to the map in the robot interface to mitigate the risks to personnel in operating hazard zones. We recommend considering whether the adding the following zones can reduce the risks in an operating hazard zone:

- Speed zones can be used to reduce the speed of the robot to the minimum robot speed.
- Sound and light zones can be used to add acoustical and visual warnings when the robot drives into the zones

For more information about zones, see [Creating and configuring a map on page 112](#).

Docking to a marker

When docking to a shelf, a charging station, or other physical markers, the robot mutes its personnel detection means temporarily and the area must therefore be marked as an operating hazard zone. For more information about markers, see [Creating markers and positions on page 126](#).

The muting starts when the robot reaches the entry position approximately one meter from the marker. To indicate this to people nearby, MiR250 Shelf Carrier slows down and starts blinking yellow, using the eight signal lights on the corners of the robot.

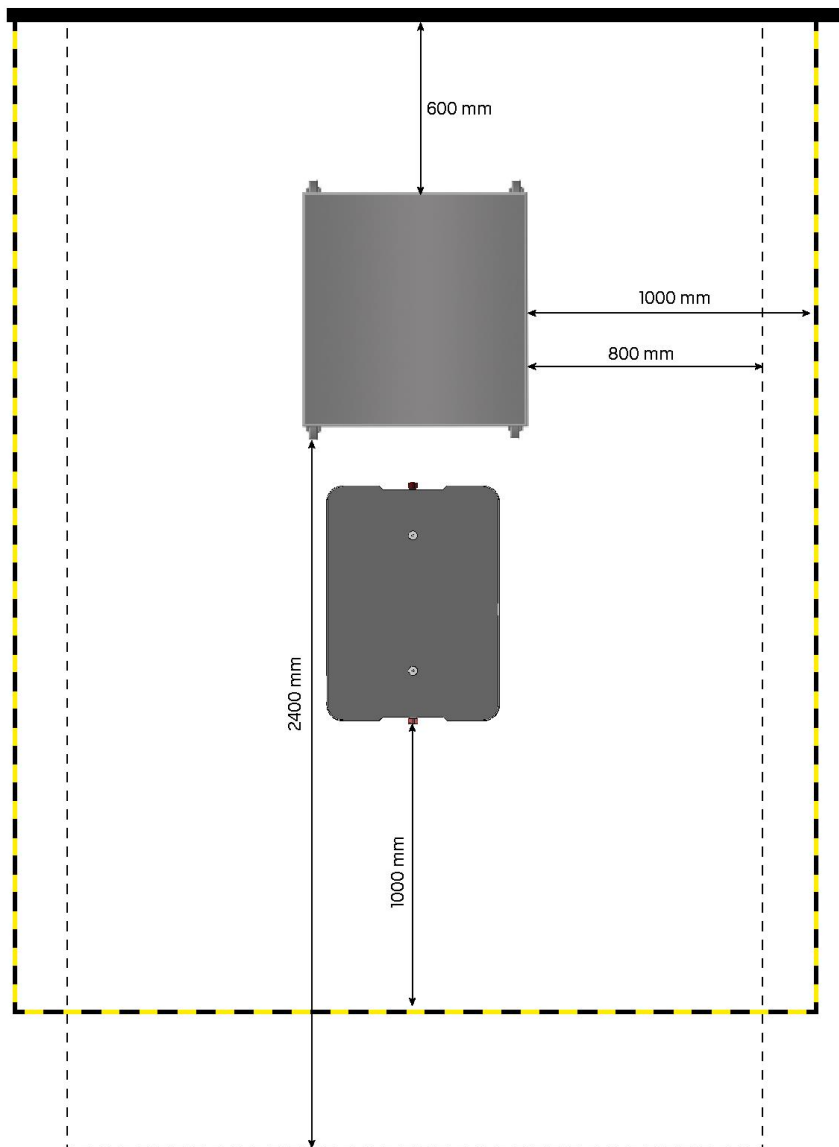


Figure 8.7. The striped black and yellow line identifies the hazard zone around a shelf. The dashed black line indicates the amount of required free space for the robot to dock smoothly.

You must mark the floor area one meter around the docking marker and the robot when it is at the entry position. This is illustrated in *Figure 8.7* where the robot is docking to a shelf.



NOTICE

The space required for a successful docking to a marker can be larger than the operating hazard zone. Consider expanding the operating hazard zone to include the required free space to ensure that personnel do not place objects so they block the robot from docking to the marker. In *Figure 8.7* the required free space is illustrated with the dashed black line.

Multiple shelves

If you have multiple shelves next to each other, it is important to place the shelves with enough space between them to ensure a correct docking procedure.

Between every shelf, there must be at least 600 mm of free space. You can reduce the distance between shelves to 150 mm if you use VL-markers to specify the exact pick up and placement position of the shelves—see [Creating the Place shelf at VL-marker mission on page 190](#).

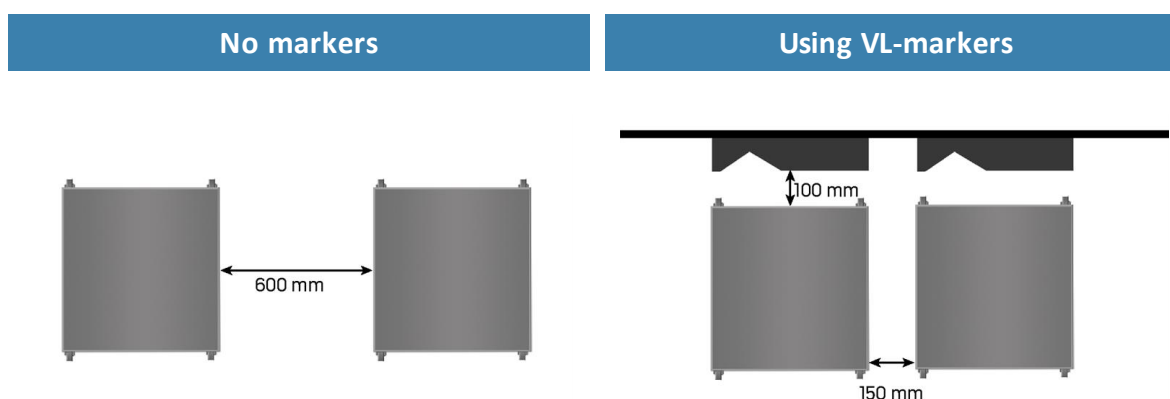


Figure 8.8. When placing and docking to shelves without using markers, there must be at least 600 mm between them. When you are using VL-markers, the distance can be reduced to 150 mm.



You can also use other markers to reduce the distance between shelves, but MiR only guarantees that it is possible to reduce the distance to 150 mm when using VL-markers.

When you use markers, the distances between shelves can be reduced enough that you must make sure that there is enough space for escape routes in case of an emergency situation. The following sections describe two setups with VL-markers that include the necessary escape routes.

Markers for shelves against a wall or structure

When setting up markers against a wall or other fixed structures, there must be escape routes between the markers. To fulfill the safety requirements, place the markers so there is 500 mm of space between every second shelf. This ensures there is always an escape route on at least one side of each shelf.

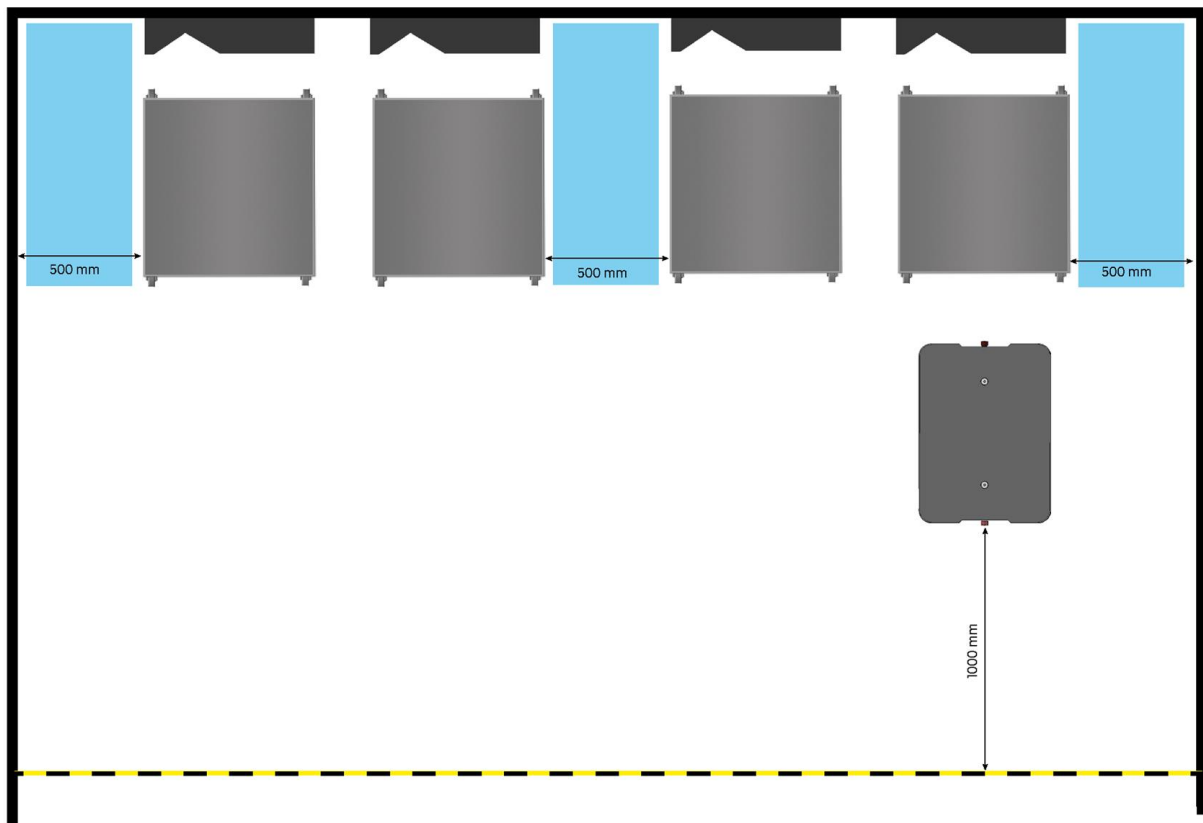


Figure 8.9. Shelf placement so there are escape routes between the shelves

Markers for shelves close together

When setting up markers for shelves so they are placed as closely together as possible, there must be an escape route behind the shelves. To fulfill the safety requirements, there must be at least 500 mm of free space behind the shelves and 500 mm of free space on the side of one of the shelves leading out of the operating hazard zone. The 500 mm behind the shelves can either be between the shelves and VL-marker or behind the VL-marker.

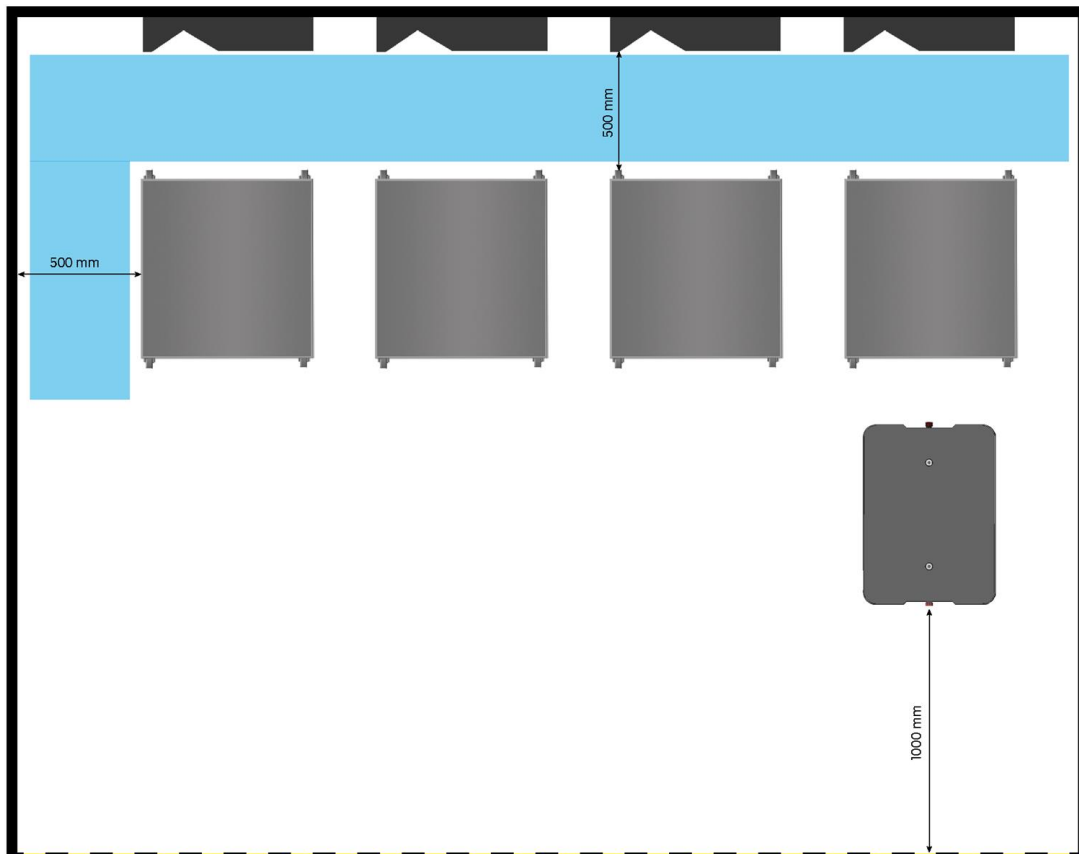


Figure 8.10. Shelf placement so there is an escape route behind the shelves.

8.9 Brake test

It is the responsibility of the commissioner to perform an adequate test of the robot's braking capability.

The braking distance of MiR250 Shelf Carrier is particularly dependent upon four factors:

1. The speed of the robot
2. The payload of the robot
3. The surface the robot drives on
4. The decline of the surface the robot drives on

Because of this, it is not possible to predetermine the exact braking distance of MiR robots. The distance has to be determined in the environment and under the driving conditions the robot will be operating in.

The goal of the brake test is to ensure that the robot will brake in time to avoid a collision with a human or object when driving with maximum payload, with different field sets for different speeds, and at the steepest supported decline.

If the measured braking distance is too long, the field sets of the robot should be made larger to ensure a safe installation. The field sets should always be at least somewhat larger than the breaking distance at all speeds. To modify the field sets, see the guide *How to adjust the field sets on MiR250/MiR500/MiR1000*. Contact your distributor for the guide.

8.10 Creating user groups and users

All users of the robot must have a user profile in the system. Users are administered in the **Users** section where you set up, edit, and delete system users.

The user profiles are created during commissioning. As default, the robot has three User groups: User, Administrator and Distributor. Parts of the user interface can be locked by the commissioner. The locked parts are typically related to the safety of the robot system, and changing the settings can violate the CE-marking of the robot.

It is important to analyze and consider who is:

- Working directly with MiR250 Shelf Carrier as direct users or operators?
- Responsible for MiR250 Shelf Carrier as commissioner?

Furhtermore, the following questions should be answered:

- How many different users are there?
- What tasks do each user have with MiR250 Shelf Carrier?
- What permissions (read/write) should the different users have?
- What functions or widgets should be available for the different users?



For more details on interface and dashboards, see *MiR Robot Reference Guide*.

Create user groups

In **Setup > User groups** you can create specific user groups with specific access to different parts of the robot interface.

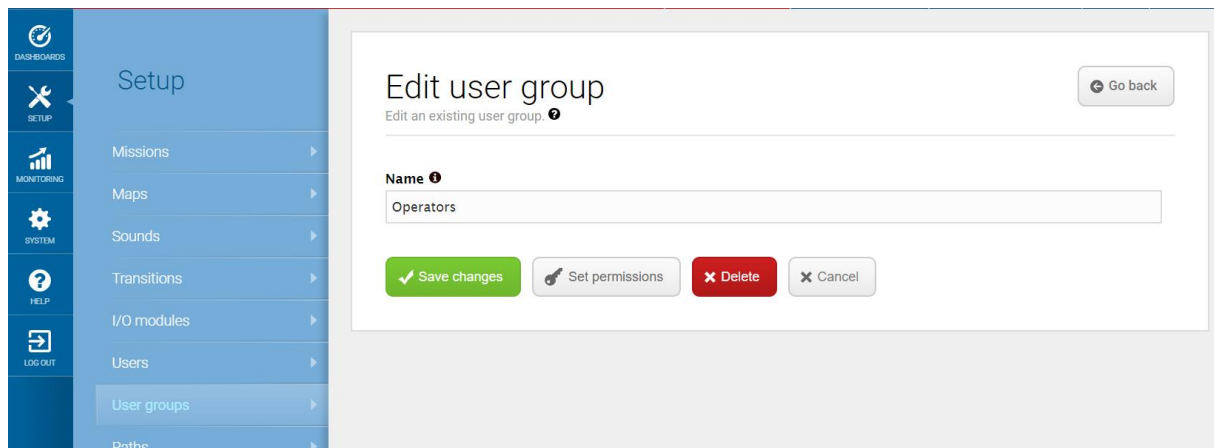


Figure 8.11. You can create specific user groups.

Under **Set permissions**, you can select the specific parts of the robot interface that the user group has access to.








Maps & positions		
	Section	<input type="checkbox"/> Write
	Sites	<input type="checkbox"/> Write
	Maps	<input type="checkbox"/> Write
	Zones	<input type="checkbox"/> Write
	Positions	<input checked="" type="checkbox"/> Write
	Paths	<input type="checkbox"/> Write
	Path guides	<input type="checkbox"/> Write
	Marker types	<input checked="" type="checkbox"/> Write

Figure 8.12. You can select the specific parts of the robot interface that the user group has access to.

Create users

In **Setup > Users**, you can create new users and select:

- Which user group they belong in.
- If they are Single dashboard users with no access to other parts of the interface than to control the robot from a dashboard.
- If they should be allowed quick access to the interface via a four digit PIN code. We only recommend PIN codes for users with no access to settings and safety system.

The following table contains some of the recommended permission settings for different user groups:

Feature	User group
Controlling the robot manually	Operator
Creating maps and positions	Commissioner
Creating and editing missions	Operator
Adjusting warning sounds	Commissioner
Creating new user groups	Commissioner
Assigning missions	Direct user
Changing system settings	Commissioner

8.11 Creating dashboards

To make the user experience as easy and simple as possible, you can build a unique dashboard for each user. Dashboards are an easy way for different user groups to control the robot giving direct access to their individual key functions.



