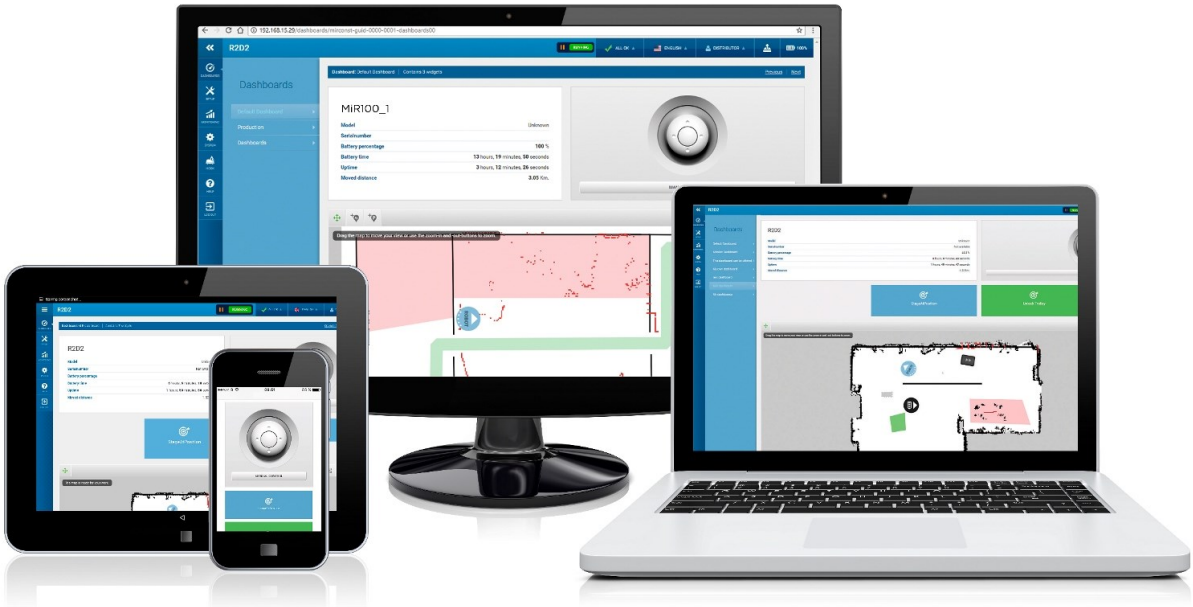
Reference guide



MiR robot

en

Revision: 1.9

Date: 2019/03

Copyright and disclaimer

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CVR: 35251235

Table of contents

1. About this document

This document describes the MiR robot interface. The manual is intended for administrators of the system and users responsible for updating the system regularly, e.g. defining new missions or setting up new users in the system.

1.1. Where to find more information

At www.mir-robots.com, the following extra resources are available. To access the pages in the Distributor site, sign in with your distributor account at http://www.mobile-industrial-robots.com/en/account/.

- Distributor site
  http://www.mobile-industrial-robots.com/en/account/
  This page contains various documents related to MiR products.
- Distributor site > How to
  http://www.mobile-industrial-robots.com/en/account/how-to/
  This page contains how-to articles that describe how to perform specific tasks.

1.2. Document history

This table shows latest and previous versions of this document and their interrelations with product software releases.

Revision	Release date	Description	SW version
1.0	2017-03-02	First edition	2.0
1.1	2017-10-30	General improvements. Continue/Pause button added to top bar. Pause action added to Missions.	2.0.2
1.2	2017-12-06	Update to SW version 2.0.14: new widgets, improved mapping editor. Jumping from 2.0.2 to 2.0.14 to align with old webinterface versions 1.8.14/1.9.14.	2.0.14
1.3	2018-01-26	Update to SW version 2.0.15: • Redesigned Dashboard with flexible widgets and new options, e.g. control of Bluetooth functions. • New feature: Path guides for precise control of robot's paths between two positions. • New mapping method: Cartographer. • Positions & Mapping section removed and fully integrated in Mapping section.	2.0.15