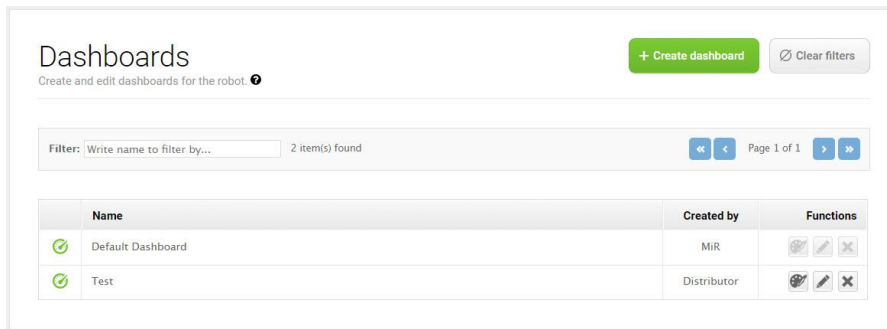
For more details on interface and dashboards, see *MiR Robot Reference Guide*.

A dashboard is made up of a number of widgets, each representing a feature in the system, for example a particular mission, the map the robot is operating on, or the current mission queue.

The system comes with a default dashboard, and users with access rights to create dashboards can create an unlimited number of additional customized dashboards.

To create a custom dashboard:

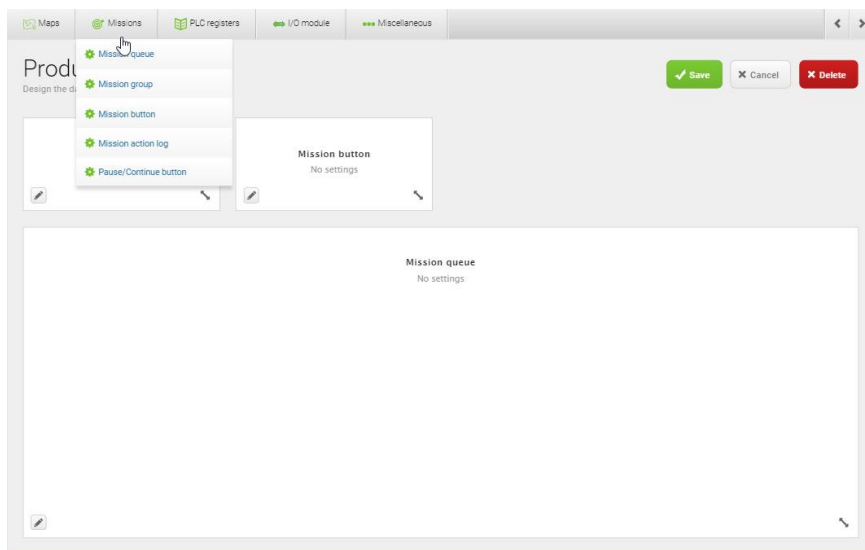
1. Go to **Dashboards > Dashboards**, and select **Create dashboard**.



2. Name the dashboard, and select **Create dashboard**.

3. In the design section:

- Design the dashboard by adding widgets from the menus in the top bar that represent the features you want to assign to the dashboard.
- Resize the widgets by pulling the arrow in the lower right-hand corner, and rearrange their order by click-dragging.
- Some widgets require further settings. For example, you must select a particular mission for mission buttons. To do this, select the pen icon in the lower left-hand corner, and select the wanted action.



4. Select **Save** to save the dashboard. The dashboard is now available under **Dashboards**.



For details on the widgets and missions available in dashboards, see *MiR Robot Reference Guide*.

8.12 Creating a marker type

Before creating missions with shelves, you need to define the different marker types that your robot will be docking to. Marker types are used to define what type of shelf is located on a shelf position and how the robot docks to it, ensuring that the robot picks up the shelf correctly.



If you are using a shelf that has dimensions supported by MiR—see Shelf specifications on page 109—you can use the default marker type **Asymmetric MiR250 shelf**.

Follow these steps to create a new marker type:

1. To create a new marker type, go to **Setup > Marker types**, and select **Create marker type**.

Marker type
View and create new marker types.

Filter: 4 item(s) found

	Name	Marker type	Bar length	Bar distance	Orientation offset	X offset	Y offset	Created by	Functions
	Narrow asymmetric MiR500/1000 shelf	Leg Shelf Marker	0.65	1.03	0	0	0	MiR	
	Wide asymmetric MiR500/1000 shelf	Leg Shelf Marker	0.65	1.16	0	0	0	MiR	
	Narrow symmetric MiR500/1000 shelf	Leg Shelf Marker	0.7	1.03	0	0	0	MiR	
	Wide symmetric MiR500/1000 shelf	Leg Shelf Marker	0.7	1.16	0	0	0	MiR	

+ Create marker type

2. Fill in the parameters with the dimensions of your shelf. Each parameter is described below.

Create marker type

Create a new marker type. ?

Go back

Name ?

Enter the marker type's name

Shelf type ?

Bar Shelf Marker

Bar length in meters ?

Enter the marker type's width in meters ...

Bar distance in meters ?

Enter the marker type's bar distance in meters ...

Orientation offset in degrees ?

Enter the marker types orientation offset in degrees ...

Offset X in meters ?

Enter the marker type's X-offset in meters

Offset Y in meters ?

Enter the marker type's Y-offset in meters

✓ Create marker type ✕ Cancel

- **Name:** Identifies the shelf type when using it in mission actions.
- **Shelf type:** Identifies the type of shelf that is going to be used. **Bar shelf markers** are for MiR100 and MiR200 robots, and **Leg shelf markers** are for MiR250, MiR500 and MiR1000 robots.
- **Bar length in meters:** Defines the distance between a set of legs parallel with the robot.
- **Bar distance in meters:** Defines the distance between a set of legs perpendicular to the robot. This can also be interpreted as the width of the space under the shelf where the robot docks.
- **Orientation offset in degrees:** Adjusts the angle of the robot's orientation when docking to the shelf. A value of 180 will make the robot dock in reverse. With a positive offset, the robot will turn to the left, and a negative value will turn it to the right.
- **Offset X in meters:** Adjusts how far forward the robot should go under the shelf when picking it up. By default, the robot should dock to the center. With a positive X-offset, the robot will move more forward, and a negative value will move it backward.

- **Offset Y in meters:** Adjusts how far to either side the robot goes under the shelf when picking it up. By default, the robot should dock to the center. With a positive Y-offset, the robot will move more the left side, and a negative value will move it to the right.
- **Leg asymmetry in meters:** Defines the offset between the two front legs. A zero value means the legs are symmetrical.



If the robot is not docking correctly, try adjusting the X and Y offsets.

3. Select **Create marker type** when you are done. The marker type is now displayed in the list of marker types.

8.13 Updating MiR250 Shelf Carrier software

MiR continuously updates the software the robots use, either to fix issues, to improve existing features, or to introduce new features. Each software release is issued with a release note explaining the content of the update and its target audience.

Contact your distributor for the latest update file.

Follow the steps below to update software:

1. Connect your computer to the WiFi of the robot you want to update, and sign in to the robot interface.
2. Go to **System > Software versions** and select **Upload software**.

The screenshot shows the 'Software versions' page in the MiR250 Shelf Carrier interface. The left sidebar has a 'SYSTEM' menu with 'Software versions' selected. The main area shows a table with one software version (2.8.0.4) and an 'Upload software' button highlighted with a red box.

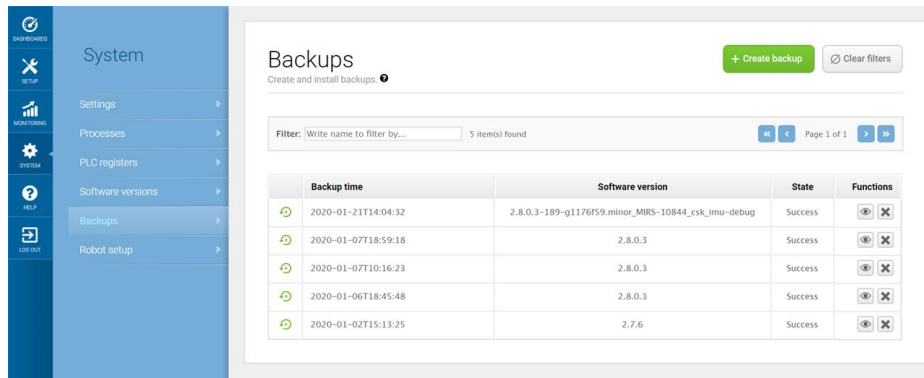
Version	Upgraded from	State	Start time	Finished	Functions
2.8.0.4	2.7.8	Success	2020-02-13T16:39:28	2020-02-13T16:41:41	

3. Locate and select the downloaded software package. It may take a few minutes for the package to successfully upload.
4. Once the software is uploaded, turn the robot off and then on again.

8.14 Creating backups

It can be useful to create a backup if you want to be able to revert to the exact state of the current software, including data such as settings, missions, and reports at a later stage.

To make a backup of your system, go to **System > Backups**. Select **Create backup**.



When the state displays **Success**, you have created a backup of your system.

Follow the steps below to revert to a previous system:

1. Go to **System > Backups**. Choose the back up version you want to revert to, and select **View**.
2. Select **Roll back**. You have now reverted your robot back to the saved version.



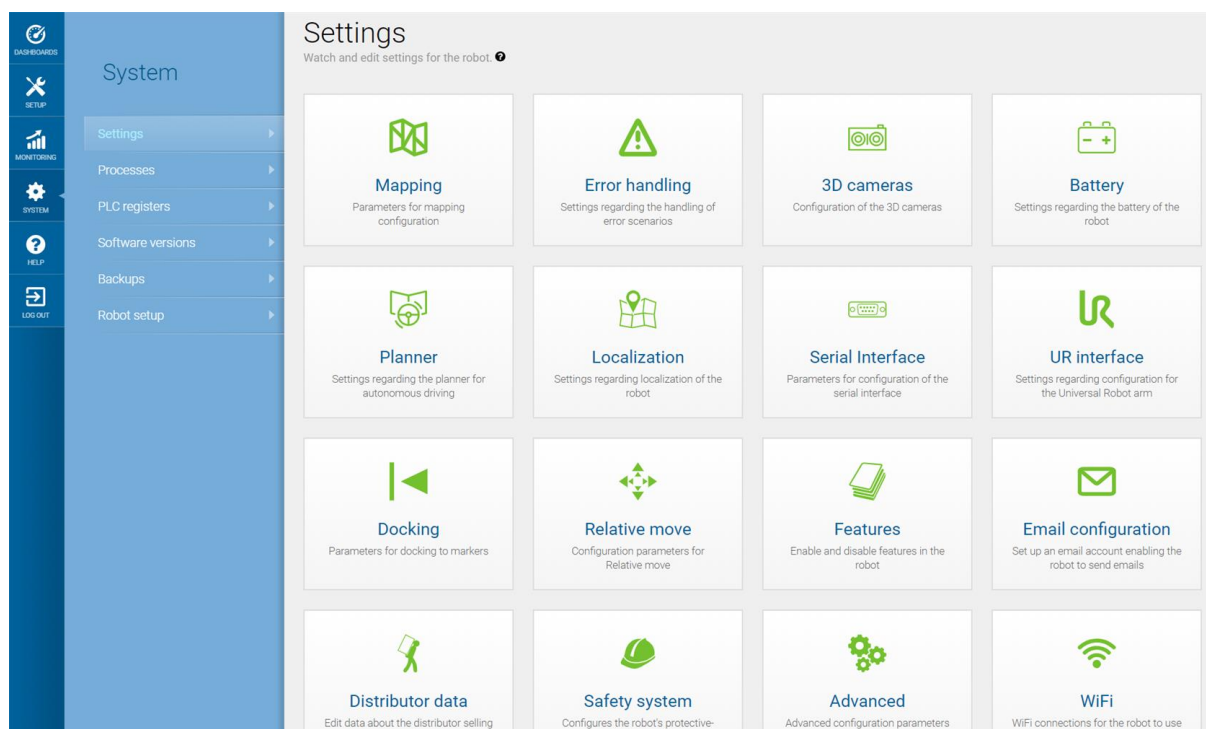
8.15 System settings

This section describes some of the commonly used system settings of MiR250 Shelf Carrier that the commissioner must be aware of.



Only the basic system settings are explained in this section, see *MiR Robot Reference Guide* for more information.

In **System > Settings**, users can access the settings of the robot. Access to the settings must be restricted by the commissioner—see [Creating user groups and users](#) on page 148.



Planner

In the Planner section, you set the basic parameters for driving the robot.

Planner

Settings regarding the planner for autonomous driving

Go back

Robot height

1.4

Restore default

Defines the robot height (Default: 1.4, minimum: 0.5, maximum 1.8).

Max distance from path

-1

Restore default

Maximum distance in meters that the robot is allowed to deviate from the optimal path in the map.

Max distance from path with cart

-1

Restore default

Maximum distance in meters that the robot with a cart is allowed to deviate from the optimal path in the map.

Maximum planning time

60

Restore default

The maximum time allocated for planning a path. The value is specified in seconds.

Path timeout

0

Restore default

Timeout before asking for a new global plan [in seconds]. Note! Negative value means infinite waiting time.

Path deviation

-1

Restore default

Maximum distance in meters that the robot is allowed to deviate from the path planner in the map. Note! Negative value disables the feature.

Indicator light

False

▼

Restore default

Set to True to enable indicator lights while driving autonomously.

Robot height defines the height of the robot including top modules. Use this setting if your robot operates permanently with a top module that makes the combined robot application higher than the robot itself. This prevents the robot from colliding with obstacles from above.

Max distance from path and **Max distance from path with cart** defines the maximum allowed distance in meters that the robot is allowed to deviate from the optimal path in the map.

Maximum planning time defines the maximum time allowed in seconds for planning a path.

Path timeout defines the maximum time allowed in seconds before the robot asks for a new plan if the robot's path is blocked.

Path deviation defines the maximum distance in meters that the robot is allowed to deviate from the path planner in the map before it makes a new path.

Optimizing the distance, time, timeout and deviation of paths, is useful in situations where you want to configure how strictly the robot should follow the path it has planned. Making the robot follow the exact path it has planned with little or no deviation is known as Line-following. This can be useful, for example, in narrow corridors where there isn't enough space for the robot to go around dynamic obstacles—see *Figure 8.13*. When there isn't enough space for the robot to go around an obstacle, it will often spend more time trying to maneuver around the obstacle and correct its trajectory afterward than it would have just waiting for the obstacle to move out of the way itself.

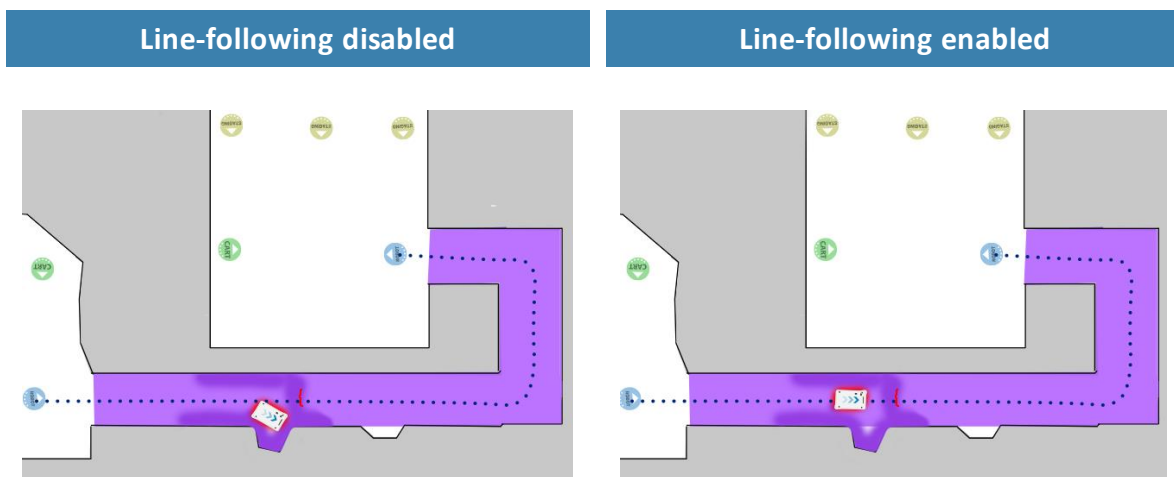


Figure 8.13. Example of where the robot might benefit from using a Line-following configuration.

Maximum allowed speed defines the overall speed limit of the robot in meters per second. The maximum allowed speed will never be exceeded no matter what is stated in the mission. This setting can be useful if, for example, the robot transports motion sensitive objects, or if the work environment in other ways require the robot to always stay below a certain speed threshold.

Desired speed sets the default speed of the robot. This setting can be useful in the same way as maximum allowed speed, but with this setting, the robot will drive faster than the set desired speed in a speed zone that requires it.

Docking

In the Docking section, you can change the parameters regarding docking to and from markers.

Docking

Parameters for docking to markers

Go back

Undock from markers

True Restore default

Select True to make the robot undock before starting move from docked position.

Hide advanced settings

Distance to marker for disabling collision checks.

0.2 Restore default

Distance to marker where collision detection is disabled.

Docked at marker side threshold

0.4 Restore default

Side threshold for being docked to a marker

Docked at marker angle threshold

20 Restore default

Angular threshold for being docked to a marker

Parameter for driving more straight during docking

1.0 Restore default

Setting of maximum allowed change to marker estimate when the robot moves towards a marker (in meters per meter). Reducing the value of this parameter makes the robot move more straight during docking. However, it also reduces the precision of the docking.

Relative move target when docking to markers.

0.5 Restore default

Relative move target offset when docking to markers. The value is specified in meters.

In **Undock from markers**, you can select if the robot should undock from a marker before it starts moving from a docked position. It is usually best to set this setting to **True** to prevent the robot going into protective stop when moving away from markers.

Select **Show advanced settings** to see the advanced docking settings.

In the advanced settings, you can adjust the parameters for docking to markers. This can be useful in case of docking issues.

Safety system

In the Safety system section, you can change the safety settings of the robot.

Safety system

Configures the robot's protective-fields system

Go back

Muted-protective-fields sound

Beep ▼ Restore default

When the robot drives with muted protective fields, this warning sound is played.

Muted-protective-fields volume

50 Restore default

The volume for warning sounds

✓ Save changes ✕ Cancel

Select **Muted protective fields sound** to change the warning sound that is played when the robot drives with muted protective fields.

Select **Muted protective fields volume** to set the volume in decibel for the warning sound that is played when the robot drives with muted protective fields.



CAUTION

Driving with with muted protective fields without audible warning sound risks damage to personnel and voids the CE marking of the application.

- Always have the robot play an audible warning sound when driving with muted protective fields.

Features

In the features setting, you can disable and enable robot features.

Features

Enable and disable features in the robot

Go back

Shelf

False



Restore default

Select **True** if the robot is used to pick up and place shelves.

Email address

True



Restore default

Select **True** to add an action for sending emails from missions.