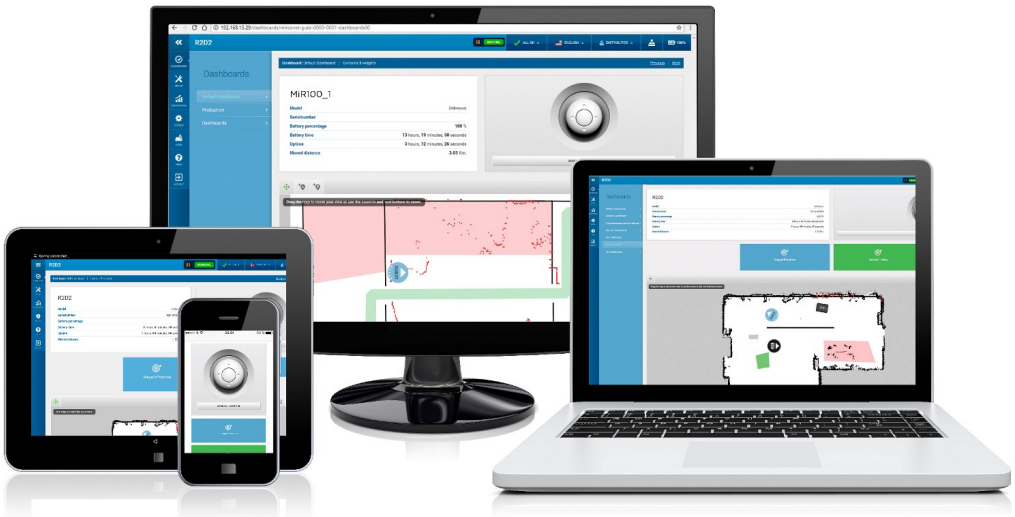
Revision	Release date	Description	SW version
1.4	2018-04-19	Update to SW version 2.0.17. New features in the interface: • New Hook widget: Hook widget described in chapter 3 Dashboard. • Modbus: a section Triggers is added to the chapter 6 System and a new chapter 11 Modbus registers has been added.	2.0.17
1.5	2018-05-24	Update to SW version 2.0.18. New features in the robot interface: • New section Mission log has been added to the Monitoring menu. • A WiFi watchdog parameter has been added to the Advanced settings section. • Minor corrections and improvements throughout the manual.	2.0.18
1.6	2018-06-18	Update to SW version 2.1.0. New features in the robot interface: • The Directional zones functionality is added to section 4.3 Maps. • Minor corrections and improvements throughout the manual.	2.1.0
1.7	2018-07-20	Update to SW version 2.2.0. New features in the robot interface: • I/O module feature replaces Bluetooth feature. Changes to chapters 3. Dashboards, 4.2 Missions and 4.3. Maps. Chapter 4.9. I/O modules replaces 4.9 Bluetooth relays. • Sound feature has been updated. Changes to chapters 4.2 Missions and 4.3 Maps.	2.2.0
1.8	2018-10-01	Update to SW version 2.3.0. New features in the robot interface: • The speed control functionality is added to the Mission editor. • Minor corrections and improvements throughout the manual.	2.3.0

Revision	Release date	Description	SW version
1.9	2019-03-06	Update to SW version 2.6.0. New features in the robot interface: • Map zones have been reconstructed and new zone settings are available. • Minor corrections and improvements throughout the manual.	2.6.0

2. MiR robot interface

This section gives a quick overview of the MiR robot interface.

The interface is responsive and automatically adapts to your use of smartphone, tablet or PC and also to the way you hold your tablet or smartphone in upright or portrait view.



2.1. Signing in

The interface comes with three default access levels:

- Distributor - the MiR distributor
- Administrator - the end-customer's production engineer with technical responsibility for the robot
- User - the daily operator(s) of the robot.