PLC registers

True



Restore default

Select **True** to add actions for setting PLC registers from missions and monitoring PLC register in the robot interface.

Universal Robots Interface

False



Restore default

Select **True** to add an action for running UR-programs from missions.

Fleet

False



Restore default

Select **True** if the robot is part of a fleet

Modbus

False



Restore default

Select **True** if the robot uses Modbus

I/O modules

True



Restore default

Add actions for communicating with I/O modules

Shelf enables the shelf feature. Select **True** if the robot is used to pick up and place shelves.

Email address enables an action for sending emails from missions.

PLC registers enables actions for setting PLC registers from missions and monitoring PLC registers in the robot interface.

Universal Robots Interface enables an action for running Universal Robots-programs from missions. It can be set to **True** if MiR250 Shelf Carrier drives with an application from Universal Robots.

Fleet makes the robot visible for a MiR Fleet. Select **True** if the robot is part of a fleet.

Modbus enables modbus.

I/O modules adds actions for communicating with **I/O modules**. Select **True** if the robot uses I/O modules.

9. Usage

The main way to use MiR250 Shelf Carrier is through missions that you create.

In the following sections, you will find practical examples of how missions can be tailored to different tasks. The examples include:

- Creating a mission that uses a Prompt user action. The example mission is titled *Prompt user*.
- Creating a mission that uses a Try/Catch action. The example mission is titled *Try/Catch*.
- Creating a mission that uses variables. The example mission is titled *Variable footprint*.
- Creating a mission that makes the robot drive through an 80 cm doorway. The example mission is titled *80 cm doorway*.
- Creating a shelf position and integrating it with a VL-marker for higher precision and closer placement of shelves. The example mission is titled *Place shelf at VL-marker*.
- Creating a mission where the robot picks up and places a shelf using the template missions. The example mission is titled *Pick up and place shelf*.

9.1 Creating the *Prompt user* mission

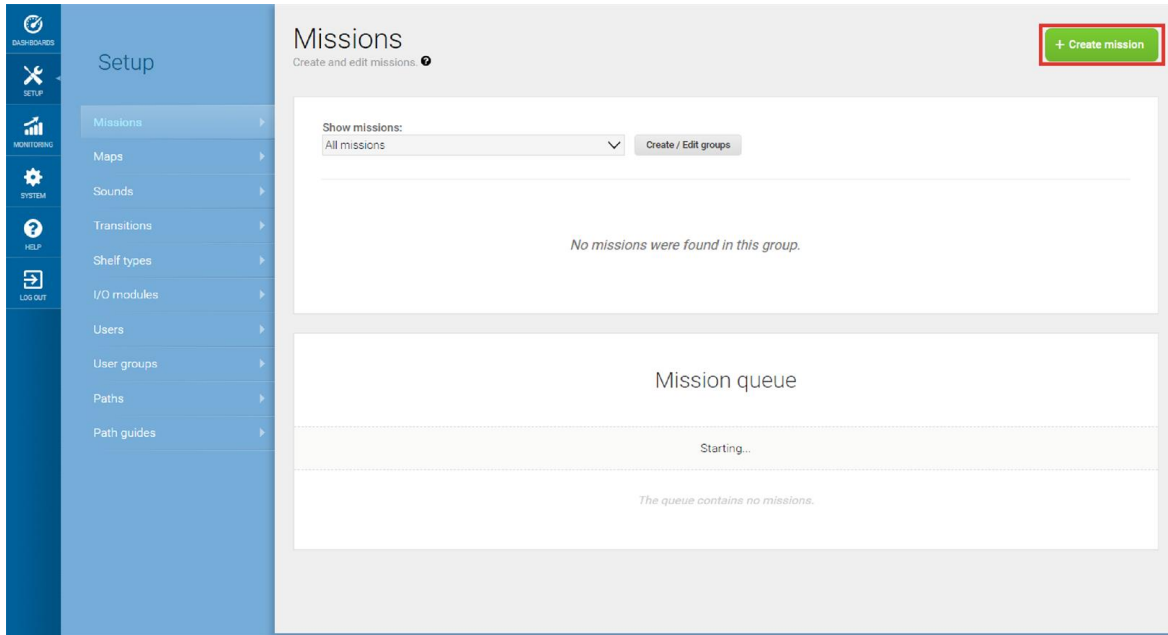
Prompt user actions are used for prompting the user with a question on how the robot should proceed. The *Prompt user* mission uses a Prompt user action that lets you choose whether to send the robot to one position or another.

To create the *Prompt user* mission, it is assumed that you have completed the following:

- Created two robot positions named **p1** and **p2** as described in [Creating markers and positions on page 126](#).
- Defined a user group named **Users**.

To create the mission, follow the steps below:

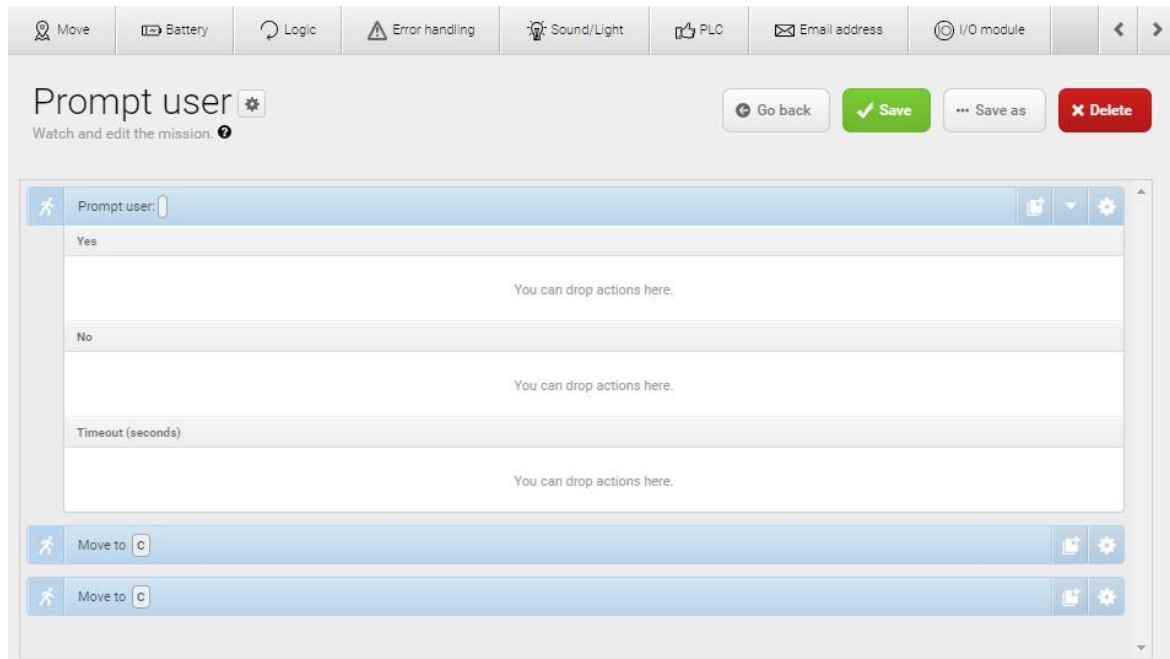
1. Go to **Setup > Missions**. Select **Create Mission**.




2. Name the mission *Prompt user*. Select the group and site you want it to belong to. Select **Create mission**.

3. Select the following actions:

- In the **Logic** menu, select **Prompt user**.
- In the **Move** menu, select **Move**.
- In the **Move** menu, select **Move**.



The following steps describe which parameters each action should be set to. To modify the parameters, select the gearwheel  at the right end of the action line to open the action dialog box. When you have set the parameters, select **Validate and close**.

4. In the **Prompt user** action, set the parameters as follows:

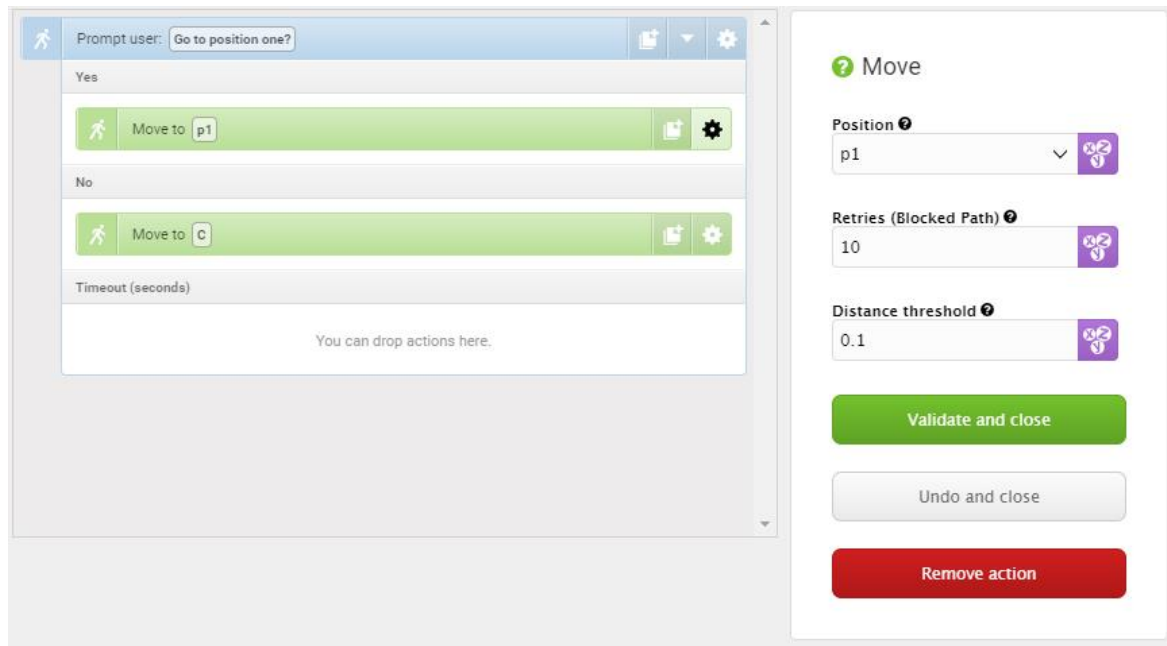
- **Question:** Enter the question **Go to position one?**
- **User group:** Select **Users**.
- **Timeout:** Set the timeout to 10 minutes.

The screenshot shows the 'Prompt user' configuration window. The main area has three sections: 'Yes', 'No', and 'Timeout (seconds)'. Each section contains a placeholder 'You can drop actions here.'. Below these are two 'Move to C' actions. The right sidebar shows the configuration for the 'Prompt user' action: 'Question' is 'Go to position one?', 'User group' is 'Users', and 'Timeout (seconds)' is set to 00 HRS, 10 MIN, 00 SEC. At the bottom are buttons for 'Validate and close', 'Undo and close', and 'Remove action'.

5. In the **Prompt user** action, drag a **Move to** action into the **Yes** box and a **Move to** action into the **No** box.

The screenshot shows the 'Prompt user' configuration window after adding 'Move to' actions. The 'Yes' and 'No' sections now each contain a 'Move to C' action. The 'Timeout (seconds)' section remains empty with the placeholder 'You can drop actions here.'.

6. In the first **Move to** action, under **Position**, select **p1**.



7. In the second **Move to** action, under **Position**, select **p2**.

The screenshot shows the MiR mission editor interface. On the left, a mission flow is visible with a 'Prompt user: Go to position one?' action. Below it, there are two 'Move to' actions. The first 'Move to' action is set to position 'p1'. The second 'Move to' action is set to position 'p2'. Below these actions is a 'Timeout (seconds)' field with the text 'You can drop actions here.' On the right, a configuration panel for the 'Move' action is shown. It includes a 'Position' dropdown menu set to 'p2', a 'Retries (Blocked Path)' field set to '10', and a 'Distance threshold' field set to '0.1'. At the bottom of the panel are three buttons: 'Validate and close' (green), 'Undo and close' (grey), and 'Remove action' (red).

The mission should look like this:

The screenshot shows the MiR mission editor interface with the mission flow completed. At the top, there is a 'Prompt user' section with a 'Watch and edit the mission' link. To the right of this section are four buttons: 'Go back' (grey), 'Save' (green), 'Save as' (grey), and 'Delete' (red). Below this, the mission flow is visible with the 'Prompt user: Go to position one?' action. Below it, there are two 'Move to' actions. The first 'Move to' action is set to position 'p1'. The second 'Move to' action is set to position 'p2'. Below these actions is a 'Timeout (seconds)' field with the text 'You can drop actions here.' The 'Save' button is highlighted in green.

8. Select **Save** to save the mission.

9.2 Creating the *Try/Catch* mission

Try/Catch actions are used to handle mission errors. When you use a Try/Catch action, you can define what the robot should do if it at any point fails to execute its main mission. This prevents the robot from going into an error state and stopping in the middle of a mission by

providing an alternative course of action if the main mission fails.

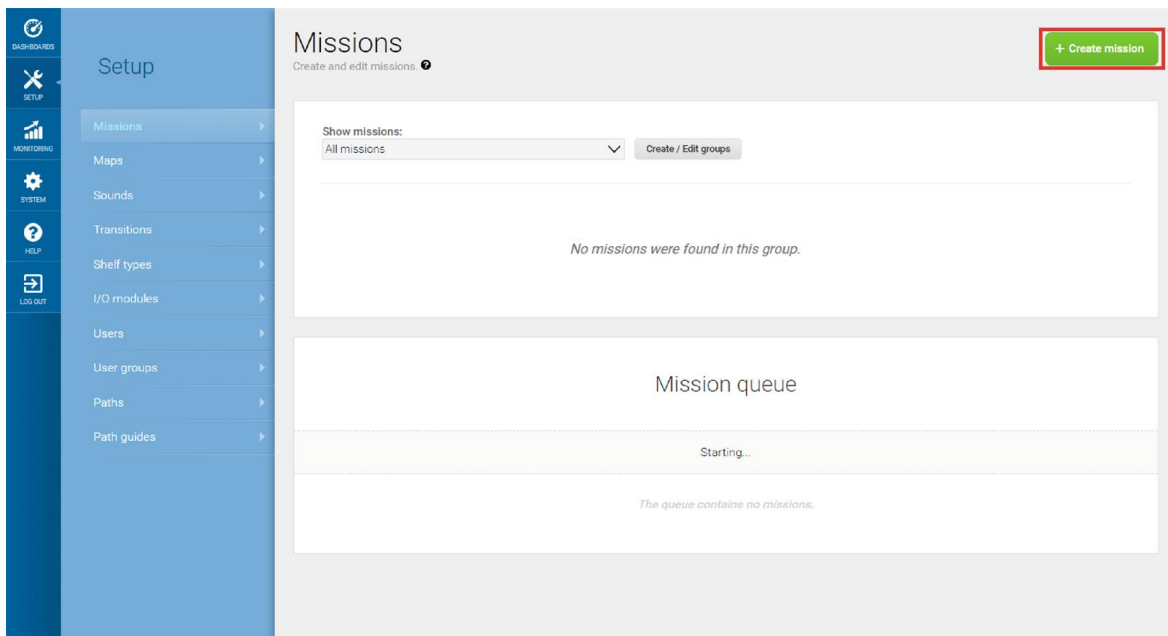
In the *Try/Catch* mission example, the robot runs the *Prompt user* mission created in [Creating the Prompt user mission on page 164](#), and if the robot for some reason fails to complete the mission, the robot plays a sound.

To create the *Try/Catch* mission, it is assumed you have completed the following:

- Created the *Prompt user* mission as described in [Creating the Prompt user mission on page 164](#).

To create the mission, follow the steps below:

1. Go to **Setup > Missions**. Select **Create Mission**.



2. Name the mission *Try/Catch*. Select the group and site you want it to belong to. Select **Create mission**.

3. Select the following actions:

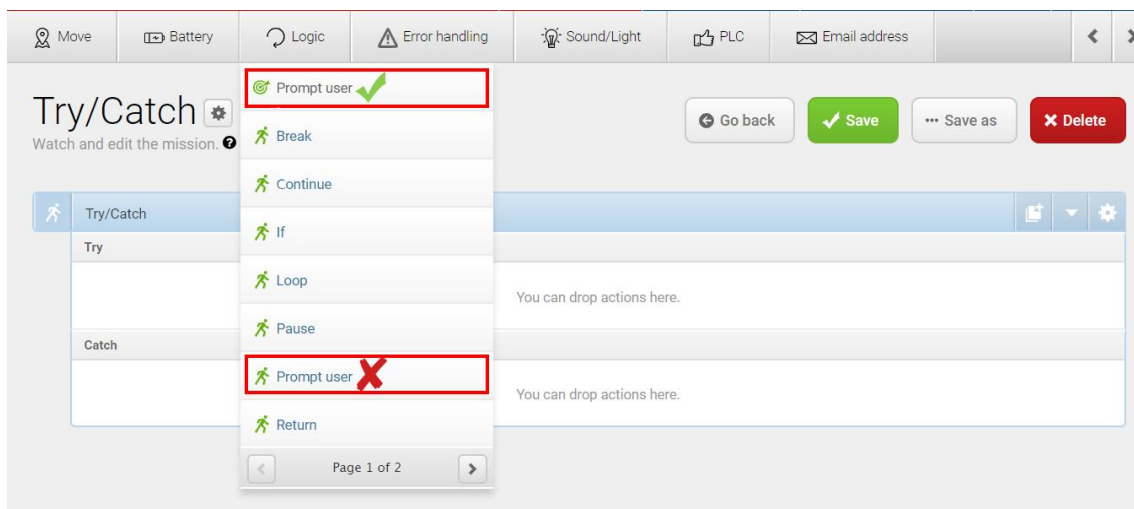
- In the **Error handling** menu, select **Try/Catch**.
- Select the **Prompt user** mission you have made.

The mission group you have saved the mission under will figure as a menu in the mission editor. The menus contain both missions and actions.

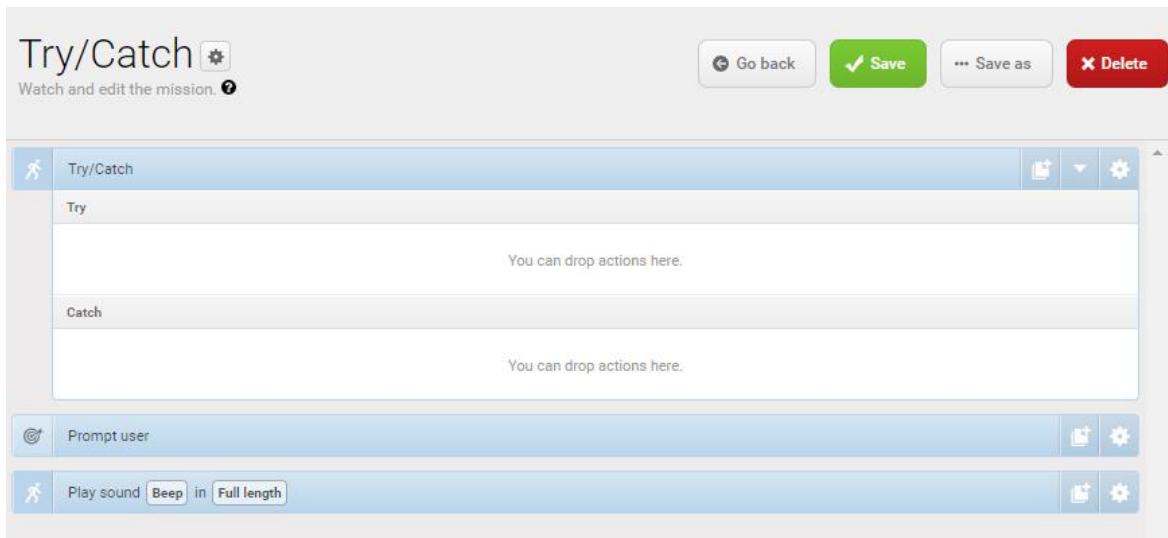



Missions have this icon and actions have this icon .

In this example, the mission is saved under the **Logic** menu that also includes the **Prompt user** action . Be sure to select the **Prompt user** mission .

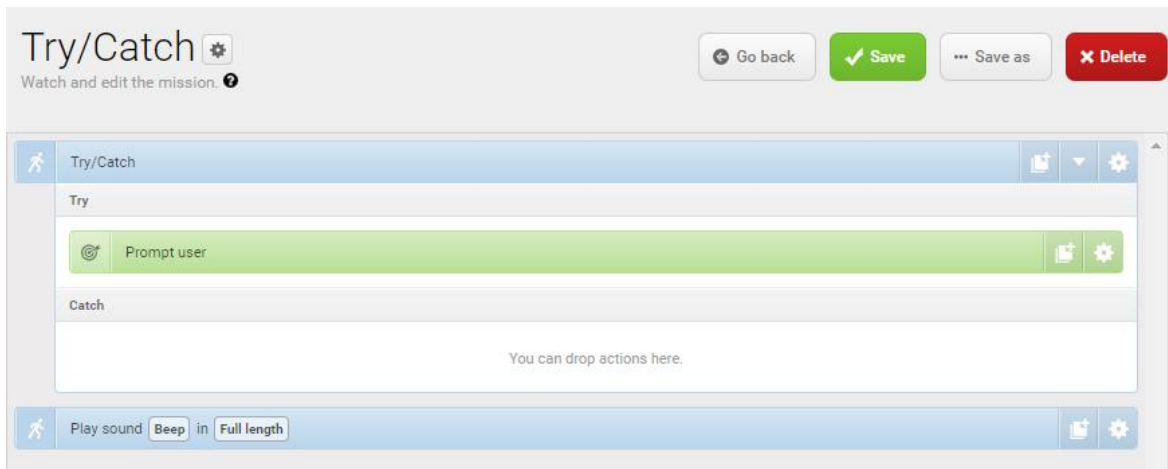


- In the **Sound/Light** menu, select **Play sound**.

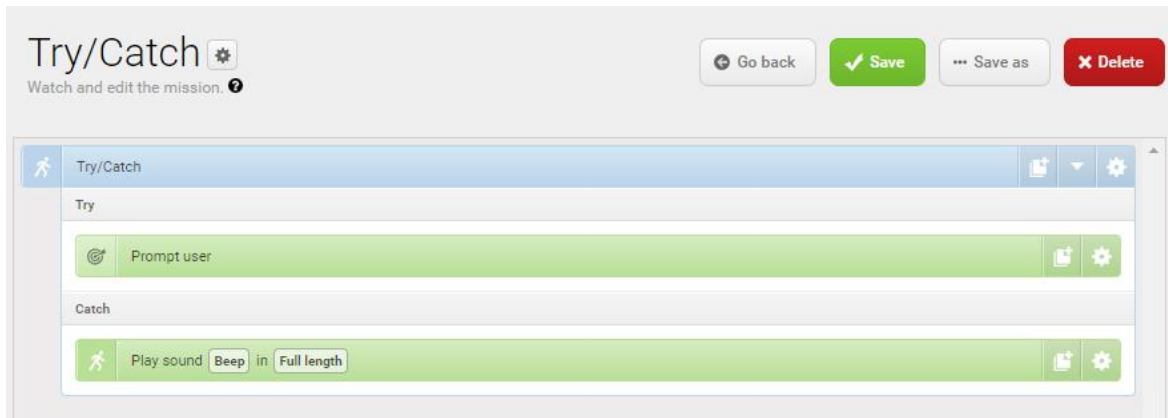


The following steps describe which parameters each action should be set to. To modify the parameters, select the gearwheel  at the right end of the action line to open the action dialog box. When you have set the parameters, select **Validate and close**.

4. Drag the **Prompt user** mission into the **Try** box under **Try/Catch**.



5. Drag the **Play sound** action under the **Catch** box under **Try/Catch**.



6. In the **Play sound** action, set the parameters as follows:

- **Sound:** Select **Beep**.
- **Volume:** Enter the value **80**. This is approximately 64 dB.
- **Mode:** Select **Custom length** so you can enter the duration of time the sound is played.
- **Duration:** Set the duration to two minutes.

The screenshot shows the 'Try/Catch' mission editor interface. The 'Try' section contains a 'Prompt user' action. The 'Catch' section contains a 'Play sound' action configured with 'Beep' as the sound, a volume of 80, and a custom length mode. The right-hand panel shows the configuration for the 'Play sound' action, with fields for Sound (Beep), Volume (80), Mode (Custom length), and Duration (00 HRS, 02 MIN, 01 SEC). A 'Validate and close' button is at the bottom of the configuration panel.

The mission should look like this:

This screenshot shows the final mission configuration in the 'Try/Catch' editor. The 'Try' section has the 'Prompt user' action, and the 'Catch' section has the 'Play sound' action configured with 'Beep', volume 80, and custom length. The mission is ready for validation and saving.

7. Select ✓ **Save** to save the mission.

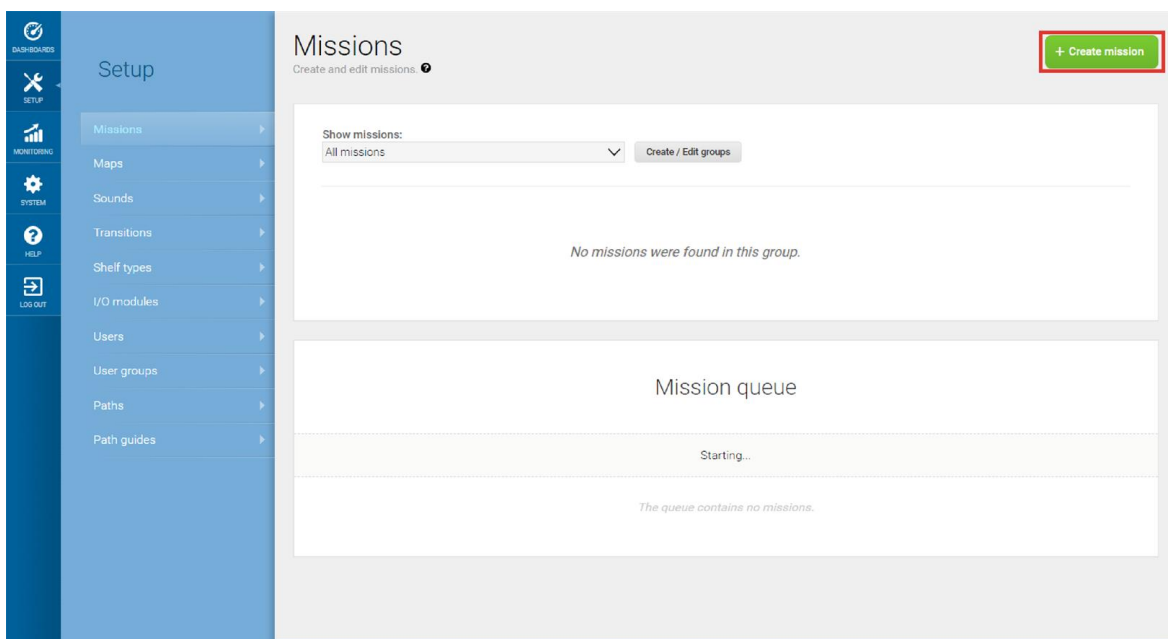
9.3 Creating the *Variable footprint* mission

All mission actions that require the user to specify the value of a parameter when they choose to use the mission have the option of defining a variable. If you use a variable in a mission when you add the mission to the mission queue or nest it inside another mission, you must select a value for the parameter where the variable is used. This allows you to reuse the same mission for different but still similar tasks.

The *Variable footprint* mission enables you to select which footprint the robot should use each time the mission is run.

To create the mission, follow the steps below:

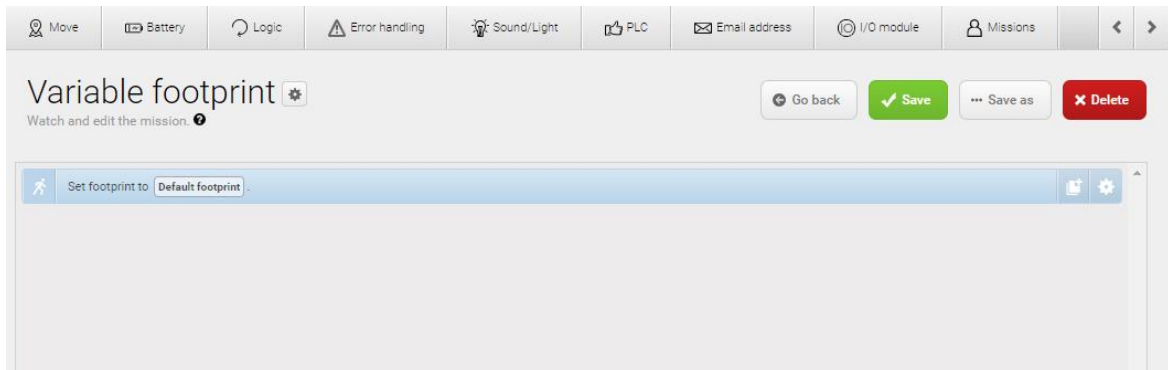
1. Go to **Setup > Missions**. Select **Create Mission**.





2. Name the mission *Variable footprint*. Select the group and site you want it to belong to. Select **Create mission**.

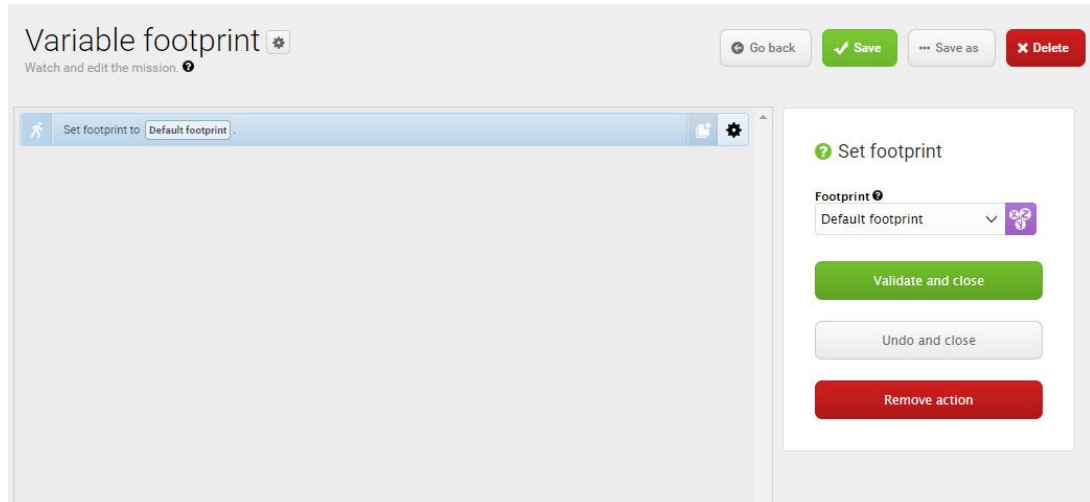
3. Select the following actions:

- In the **Move** menu, select **Set footprint**.



The following steps describe which parameters each action should be set to. To modify the parameters, select the gearwheel  at the right end of the action line to open the action dialog box. When you have set the parameters, select **Validate and close**.

4. In the **Select footprint** action, make the parameter **Footprint** a variable that can be set each time you use the mission. The following steps describe how to create a variable:
 - a. Under **Footprint**, select **Variables** .



- b. Select **Create variable** in the upper-right corner.
 - c. Name the variable **Use default footprint or narrow footprint?**. Select **OK**.

Create variable

In the **Name** field, enter a question that describes what the variable is used for, for example, "How far should the robot move?" In the **Default value** field, enter a default distance.

Variable name

Use default footprint or narrow footprint?

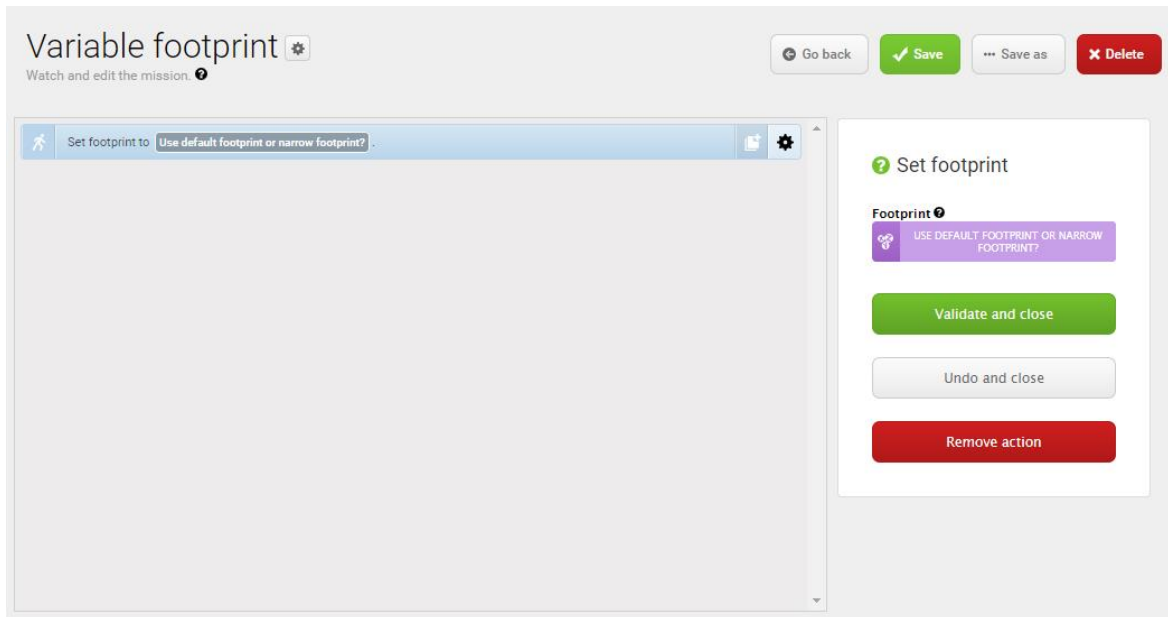
Default value

Default footprint

OK

Cancel

The mission should look like this:



5. Select ✓ **Save** to save the mission.

9.4 Creating the *80 cm doorway* mission

This section describes how to create a mission that makes the robot drive through a doorway that is 80 cm wide in one direction. To do this the robot does the following actions:


1. Moves to a position in front of the 80 cm wide doorway (the narrowest possible for MiR250).
2. Adjusts its localization.
3. Sets a defined narrow footprint.
4. Mutes its protective fields so it can traverse the doorway.
5. Goes through the doorway to a position on the other side.
6. Changes its footprint back to default.

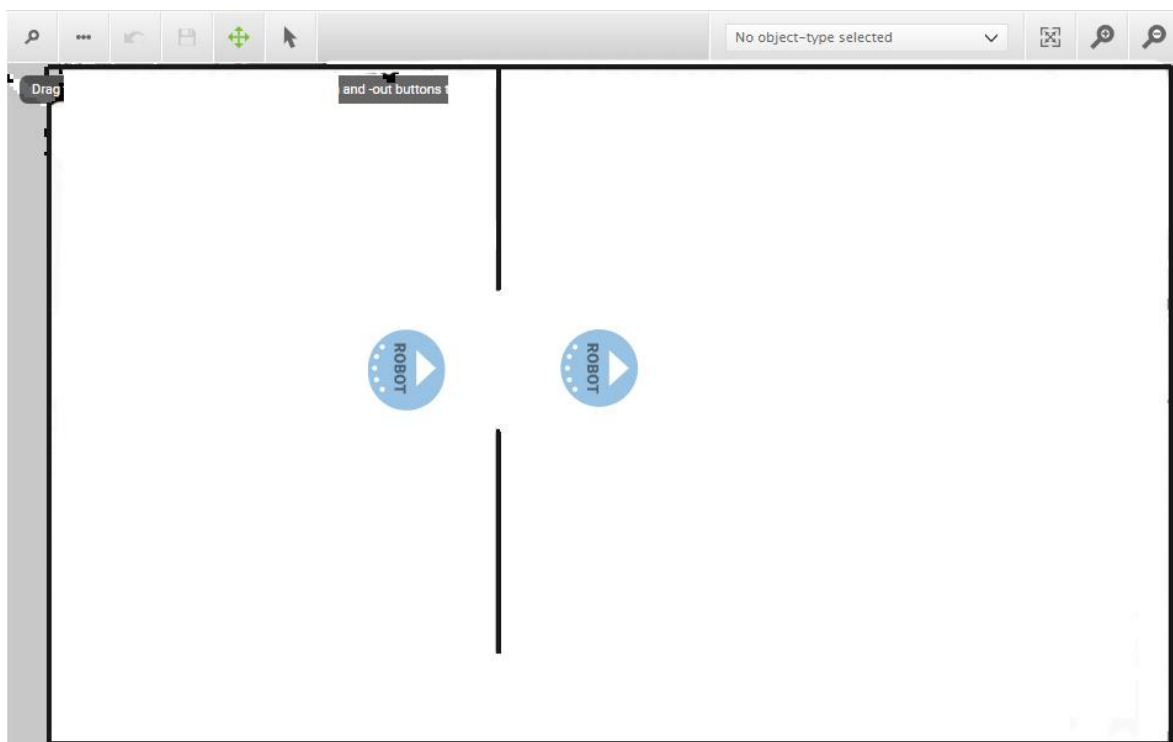
To create the mission, it is assumed that you have completed the following:

- Created a map. To drive through narrow doorways, it is very important that the map is accurate and thoroughly cleaned, and that the robot is localized accurately—see [Creating and configuring a map on page 112](#).