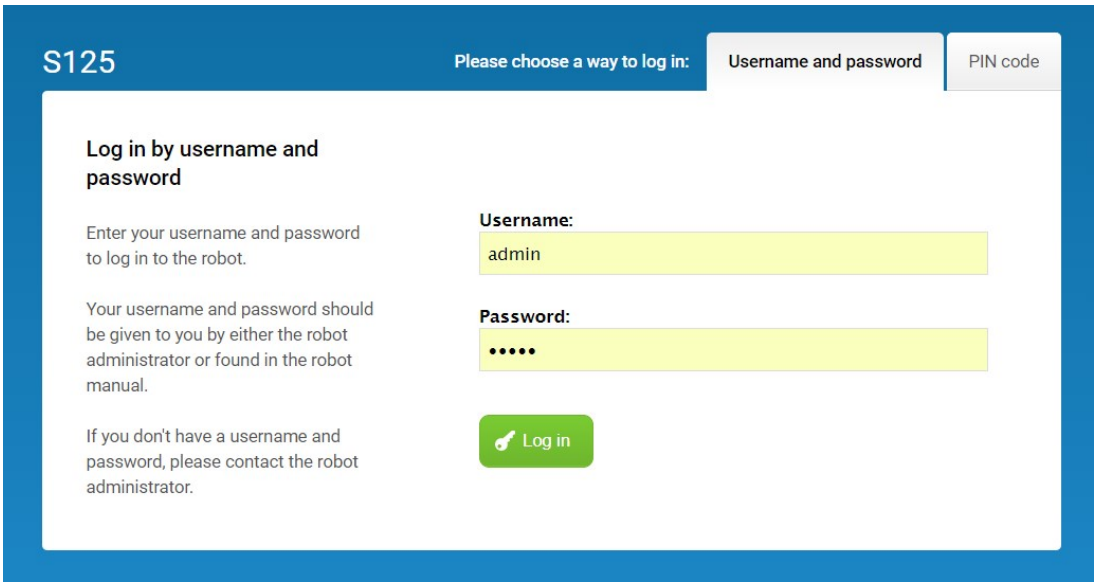
There are two ways in which you can sign in to the MiR robot interface:

- Username and password
- PIN code

System permissions are handled per user group whereas login credentials are handled per individual user. Read more in Users and User groups.

Username and password

Enter your username and password to sign in to the robot interface.



Default login credentials

The default usernames and passwords are:

Distributor

- Username: Distributor
- Password: contact MiR Support

Administrator

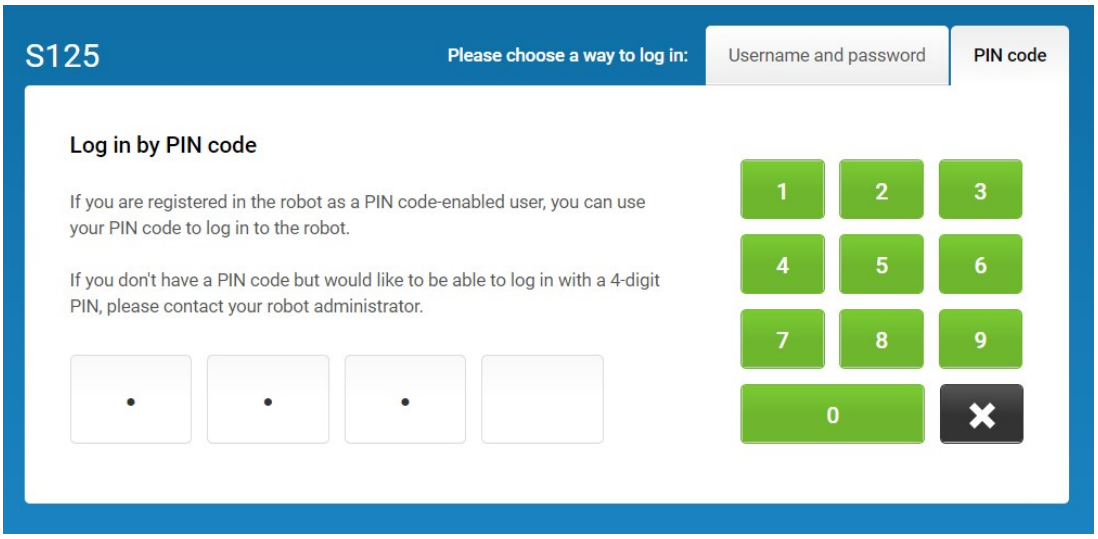
- Username: Admin
- Password: admin

User

- Username: User
- Password: user

PIN code

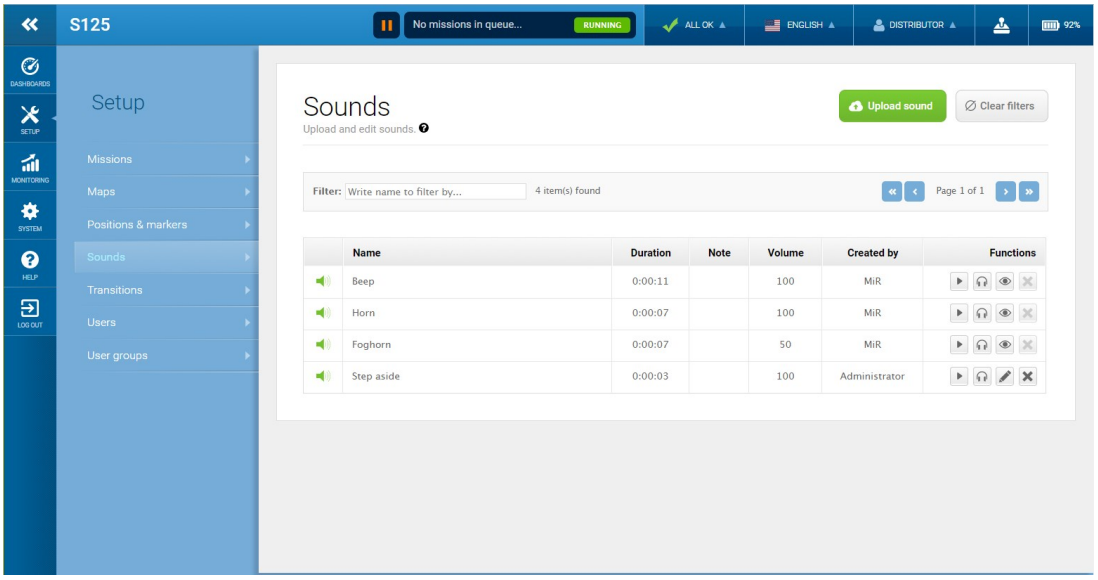
Select the PIN code tab and enter a four-digit PIN code. There is no preconfigured PIN code.



2.2. Navigating the MiR robot interface

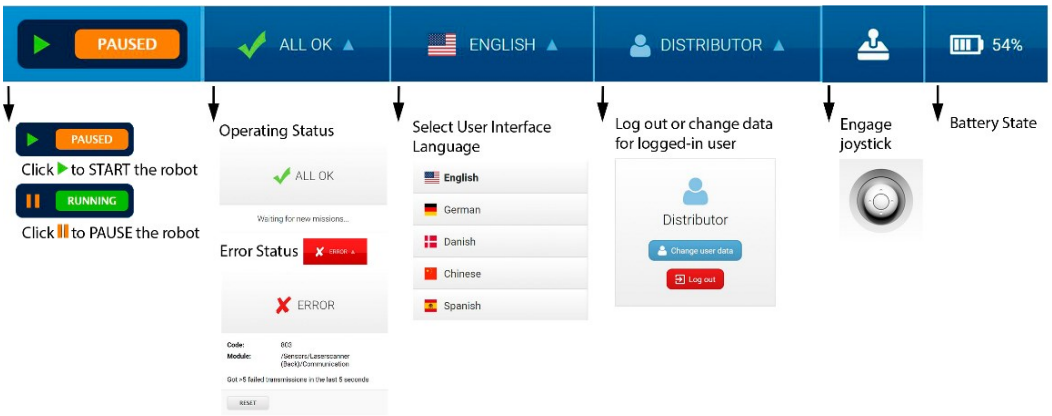
The MiR robot interface has a straight-forward structure and an intuitive design. From the main menu, you never have to open more than one submenu to find the wanted section. When you click on a main menu, the related submenus appear, and with the next click, you access the wanted section.

For example, to go to the Sounds section, click on Setup on the main menu bar, then select Sounds on the submenu bar.



Top bar

The top bar shows information on the current state of the robot, and you can start and pause the robot by clicking the button.



2.3. Getting started

The interface supports multi-level user access, and tailored dashboards make it easy for all users to have their daily functions at the fingertips.

User setup

To get started, users must be set up in the system. This implies the following:

1. Set up users, see Users on page 57.
2. Define user groups, see User groups on page 59.
3. Create dashboards tailored to different users' tasks, see Dashboards on page 12.

System setup

One or more maps for the robot to navigate in and missions defining various robot tasks are the basics to get the robot up and running. Features added to maps such as positions and preferred drive zones, forbidden zones etc. make the robot move smoothly in the area.

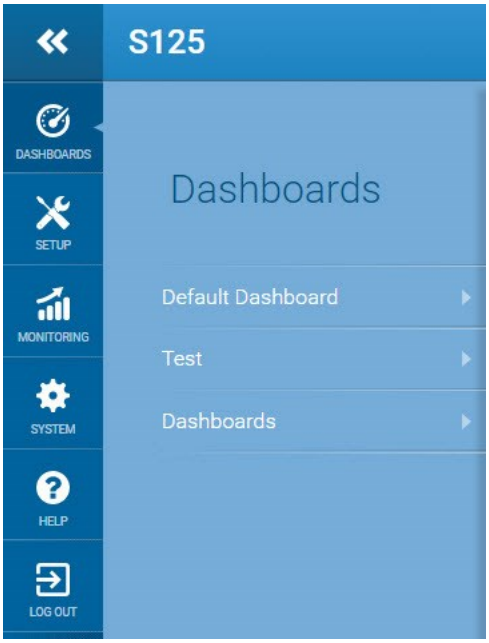
- Create a map, see Maps on page 42.
- Edit the map: add positions, drive zones etc., see Mapping tools on page 44.
- Create missions, see Missions on page 21.

3. Dashboards

This section describes the items in the Dashboards menu.

The Dashboards submenu displays all Dashboards currently available on the robot.

In the Dashboards section, you can create new dashboards and edit the existing ones. Click on the Dashboards title to open the list of dashboards, and click the Create dashboard button to open the dashboard designer.

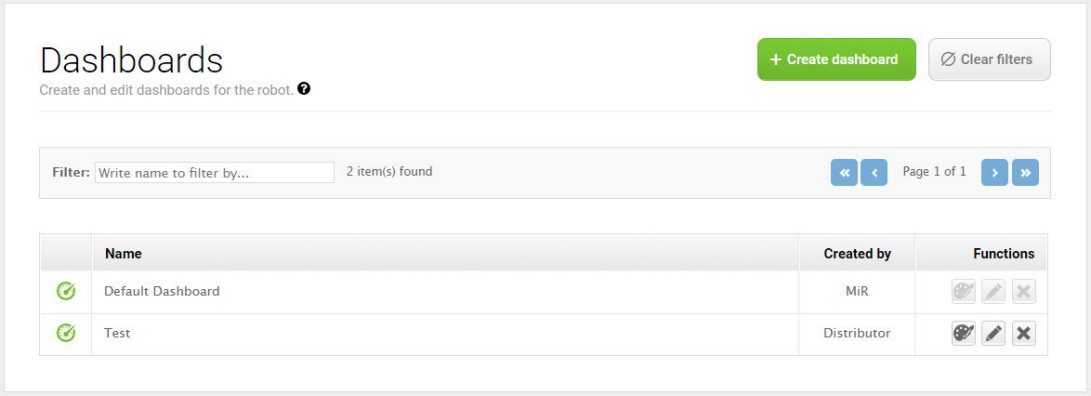


The Dashboards menu contains the following items:

3.1. Dashboards

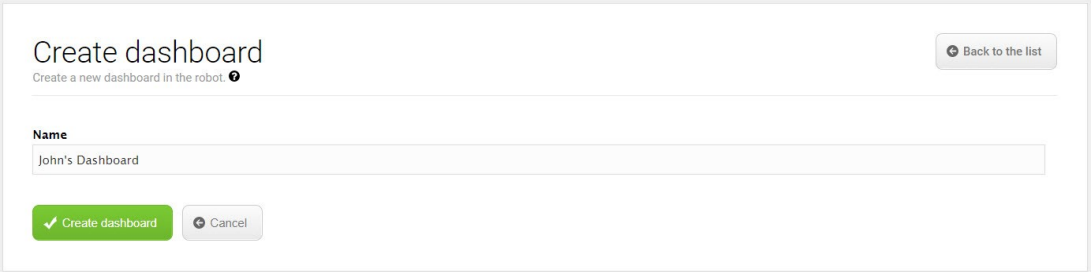
Dashboards are an easy way for different user groups to control the robot giving direct access to their individual key functions. A dashboard is made up of a number of widgets each representing a feature in the system, e.g. a particular mission, the map the robot is running in or the current mission queue.

The system comes with a Default dashboard and, in addition, you may create an unlimited number of customized dashboards.