For better localization, draw the walls where the doorway is, and make the doorway approximately one meter wide in the map by deleting some of the walls on each side of the doorway. You may need to delete more of the wall if the robot will not go through the doorway.

- Placed a robot position  on each side of the doorway where the first position is named **pos 1** and the second **pos 2**. The positions must be placed in front of and directly in the middle of the doorway, and they must point in the same direction (the driving direction of the robot).



- Made the area around the doorway an operating hazard zone as the robot will be driving through the doorway with muted personnel detection means—see [Operating hazard zones on page 143](#).

- Enabled the muting of personnel detection means. Go to **System > Settings > Features**, and set **Mute protective fields** to **True**.

System

- Settings
- Processes
- PLC registers
- Software versions
- Backups
- Robot setup

PLC registers

True Restore default

Select True to enable actions for setting PLC registers from missions and monitoring PLC registers in the robot interface.

Universal Robots Interface

False Restore default

Select True to enable an action for running UR-programs from missions.

Fleet

False Restore default

Select True if the robot is part of a fleet.

Modbus

False Restore default

Select True if the robot uses Modbus.

I/O modules

True Restore default

Select True to enable actions for communicating with I/O modules.

Mute protective fields

True Restore default

True

False

✓ Save changes ✗ Cancel

- Enabled the use of dynamic footprints. Go to **System > Settings > Planner > Show advanced settings**, and set **Use dynamic footprint** to **True**.

System

- Settings
- Processes
- PLC registers
- Software versions
- Backups
- Robot setup

20 Restore default

Enter the docking threshold in degrees of the orientation relative to a charging station.

Use the path planning implementation from software version 2.0.16 and earlier.

False Restore default

Enabling this feature will configure the path planner to work in the same way as in software version 2.0.15.

Obstacle history clearing

No clearing Restore default

Select how the robot will clear its obstacle history while driving.

No clearing: the robot remembers all obstacles and only clears those in the field of view of cameras and laser scanners.

Clear in front of robot: the robot disables obstacle history in a cone shape in front of the robot, starting with the width of the footprint and increasing the width by 0.3 m per meter.

Clear all: the robot disables obstacle history altogether, and only avoids obstacles that it detects with its sensors while driving.

Charging station depth threshold

0.6 Restore default

Enter the docking threshold in meters of the depth from a charging station.

Use dynamic footprint

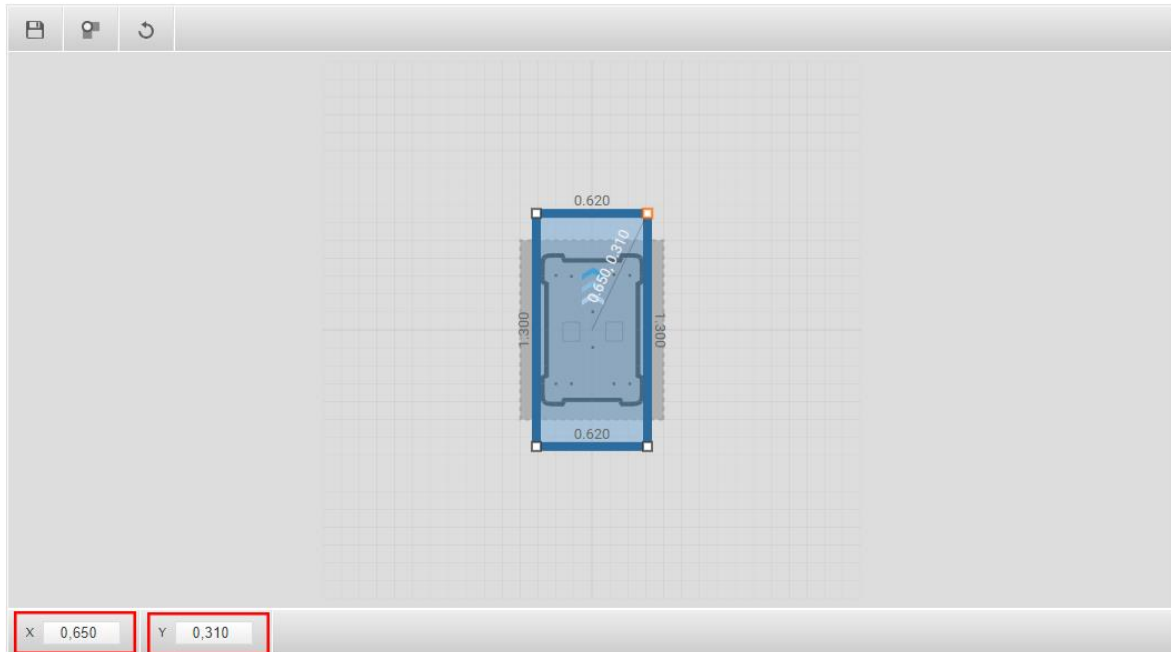
True Restore default

True

False

✓ Save changes ✗ Cancel

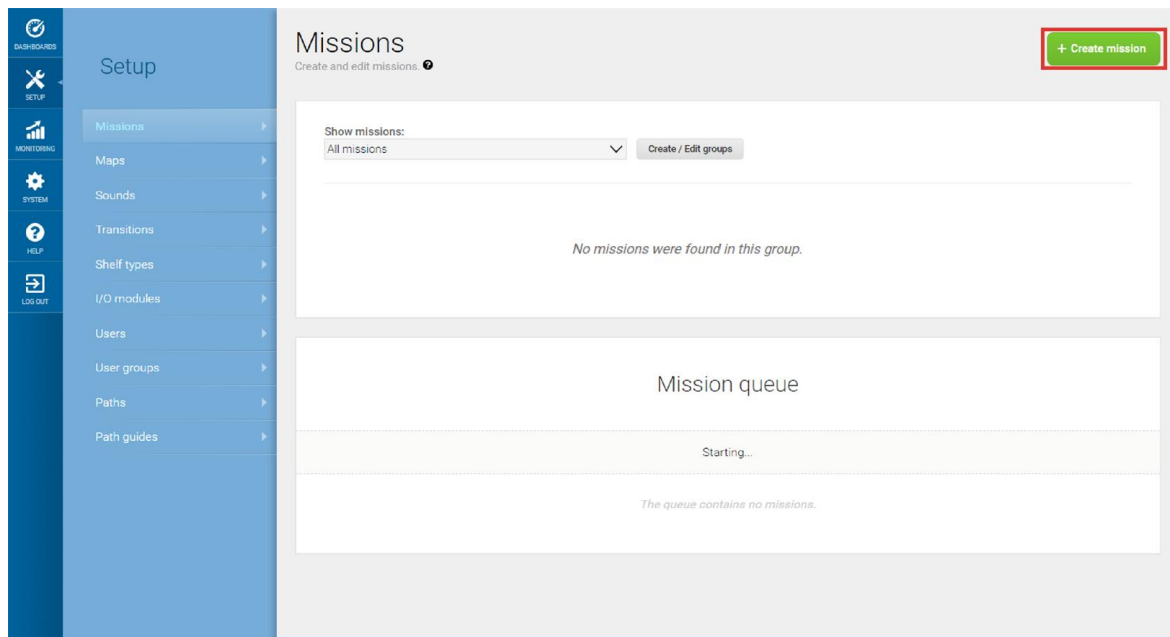
- Created a footprint named **Narrow doorway** that is 620 mm wide and 1300 mm long—see [Creating a footprint on page 139](#). The robot must be centered in the middle of the footprint.



This mission only drives the robot through the doorway in one direction. If you want the robot to go both ways you need to make a new set of position facing the opposition direction and a new mission using these positions.

To create the mission, follow the steps below:

1. Go to **Setup > Missions**. Select **Create Mission**.



2. Name the mission *80 cm doorway*. Select the group and site you want it to belong to. Select **Create mission**.

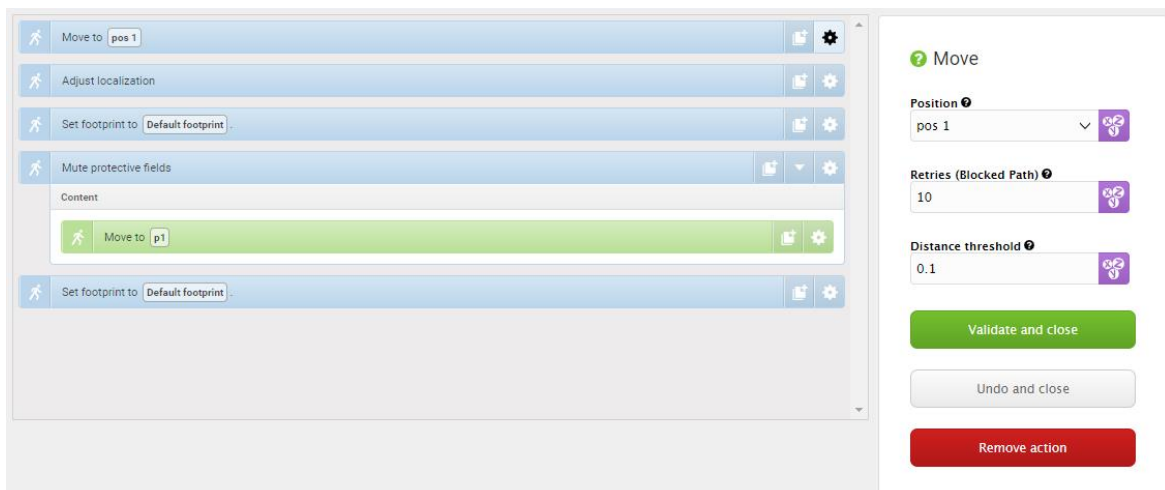
3. Select the following actions:

- In the **Move** menu, select **Move to**.
- In the **Move** menu, select **Adjust localization**.
- In the **Move** menu, select **Set footprint**.
- In the **Safety system** menu, select **Mute protective fields**.
- In the **Move** menu, select **Move to** and drag it into the **Mute protective fields** action.
- In the **Move** menu, select **Set footprint**.

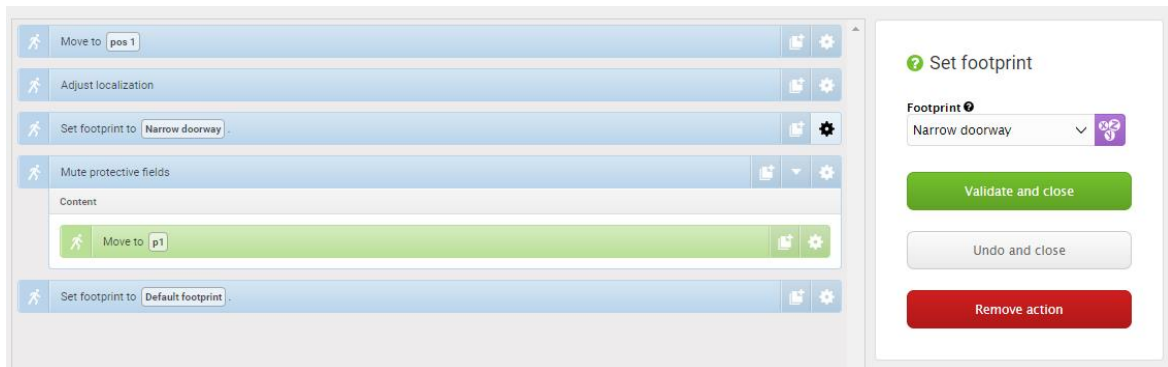


The following steps describe which parameters each action should be set to. To modify the parameters, select the gearwheel ⚙ at the right end of the action line to open the action dialog box. When you have set the parameters, select **Validate and close**.

4. In the **Move** action, under **Position**, select **pos 1**.

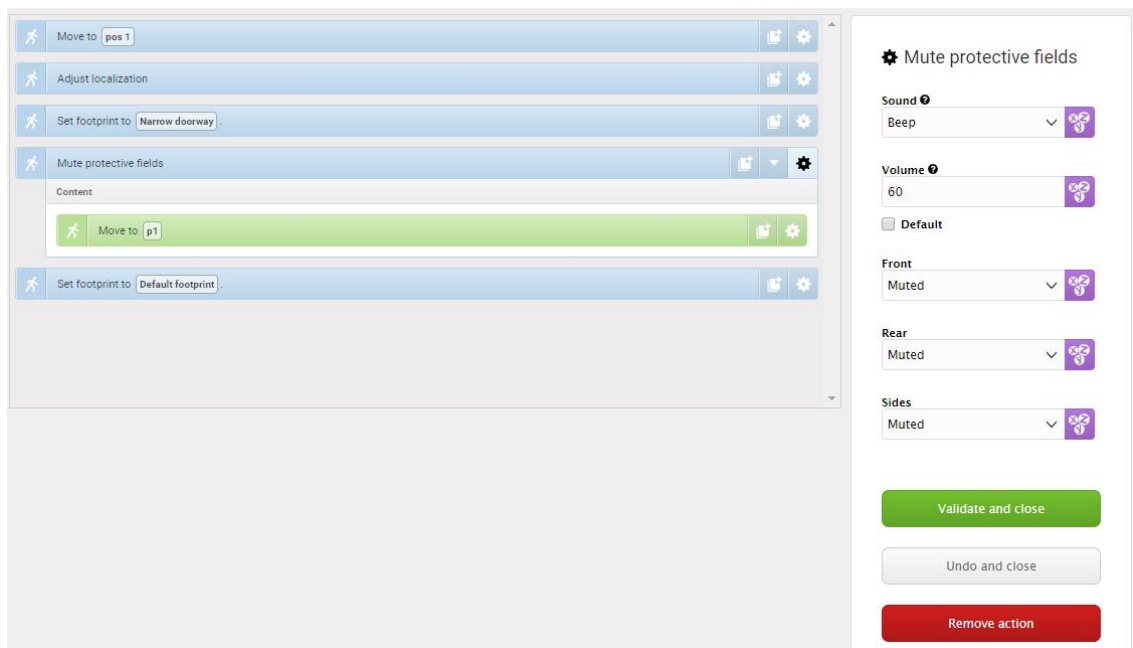


5. In the **Set footprint** action, select **Narrow doorway**.

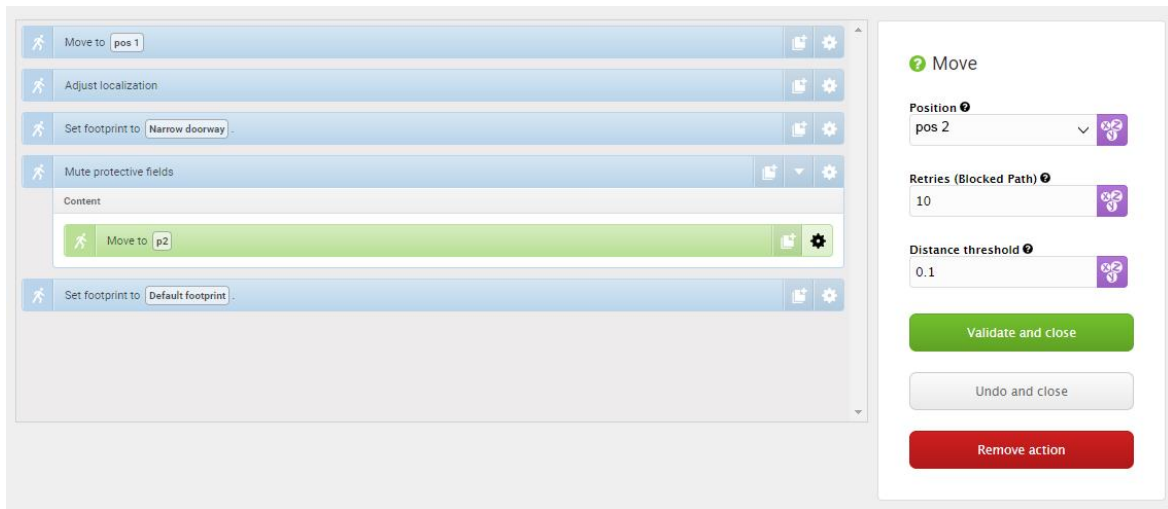


6. In the **Mute protective fields** action, set the parameters as follows:

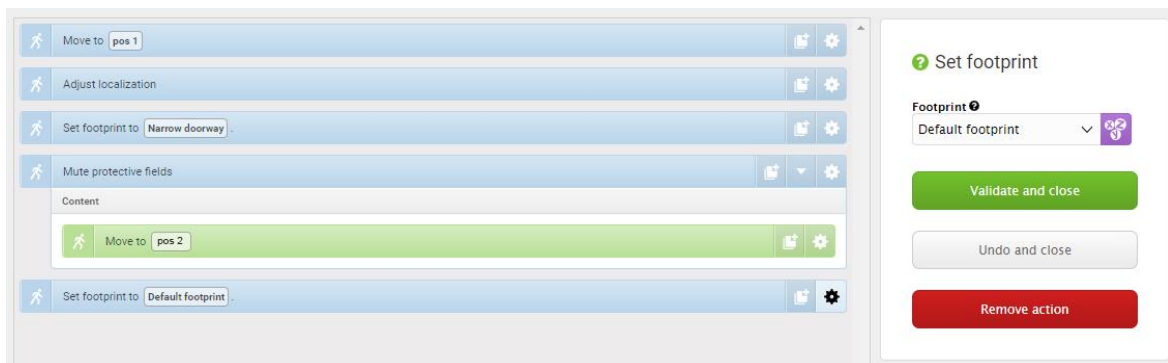
- **Sound:** Select **Beep**.
- **Volume:** Enter the value 60. This is 48 dB approximately.
- **Front:** Select **Muted**.
- **Rear:** Select **Muted**.
- **Sides:** Select **Muted**.