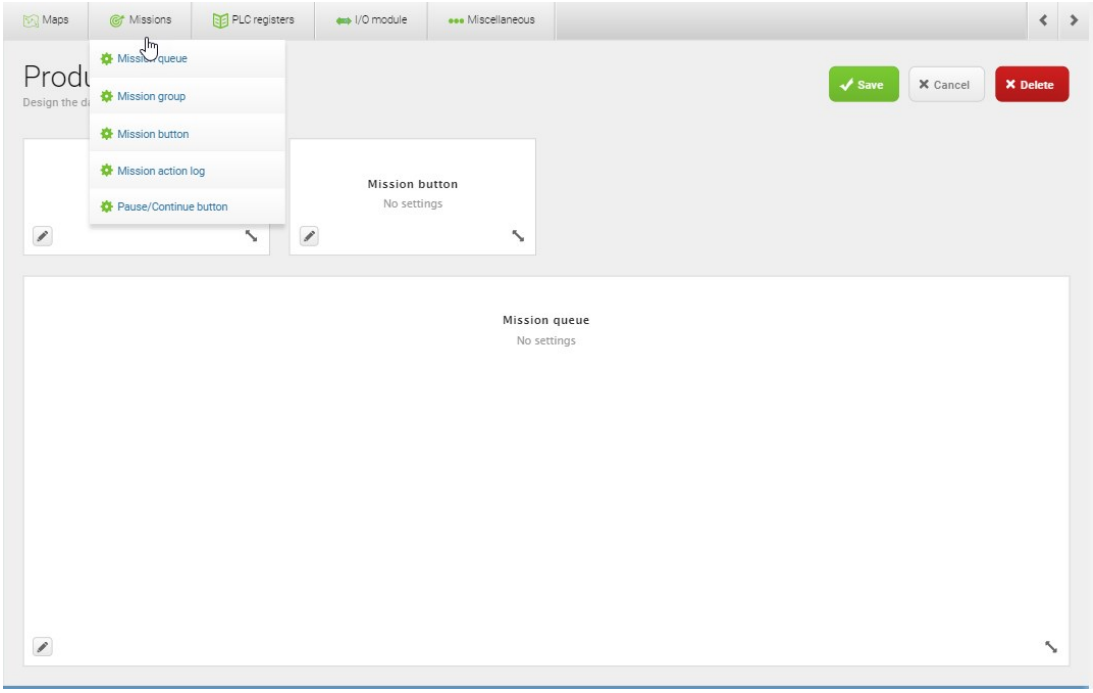
3.1.1. Create dashboard

To create a dashboard, first fill in the name field and then click the Permissions button to specify which user groups should have access to edit the dashboard. Continue to the Design section by clicking the Create dashboard button. Design the dashboard by adding widgets that represent the features you want to assign to the dashboard.



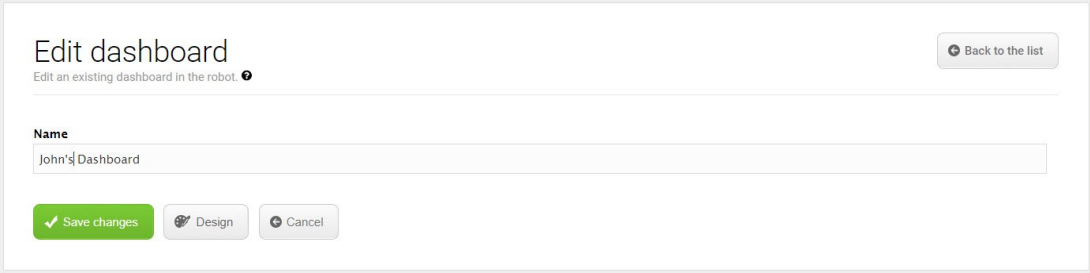
3.1.2. Dashboard designer

Design the dashboard by selecting widgets from the menus in the top bar of the user interface. 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, click the pen icon in the lower left-hand corner and select the wanted action.