7. In the **Move** action, under **Position**, select **pos 2**.



8. In the **Set footprint** action, select the robot's default footprint.



9. Select **Save** ✓ to save the mission.

9.5 Creating the *Pick up and place shelf* mission

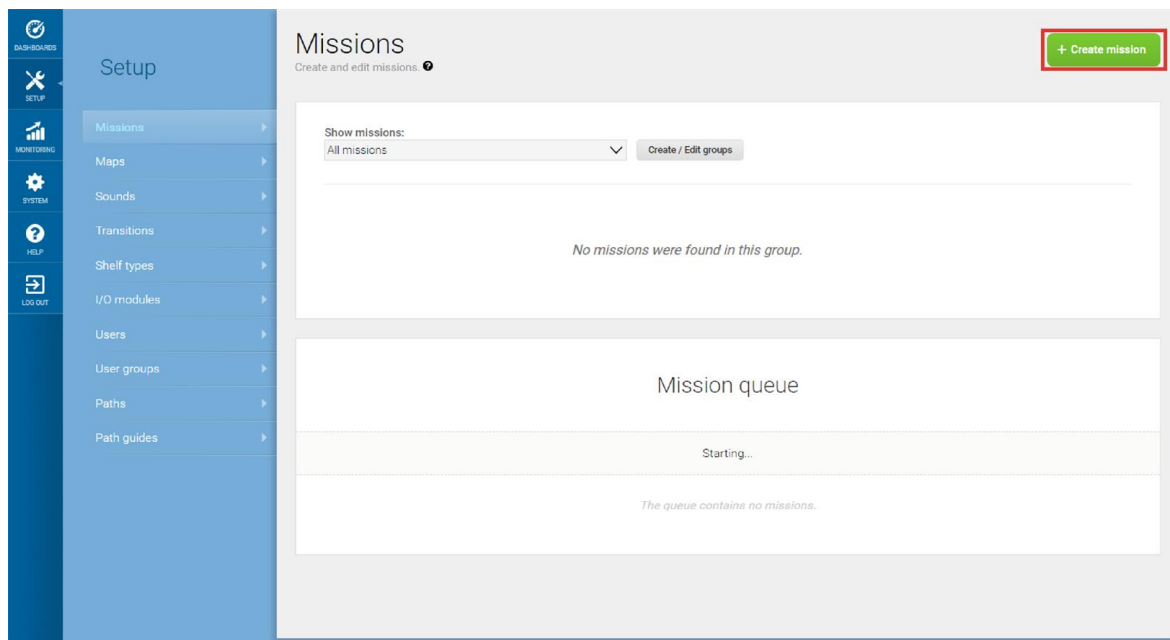
In the *Pick up and place shelf* mission, MiR250 Shelf Carrier drives to a shelf position to pick up a shelf and transports the shelf to another position and places it there.

To create the mission, it is assumed you have completed the following:

- Created two shelf positions named **Shelf pos A** and **Shelf pos B**—see [Creating markers and positions on page 126](#).
- Placed a physical shelf at shelf position **Shelf pos A**.

- Created a marker type for the shelf named **MiR250 Shelf**—see [Creating a marker type on page 153](#).
- Created a footprint named **MiR250 Shelf** with the footprint dimensions when the robot is carrying the shelf —see [Creating a footprint on page 139](#).

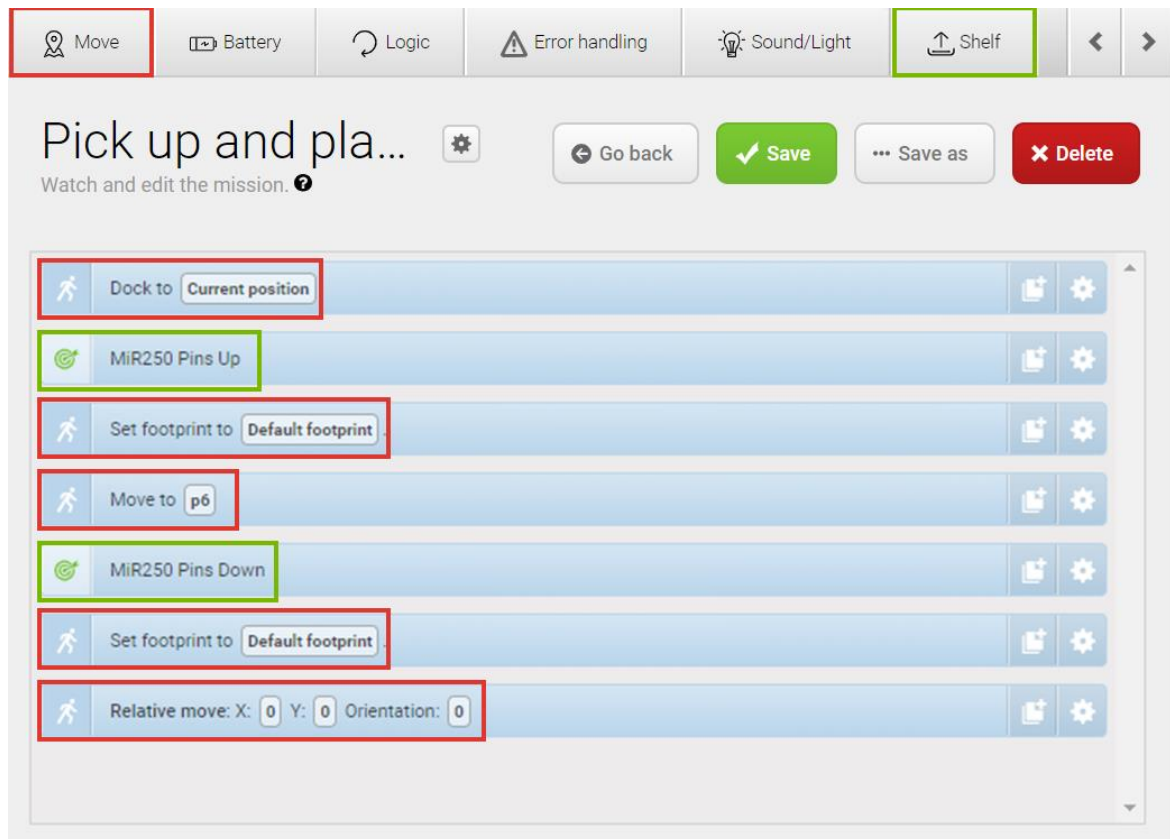
1. Go to **Setup > Missions**. Select **Create mission**.



2. Name the mission *Pick up and place shelf*. Select the group and site you want it to belong to. Select **Create mission**.

3. Select the following actions:

- In the **Move** menu, select **Dock**.
- In the **Shelf** menu, select the **MiR250 Pins Up** template mission.
- In the **Move** menu, select **Set footprint**.
- In the **Move** menu, select **Move**.
- In the **Shelf** menu, select the **MiR250 Pins Down** template mission.
- In the **Move** menu, select **Set footprint**.
- In the **Move** menu, select **Relative move**.



The following steps describe which parameters each action should be set to. To modify the parameters, select the gearwheel ⚙ of the action in question to open the dialog of that action.

4. For the **Docking** action, set the parameters as follows:
 - **Position:** Select **Shelf pos A**.
 - **Marker type:** Select **MIR250 Shelf**.
 - **Retries** and **Maximum linear speed:** Leave these at the default value.

The screenshot shows the 'Docking' configuration window. On the left, a list of actions is visible: 'Dock to' (Current position), 'MIR250 Pins Up', 'Set footprint to' (Default footprint), 'Move to' (p6), 'MIR250 Pins Down', 'Set footprint to' (Default footprint), and 'Relative move: X: 0 Y: 0 Orientation: 0'. The 'Docking' configuration panel on the right includes the following settings:

- Marker position:** Shelf pos A (selected from a dropdown menu).
- Marker type:** Mir250 Shelf (selected from a dropdown menu).
- Retries (Blocked Path):** 10 (default value).
- Maximum linear speed:** 0.5 (default value).

At the bottom of the configuration panel, there are three buttons: 'Validate and close' (green), 'Undo and close' (grey), and 'Remove action' (red).

5. For the **Set footprint** action, select the **MIR250 Shelf**.

The screenshot shows the 'Set footprint' configuration window. On the left, the list of actions is updated: 'Dock to' (Shelf pos A), 'MIR250 Pins Up', 'Set footprint to' (MIR250 Shelf), 'Move to' (p6), 'MIR250 Pins Down', 'Set footprint to' (Default footprint), and 'Relative move: X: 0 Y: 0 Orientation: 0'. The 'Set footprint' configuration panel on the right includes the following settings:

- Footprint:** MIR250 Shelf (selected from a dropdown menu).

At the bottom of the configuration panel, there are three buttons: 'Validate and close' (green), 'Undo and close' (grey), and 'Remove action' (red).

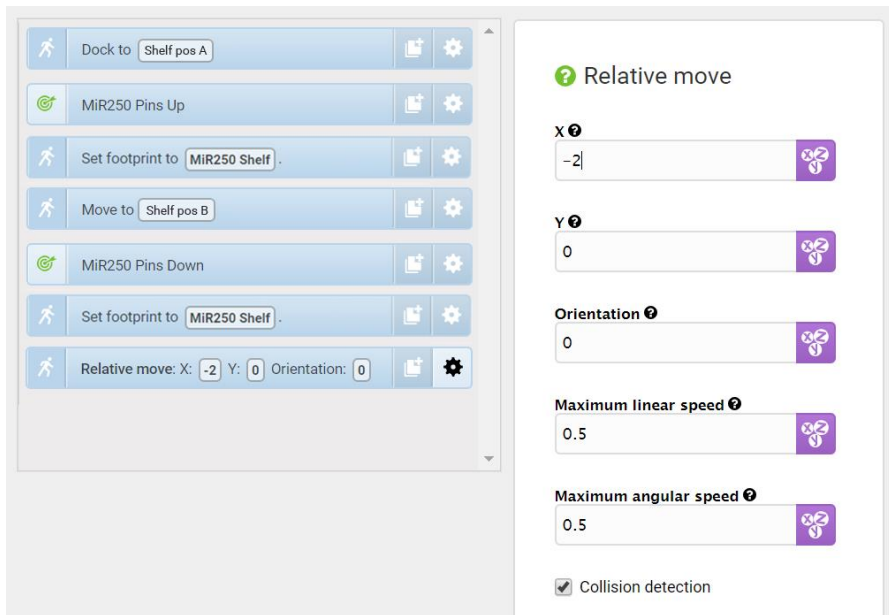
6. For the **Move** action, select **Shelf pos B**.

The screenshot shows the MiR250 Shelf Carrier interface. On the left, a list of actions is displayed: 'Dock to Shelf pos A', 'MiR250 Pins Up', 'Set footprint to MiR250 Shelf', 'Move to Shelf pos B', 'MiR250 Pins Down', 'Set footprint to MiR250 Shelf', and 'Relative move: X: -2 Y: 0 Orientation: 0'. The 'Move to Shelf pos B' action is selected. On the right, the 'Move' configuration panel is open. It contains the following fields: 'Position' set to 'Shelf pos B', 'Retries (Blocked Path)' set to '10', and 'Distance threshold' set to '0.1'. At the bottom of the panel are three buttons: 'Validate and close' (green), 'Undo and close' (grey), and 'Remove action' (red).

7. For the **Set footprint** action, select the robot's default footprint.

The screenshot shows the MiR250 Shelf Carrier interface. On the left, the same list of actions is displayed. The 'Set footprint to Default footprint' action is selected. On the right, the 'Set footprint' configuration panel is open. It contains the following field: 'Footprint' set to 'Default footprint'. At the bottom of the panel are three buttons: 'Validate and close' (green), 'Undo and close' (grey), and 'Remove action' (red).

8. For the **Relative move** action, enter an **X** value of **-2**. This makes the robot move two meters back to undock from the shelf.



9. The mission is now ready. Select **Save** to save the mission.

9.6 Creating the *Place shelf at VL-marker* mission

If you need to place shelves with greater precision or have shelves placed close to obstacles or other shelves, you can do so by creating shelf positions in front of markers.



We recommend using VL-markers to place shelves, but you can also use other types of markers if preferred.

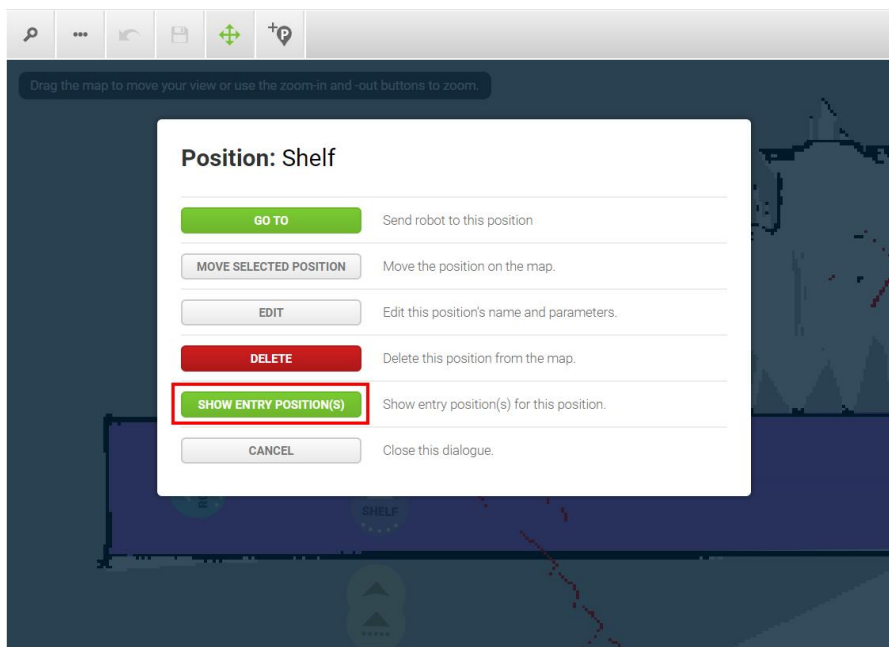
To use a marker with a shelf position correctly, you must make the robot dock to the marker when placing a shelf and make the robot dock to the shelf when picking it up. The *Place shelf at VL-marker* mission makes the robot place a shelf accurately on a shelf position by docking to a VL-marker. The mission uses a variable for the marker, enabling you to reuse the mission for any marker placed in front of a shelf position.

To create the mission it is assumed you have completed the following:

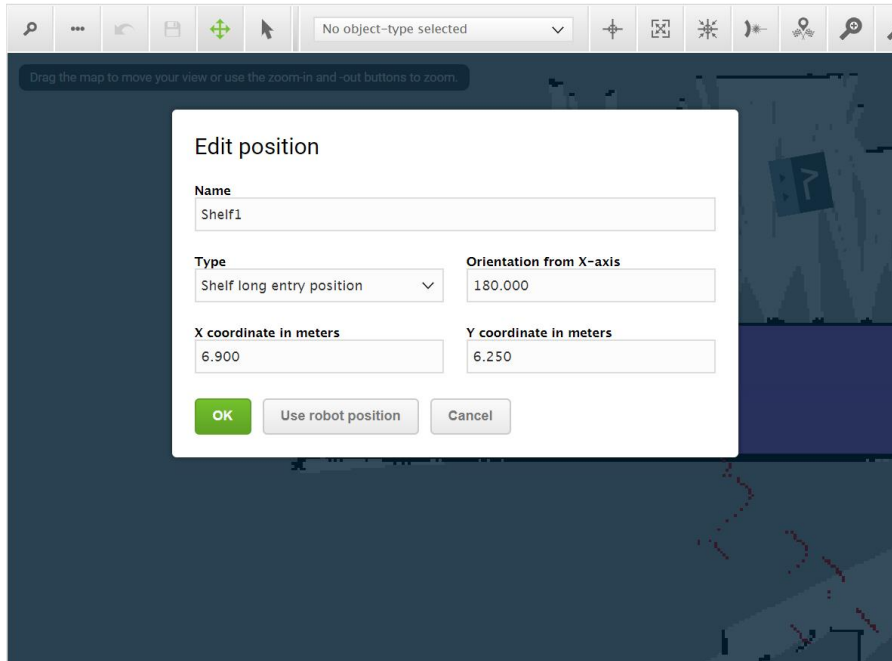
- Created a marker titled **Shelf VL-marker**—see [Creating markers and positions on page 126](#).
- Defined a mission group titled **Missions**.

The following steps describe how to create a mission that makes the robot dock to a marker and place a shelf:

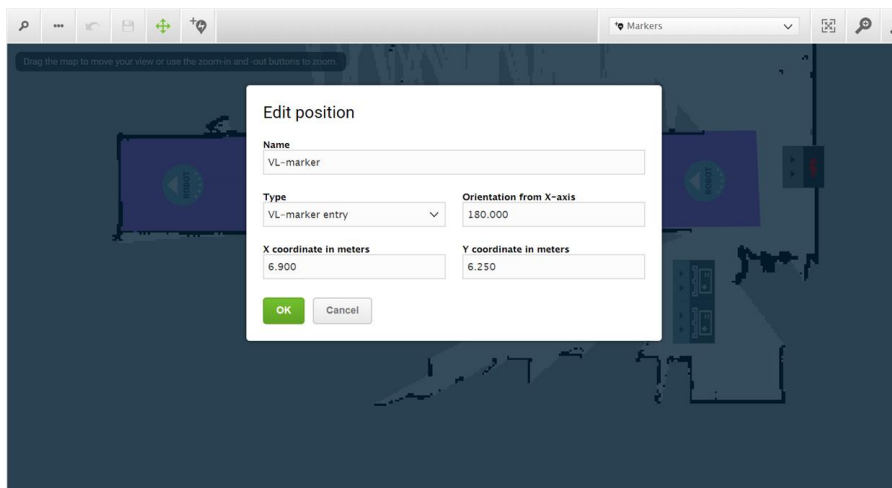
1. Go to the map editor of the active map.
2. Create a shelf position directly in front of the VL-marker you created—see [Creating markers and positions on page 126](#).
3. Select the shelf position on the map. Then select **Show entry position**. Two entry positions are displayed. They indicate where the robot will go to first when docking to the position. The entry position furthest from the shelf position is for MiR250 Shelf Carrier.



4. Select **Edit** if you want to adjust the entry position. Note the X and Y coordinates of the entry position.

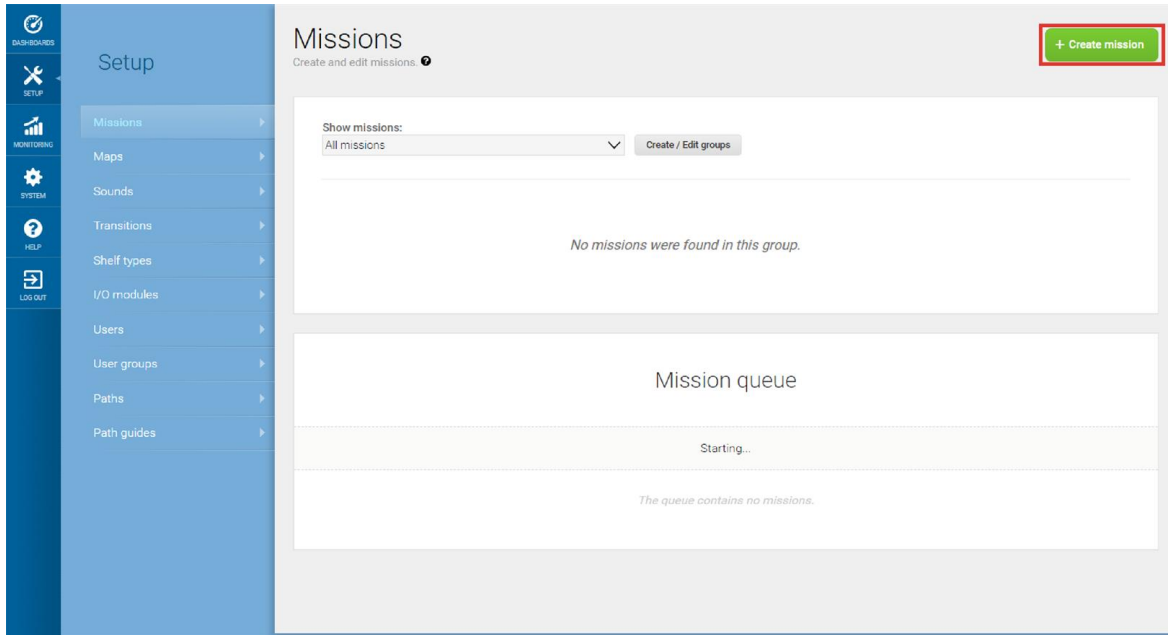


5. Select the VL-marker on the map. Then select **Show entry position**.
6. Select the VL-marker's entry position, and insert the same X and Y coordinates of the shelf position's entry position.



7. Repeat the previous steps with all other markers where you want the robot to place shelves accurately.

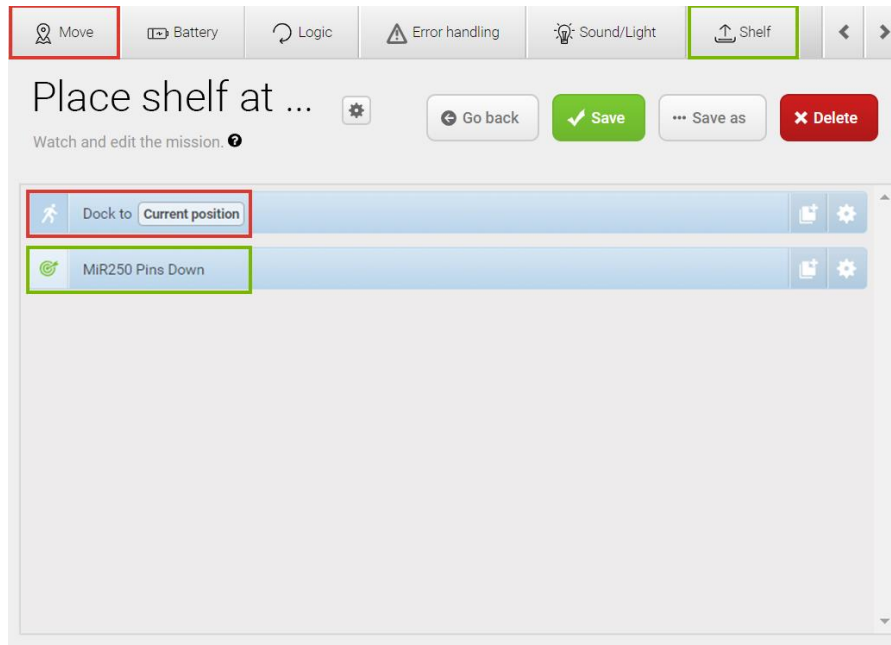
8. Go to **Setup > Missions**, and select **+ Create Mission**.




9. Name the mission *Place shelf at VL marker*, and select **Missions** under **Mission group**.

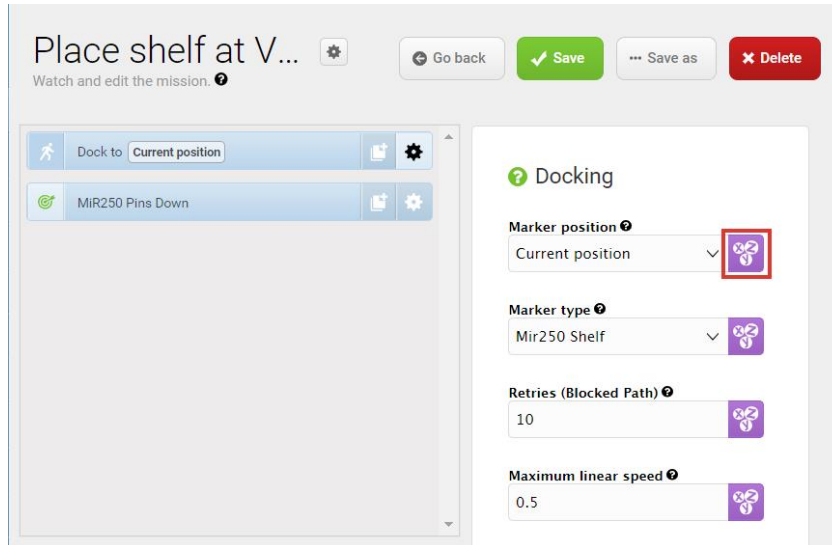
10. Select the following actions:

- In the **Move** menu, select **Docking**.
- In the **Shelf** menu, select the **MiR250 Pins Down** template mission.



The following steps describe which parameters each action should be set to. To modify the parameters, select the gearwheel ⚙ at the right end of the action line to open the action dialog box. When you have set the parameters, select **Validate and close**.

11. For the **Dock to** action, make the parameter **Marker position** a variable that can be set each time you use the mission. The following steps describe how to create a variable:
 - a. Under **Marker position**, select **Variables** .



- b. Select **Create variable** in the upper-right corner.
- c. Name the variable **Marker**, and set the **Shelf VL-marker** as the **Default value**. Select **OK**.

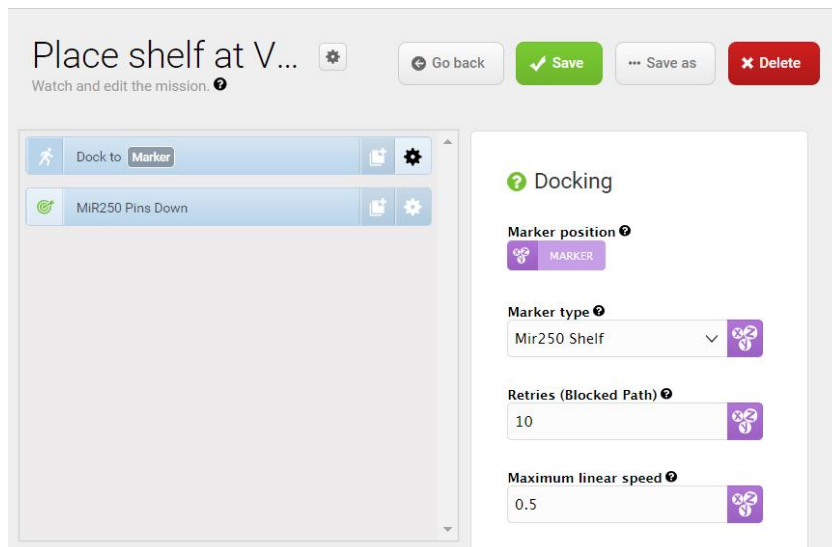
Create variable

In the Name field, enter a question that the operator must answer before the mission can begin, e.g. "How many meters forwards or backwards?" In the Default value field, enter a default distance.

Variable name

Default value

- d. Leave the other parameters at their default values. The **Marker type** is not used as long as you select a V, VL, or L-marker when using the mission.



12. The mission is now ready. Select **Save** to save your mission.

When you are creating other missions in the mission editor, you can now select this mission from the **Missions** menu and select any type of marker to make the robot place a shelf in front of it. Make sure you have modified the entry point of the marker as described in the first steps.

9.7 Testing a mission



Run the mission to test that the robot executes the mission correctly.



NOTICE

Always test missions without payload to minimize potential hazards.

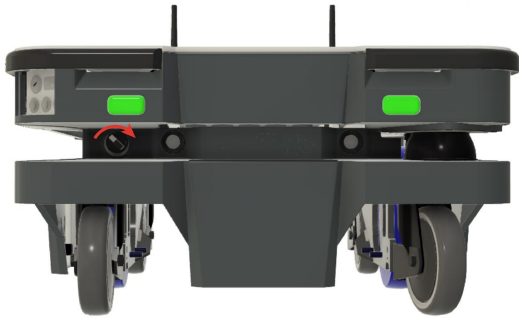
To run the mission, follow these steps:

1. Go to **Setup > Missions**.
2. Select **Queue mission**  next to the mission you just created. The mission is now added to the mission queue.
3. Select **Continue**  to start the mission.
4. Watch the robot execute the mission, and verify that it performs as expected.

10. Unmounting the top module

If you ever need to access the robot from the top, you will need to unmount the MiR Shelf Carrier 250. This can be required when troubleshooting issues or replacing robot components. The following steps describe how to unmount the top module:

1. Turn off the robot by pressing the On/Off button, and disconnect the battery by turning the battery disconnect switch.



2. Unscrew the six screws on the front and rear of the top module's top plate.



3. Unscrew the six screws on the sides of the top module's top plate.



4. Unscrew the two center screws next to the carrier pins.



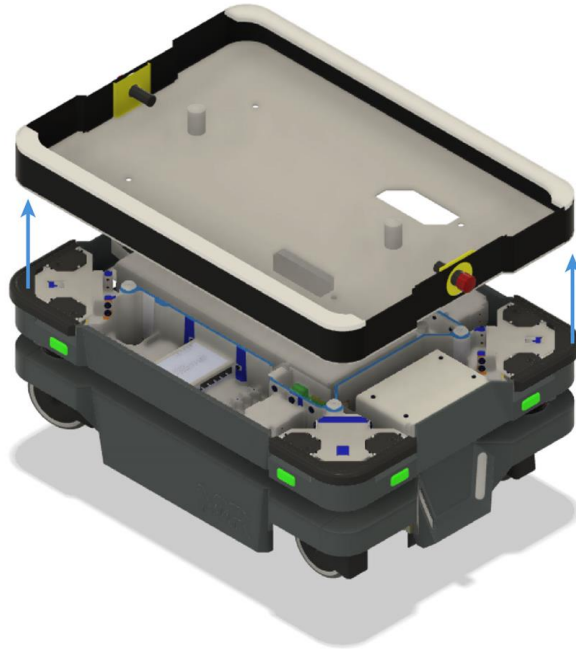
5. Remove the top plate from MiR Shelf Carrier 250, and disconnect the cables connecting the top application interface of the robot.



6. Unscrew the four screws mounting the top module to the robot.



7. Remove MiR Shelf Carrier 250 from the robot gently. The top module is now removed from the robot and you can access the area of the robot usually covered by its top plate.



After you have finished completing the maintenance that has required you to remove MiR Shelf Carrier 250, you can mount again by following the above instructions in the reverse order.



NOTICE

When screwing in the large screws that mount MiR Shelf Carrier 250 to the robot, tighten the screws to a torque of 18 Nm.

When screwing in the small screws that mount the top plate to MiR Shelf Carrier 250, tighten the screws to a torque of 2.5 Nm.

11. Maintenance

The following maintenance schedules give an overview of regular cleaning and parts replacement procedures.

It is the responsibility of the operator to perform all maintenance tasks on the robot.



The stated intervals are meant as guidelines and depend on the operating environment and frequency of usage of the robot.




NOTICE


Only use approved spare parts. Contact your distributor for the list of spare parts.

Mobile Industrial Robots disclaims any and all liability if unapproved spare parts are used. Mobile Industrial Robots can not be held responsible for any damages caused to the robot, accessories or any other equipment due to use of unapproved spare parts.

11.1 Regular weekly checks and maintenance tasks

Once a week, carry out the following maintenance tasks:

Parts	Maintenance tasks
Robot top plate and covers	<p>Clean the robot on the outside with a damp cloth.</p> <div>  <p>Do not use compressed air.</p> </div>
Laser scanners	Clean the optics covers of the scanners for optimum performance. Avoid aggressive or abrasive cleaning agents.


Parts	Maintenance tasks
	<p>In the robot interface under Monitoring > Hardware health > Emergency stop, see if Front scanner cover and Back scanner cover is Clean.</p> <div>  <p>NOTICE</p> <p>Static charges cause dust particles to be attracted to the optics cover. You can diminish this effect by using the anti-static plastic cleaner (SICK part no. 5600006) and the SICK lens cloth (part no. 4003353). See the manufacturer's own documentation.</p> </div>
Caster wheels (the four corner wheels)	Remove dirt with a damp cloth, and make sure nothing is entangled in the wheels.
Drive wheels (the two middle wheels)	Remove dirt with a damp cloth, and make sure nothing is entangled in the wheels.
Status lights	Check if the LED light band is intact. Ensure the light shows all the way around the robot. Clean with a soft cloth to ensure even lighting around the robot.
Signal lights	Check if the signal lights on the four corners blink and show correctly.
MiR Shelf Carrier 250 top module	Remove dust with a soft and clean brush, and remove dirt with a damp cloth.



11.2 Regular checks and replacements

Before starting replacement tasks that involve removal of the top plate or side covers or accessing the rear compartment:

- Shut down the robot—see [Shutting down the robot on page 64](#).
- Disconnect the battery—see [Packing for transportation on page 207](#).

The following table contains the parts that you should check and how often you should do that:

Part	Maintenance	Interval
Robot top cover	Check mounting. Ensure it sits evenly on top of the robot with connections accessible.	Check monthly, and replace as needed.
Laser scanner	In the robot interface under Monitoring > Hardware health > Communication , see if the robot is running with the correct SICK configuration, or if the warning The SICK Safety PLC is running a non-standard configuration appears.	Check monthly and after commissioning, or if you make any changes to the robot setup.
Robot hardware	In the robot interface under Monitoring > Hardware health , check if there are any warnings (marked with yellow).	Check monthly and after commissioning, or if you make any changes to the robot setup.
Front, rear, and side compartment covers	Check mounting. Ensure the covers are even and are not in contact with the wheels.	Check monthly, and replace as needed.
		 <p>If you replace the cover with the robot's nameplate, make sure to mount a new copy of the nameplate to the replacement cover.</p>
Loudspeaker and signal	Check that all visual and auditory warnings function.	Check monthly, and replace as needed.

Part	Maintenance	Interval
lights		
Caster wheels (the four corner wheels)	Check bearings and tighten, and check the wheels for wear and tear.	Check weekly, and replace as needed.
Drive wheels (the two middle-wheels)	Check wheel surfaces for wear.	Check every six months, and replace as needed.
		 NOTICE The robot must be calibrated after replacement of the wheels.
Safety laser scanners	Check for visual defects, for example cracks and scratches.	Replace as needed.
		 NOTICE The robot must be calibrated after replacement of the scanners.
Control panel	Check that all buttons on the control panel function.	Every three to four months.
Emergency stop	Check that the Emergency stop buttons work, push down the red button, and check that the Emergency reset button lights up.	Every three to four months / according to <i>EN/ISO 13850 Safety of machinery - Emergency stop function</i> .

Part	Maintenance	Interval
Charging pads/broom	Check if the charging pads are dirty or dusty and if the broom is intact. Clean the broom.	Check every six months, and replace as needed.
3D cameras	Check for visual defects, for example cracks and scratches.	Check monthly, and replace as needed.
Proximity sensors	Check for dust or dirt and clean with a swab.	Check weekly.
Manual brake release switch	Check if the Manual brake release switch functions. Release the brakes, and push the robot gently forward. Remember to enable the brakes again when done.	Check monthly, and replace as needed.
Safety marking on the floor	Check if the safety markings around operating hazard zones are intact and visible.	Check every six months and replace as needed.
Safety stickers and nameplate	Check if the safety stickers, ID label, and nameplate on the robot are still intact and visible.	Check every six months, and replace as needed.
Shelf carrier actuators and lifting mechanism	Check that the carrier pins can be raised and lowered smoothly and completely.	Check every six months, and replace as needed.



CAUTION

A robot that has been impacted may be structurally damaged, risking malfunction and damage to personnel.

- If you suspect the robot has suffered any damage, you need to conduct a thorough inspection to ensure that the robot's strength and structure is not compromised.

11.3 Battery maintenance

The battery is generally maintenance-free but should be cleaned if it gets very dirty. When cleaning, the battery must be removed from any power source. Only use a dry and soft cloth to clean the housing of the battery and do not use abrasives or solvents.

For storage of battery, see [Enabling fast swap and swapping out the lithium-ion battery on page 67](#).

For disposal of batteries, see [Disposal of robot on page 210](#)

12. Packing for transportation

This section describes how to pack the robot for transportation.

12.1 Original packaging

Use the original packaging materials when transporting the robot.



The packaging materials are:

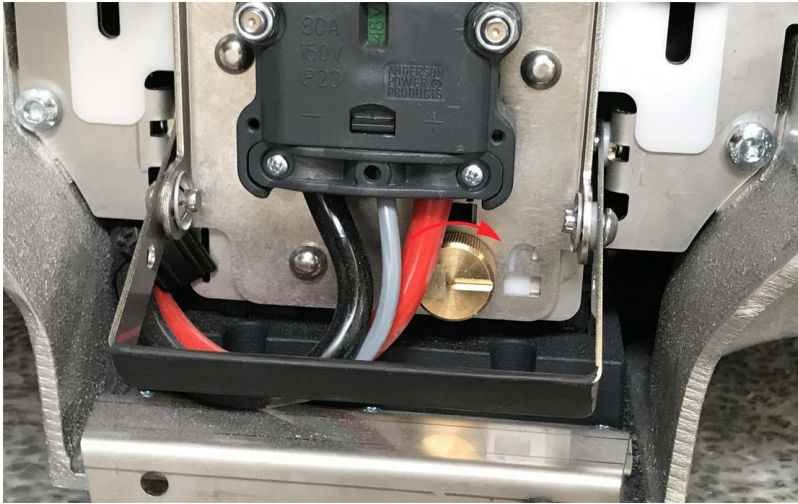
- The bottom of the box (the pallet)
- The lid of the box (the ramp)
- The walls of the box
- Protective foam blocks: Side blocks and the top layer
- Protective corner braces. The braces prevent the robot from being damaged by the transport straps

12.2 Packing the robot for transportation

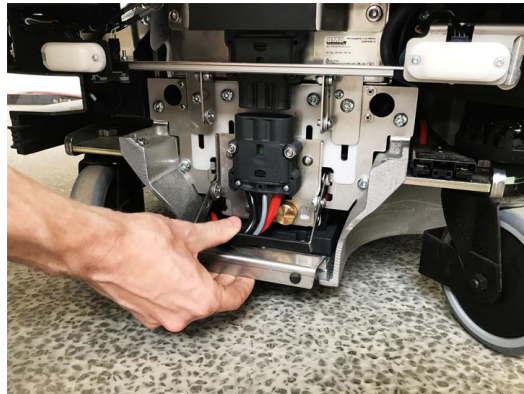
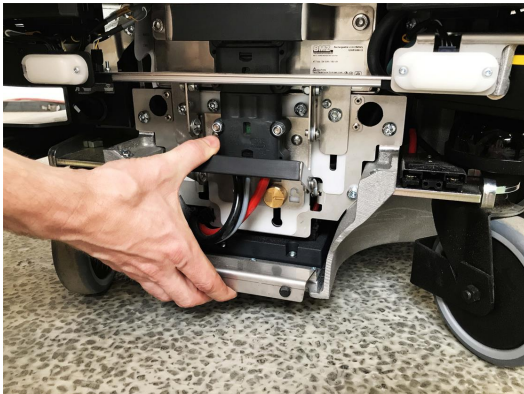
Before packing the robot for transportation, you need to access the rear compartment—see [Accessing the internal parts on page 30](#)—, and shut down the robot—see [Shutting down the robot on page 64](#).