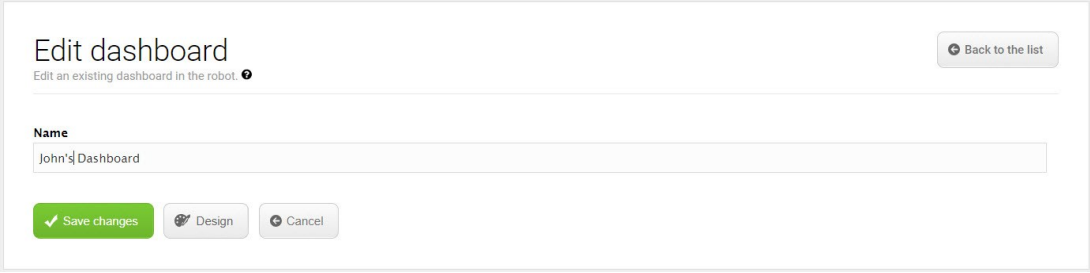
3.1.3. Edit dashboard

The dashboard design can be edited and widgets added or removed.



3.1.4. Delete dashboard

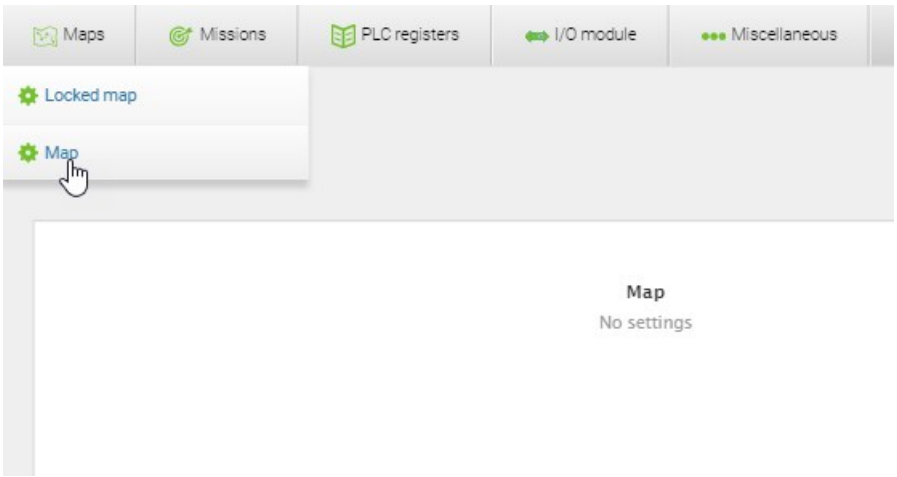
You can delete all dashboards that are created by you or another member of the user group you belong to.



3.2. Widgets

This section describes the dashboard widgets.

3.2.1. Maps



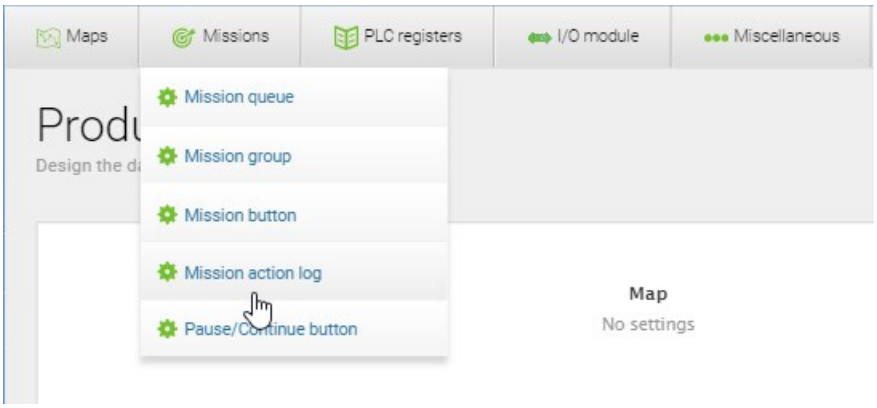
Locked map

A locked robot map widget makes the active map of the selected robot visible on the dashboard. The robot is always shown in the middle of a locked map. Select the robot you want shown on the dashboard.

Map

A map widget makes the active map visible on the dashboard. You can add and edit positions and markers in the widget and adjust the robot's position.

3.2.2. Missions



Mission button

You can start a mission from the dashboard by adding a Mission button wizard and selecting a predefined mission.

Pause/Continue button

You can have a Pause/Continue button on the dashboard by adding a Pause/Continue button wizard. This toggle button is also available on the top bar of the robot interface, but may be inserted as wizard if you want it in a larger size.