Follow these steps to pack the robot for transportation:

1. Turn the battery lock clockwise to release it.



2. Press down on the battery lever.





NOTICE

Pack and transport the robot in an upright position. Packing and transporting the robot in any other position voids the warranty.

12.3 Battery

The lithium-ion battery is subject to transport regulations. Make sure that you follow the safety precautions in this section and the instructions in [Packing for transportation on page 207](#). Different regulations apply depending on the mode of transportation: land, sea, or air.

Contact your distributor for more information.



CAUTION

Lithium-ion batteries are subject to special transportation regulations according to United Nations Regulation of Dangerous Goods, UN 3171. Special transport documentation is required to comply with these regulations. This may influence both transport time and costs.

13. Disposal of robot

MiR250 Shelf Carrier robots must be disposed of in accordance with the applicable national laws, regulations, and standards.

Fee for disposal and handling of electronic waste of Mobile Industrial Robots A/S robots sold on the Danish market is prepaid to DPA-system by Mobile Industrial Robots A/S. Importers in countries covered by the European WEEE Directive 2012/19/EU must make their own registration to the national WEEE register of their country. The fee is typically less than 1€ per robot. A list of national registers can be found here: <https://www.ewrn.org/national-registers>.

For Battery storage and disposal, see [Battery storage and disposal on page 71](#).

14. Payload specifications

The payload specifications for MiR250 Shelf Carrier are in progress. See the *MiR250 User Guide* for an approximation of where the center of mass of the payload must be positioned for safe operation.

15. Interface specifications

This section describes how MiR Shelf Carrier 250 interfaces with MiR250.

MiR250 uses five electrical interfaces to communicate with MiR Shelf Carrier 250:

- Robot's left side:
 - Emergency stop
- Robot's right side:
 - GPIO A
 - GPIO B
 - Auxiliary Safety Functions A
 - Auxiliary Safety Functions B

To see the locations of the interfaces on the robot, see [Internal parts on page 19](#).

15.1 Left side interfaces

This section describes the general purpose interfaces that are used to interface to the top module on the left side of the robot.



CAUTION

Connecting power and ground signals to the chassis while stacking the 24 V and 48 V power supplies can lead to severe damage to the robot and electrical shock.

- Never connect power and ground signals to the chassis, and never stack the 24 V and 48 V power supplies.



CAUTION

Connecting 48 V power supplies to 24 V pins or vice versa can lead to severe damage to the robot and electrical shock.

- Never connect 48 V power supplies to 24 V pins or vice versa.

Emergency stop

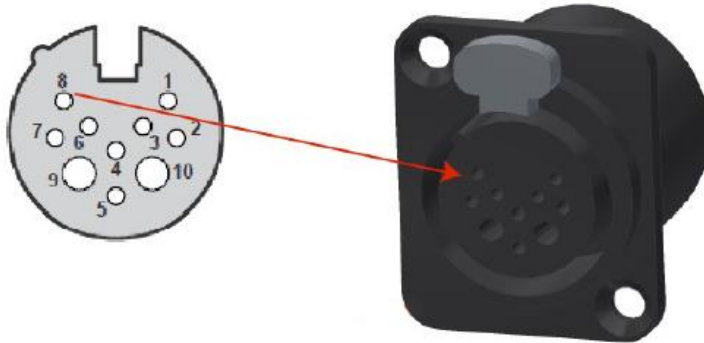


Table 15.1 describes the pins of the Emergency stop interface.

Pin no.	Signal name	Type	Description
1	SAFE_ RETURN	Ground	Return for lamp signal
2	Test output 1	Output	Safety output 1. Connects to pin 5 through the Emergency stop buttons.
3	Test output 2	Output	Safety output 2. Connects to pin 4 through the Emergency stop buttons.
4	E-stop 1	Input	Safety input 1. Connects to pin 3 through the Emergency stop buttons.
5	E-stop 2	Input	Safety input 2. Connects to pin 2 through the Emergency stop buttons.
6	Restart	Input	Safety input 3
7	RST_LAMP_ 24_V	Output	24 V output for powering the lamp on the Emergency stop box.
8	NC		Not connected to the robot.
9	NC		Not connected to the robot.
10	NC		Not connected to the robot.

Table 15.1. Description of pins in the Emergency stop interface.

15.2 Right side interfaces

This section describes the general purpose interfaces that are used to interface to the top module on the right side of the robot.

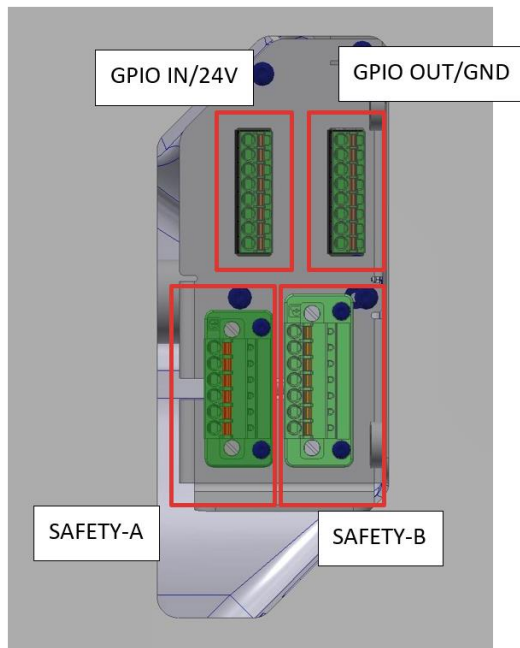


Figure 15.1. Overview of the interfaces in the right side compartment.

GPIO A and B

The GPIO interfaces have the following pins:

- Four inputs, for use with 24V, but robust against 48V.
- Four outputs, for use with 24V.

Outputs (O0, O1, O2, O3) are used to either raise or lower the carrier pins. They can be set using a **Set I/O module** mission action or manually in **Setup > I/O modules**.

Inputs (I0, I1, I2, I3) are used by the top module to send input signals to the robot regarding the STO contactor and the position of the carrier pins.

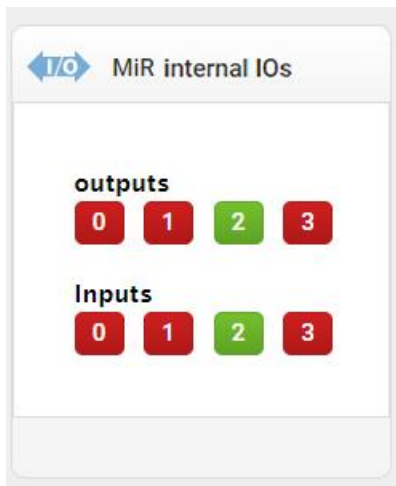


Figure 15.2. Example of I2 registered as active by the robot and O2 set to active by the user.

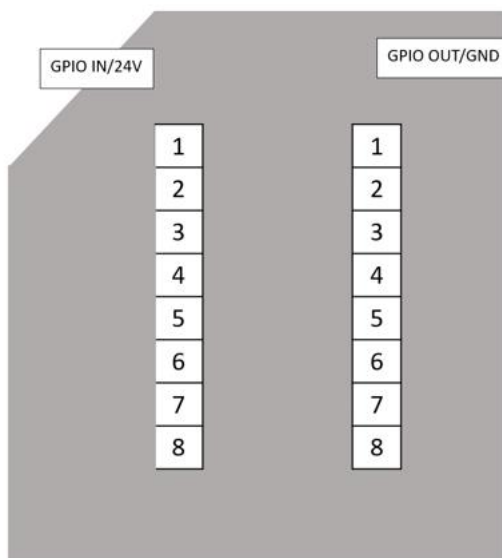


Figure 15.3. Pin numbers for the GPIO interfaces.

Table 15.2 describes inputs and 24 V supply.

Pin no.	Signal name	Type	Description
1	IN1	Input	Input 1. Lowers the carrier pins when on.

Pin no.	Signal name	Type	Description
2	24V	Output	24 V output.
3	IN2	Input	Input 2. Unassigned.
4	24V	Output	24 V output.
5	IN3	Input	Input 3. Raises the carrier pins when active.
6	24V	Output	24 V output.
7	IN4	Input	Input 4. Unassigned.
8	24V	Output	24 V output.

Table 15.2. Description of the pins in the input interface.

Table 15.3 describes outputs and ground.

Pin no.	Signal name	Type	Description
1	OUT1	Output	Output 1. Receives 24 V.
2	GND	Ground	Protected return.
3	OUT2	Output	Output 2. Signals when carrier pins are raised.
4	GND	Ground	Protected return.
5	OUT3	Output	Output 3. Signals when carrier pins are lowered.
6	GND	Ground	Protected return.
7	OUT4	Output	Output 4. Safety relay control.
8	GND	Ground	Protected return.

Table 15.3. Description on the pins in the outputs interface.

Auxiliary Safety Functions A and B

The Auxiliary safety functions interfaces are designed to support Emergency and Protective stops and other safety functions.

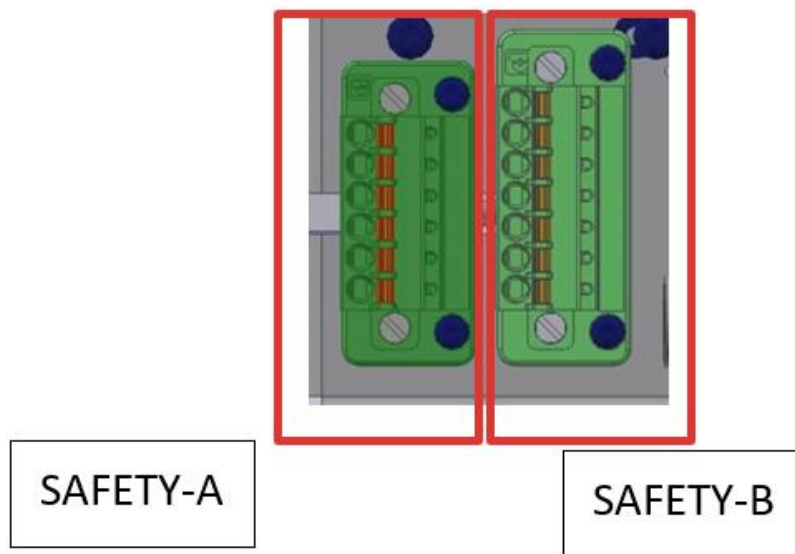


Table 15.4 and Table 15.5 contain the description of the pins of the Auxiliary safety functions interfaces when MiR Shelf Carrier 250 is mounted on MiR250.

Safety A:

Pin no.	Signal name	Type	Description
1	Test output 1	Output	24 V test signal. Sends test pulses (not on constantly).
2	STO feedback 1	Input	Feedback from top module safety relay 1.
3	Pins down	Input	Indicates when the carrier pins are lowered.
4	STO control	Input	Indicates to the safety PLC that the pins will move. The safety PLC turns on the STO contactor in the top module and

Pin no.	Signal name	Type	Description
			monitors the speed of the robot.
5	Pins down out	Output	Indicates when the pins are down.
6	NC	Unassigned	

Table 15.4. Description of the pins in the Auxiliary safety function interface A.

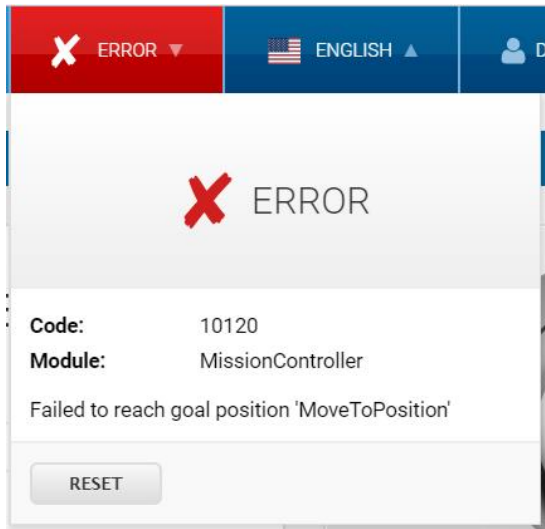
Safety B:

Pin no.	Signal name	Type	Description
1	Test output 2	Output	24 V out test signal. Sends test pulses (not on constantly).
2	STO feedback 2	Input	Feedback from top module safety relay 2.
3		Input	Indicates when the carrier pins are raised.
4	NC	Input	Not used.
5	STO activation	Output	Signals when to activate the safety relays.
6	Pins up out	Output	Indicates when the pins are down.
7	SAFE_RETURN		Safe return for output signals.

Table 15.5. Description of the pins in the Auxiliary safety function interface B.

16. Error handling

The robot enters an error state when it can't solve a problem on its own.



Errors include:

- Hardware faults
- Failed localization
- Failure to reach destination
- Unexpected events in the system

An error triggers a Protective stop. The robot is paused until a user acknowledges the error and clears it.

16.1 Software errors

Software errors such as localization and failure to reach the goal destination can be prevented with the proper setup of maps and missions:

- Always test your missions under full observation and normal work environment conditions before leaving the robot to execute them autonomously.
- Use Try/Catch actions to make the robot react in a specific way if it fails to execute certain actions.
- Use Prompt user actions in missions that require intervention from users.

- Define forbidden areas with Forbidden or Unpreferred zones on the map.
- Remove noise from maps.
- Create Directional or Preferred zones to guide the robot around areas that are difficult for the robot to travel through.

See [Creating and configuring a map on page 112](#) for more information.

To clear an error, select the red warning indicator in the interface and select **Reset**.

For more details on setting up missions and error handling, see the *MiR Robot Reference Guide* on the MiR website.

16.2 Hardware errors

If the error is a fault in the hardware, you will either not be able to clear it, or the error will return until the fault is fixed. If this occurs you can try to fix the issue with these actions:

- Turn your robot off and then on again. This resets the robot components and may resolve the issue.
- Check that the Emergency stop button is released.
- Check your robot for any physical damage such as cracks, dents, or severe scratches or contamination such as dust, dirt, and grease. Pay special attention to the 3D cameras, safety laser scanners, and drive wheels.
- Sign in to the robot interface and go to **Monitoring > Hardware health**. The interface displays which component is failing and often for what reason. This can help identify the source of the error. If an internal component is failing, turn off the robot, disconnect the battery, and have the commissioner or operator visually check the internal component for obvious faults.
- For further troubleshooting, contact your distributor for specific MiR troubleshooting guides or assistance from MiR Technical Support.

Glossary

A

Autonomous mode

Mode in which the robot drives autonomously based on the missions you assign it.

C

Cart

A cart can be towed by a MiR robot with a MiR hook mounted to it.

Commissioner

Commissioners have thorough knowledge of all aspects of commissioning, safety, use, and maintenance of MiR250 Shelf Carrier and have the following main tasks: Commissioning the product, including creating maps and restricting the user interface for other users; making the risk assessment; determining the payload limit, weight distribution, and safe fastening methods of loads to MiR250 Shelf Carrier; and ensuring the safety of nearby personnel when a MiR robot is accelerating, braking, and maneuvering.

D

Direct user

Direct users are familiar with the safety precautions in the user guide and have the following main tasks: assigning missions to MiR250 Shelf Carrier and fastening loads to MiR250 Shelf Carrier properly.

Dynamic obstacle

Obstacles that are moved around such as pallets, crates, and carts. These should not be included when creating a map.

E

Emergency stop

Emergency stop is a state the robot enters when an Emergency stop button has physically been pressed. When the robot is in Emergency stop, the status light of the robot turns to red, and you are not able to move the robot or send it on missions

until you bring the robot out of Emergency stop. To do this, you must release the Emergency stop button and then press the Resume button.

G

Global path

The global path is the route the robot calculates that leads it to its goal position.

I

Identification label

The label that is mounted to the product during production. This is used to identify the components in your MiR application. It identifies the product model, the hardware version, and the product serial number.

L

Local path

The route the robot creates within its immediate vicinity that guides it around obstacles while still following the global path.

Localization

The method used by the robot to determine its position on the map relative to where it is in the work environment.

M

Manual mode

The mode in which you can drive the robot manually using the joystick in the robot interface.

Marker

A marker is a physical entity that the robot can dock to. This enables the robot to position itself accurately relative to the marker.

MiR application

A MiR application is either a single MiR product or a combination of MiR products that is able to execute certain tasks. A MiR application is often a MiR base robot

combined with a MiR top module. If a custom top module is used, the CE mark on the nameplate of the base robot does not extend to the top module.

MiR robot interface

The robot interface is the web-based interface that enables you to communicate to your MiR robot. It is accessed by connecting to the robot's WiFi and then going to the site mir.com.

Muted personnel detection means

When personnel detection means are muted, the robot moves at a reduced speed, and the protective field sets are minimized so the robot does not enter protective stop until it is very close to an obstacle.

N

Nameplate

The label delivered with your MiR application that must be mounted before you commission the robot. The nameplate identifies the MiR application model, application number, mechanical and electrical specifications, and includes the CE mark of your application.

O

Operating hazard zone

A zone where the personnel detection means of the robot are reduced or muted to a level where personnel safety is at risk.

Operator

Operators have thorough knowledge of MiR250 Shelf Carrier and of the safety precautions presented in the User guide of MiR250 Shelf Carrier. Operators have the following main tasks: servicing, maintaining, and creating and changing missions and map positions in the robot interface.

P

Position

A position is a set of X-Y coordinates on the map that you can send the robot to.

Protective stop

Protective stop is a state the robot enters automatically to ensure the safety of nearby personnel. When the robot enters Protective stop, the status light of the robot turns red, and you are not able to move the robot or send it on missions until it is brought out of Protective stop. The robot goes into Protective stop in a number of situations:: if a safety laser scanner detects an object in its active protective field, when the robot finishes the startup process, when the robot has switched between Manual mode and Autonomous mode, if the safety system detects a fault, or if the motor control system detects a discrepancy.

S

Shelf

A shelf can be picked up by a MiR robot with a shelf lift application mounted to it.

Static landmark

Obstacles that cannot be moved, such as walls, columns, and fixed structures. These must be included on the map and are used by the robot to localize itself.