Mission queue

You can have the mission queue displayed on the dashboard by selecting a Mission queue wizard.

Mission action log

The Mission action log-widget displays the individual actions being performed during the execution of a mission.

Mission group

You can select a mission group and have all missions from that group displayed on the dashboard by adding a Mission group wizard.

3.2.3. PLC registers

PLC button/display

Get easy access to PLC functions from the dashboard. A PLC widget can be designed as a click button, e.g. to shift between two stages or a display button, e.g. for monitoring read-out values.

3.2.4. I/O module

I/O module

The Connect I/O module widget lets you connect and disconnect I/O modules from the dashboard.

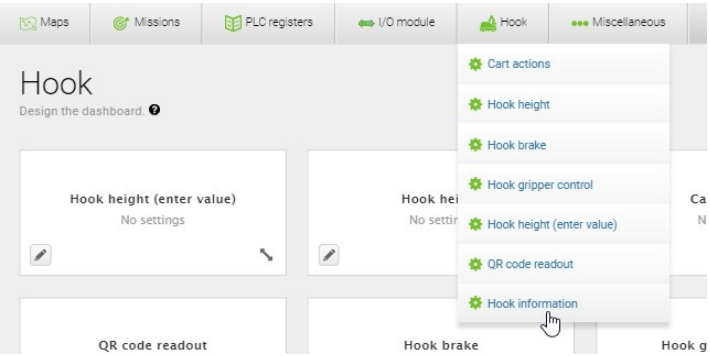
I/O configuration

The I/O module configuration widget lets you program one or more actions that you want the I/O module to perform when the outputs are in a certain state and when you click the button. Add states to the widget and configure the conditions that trigger the state and the outputs that the robot sets on the I/O module when you click the widget. Use the Reset section to configure a default output configuration.

I/O status

The I/O module status widget shows the current status of the selected I/O module.

3.2.5. Hook

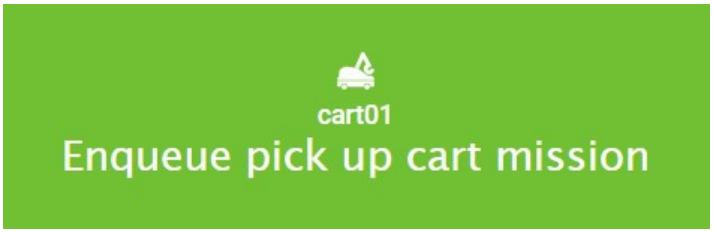


Cart actions

This widget lets you queue the following missions: Pick up cart, Place cart.

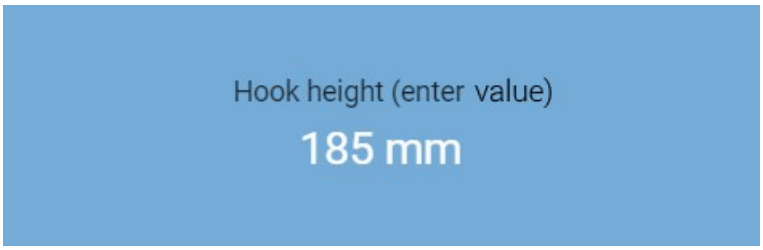
Use the check boxes to define which missions are available in the widget. You must select at least one option (either Pick up cart or Place cart).

When you click the widget, the robot adds the mission shown in the widget to the mission queue. In the Place cart mission, the robot releases the gripper, lowers the hook, and leaves the cart in the current position. In the Pick up cart mission, the robot tries to find a cart within the hook camera's sight and pick it up. For the Pick up cart mission to work, it is necessary that the hook camera sees the QR code at the robot's current position.



Hook height

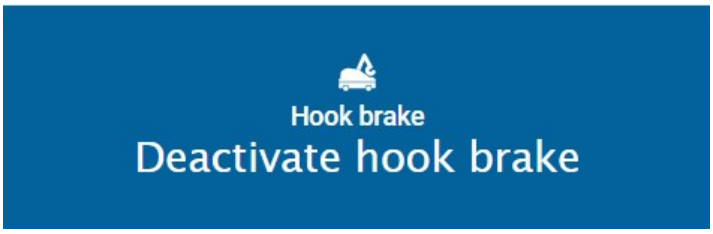
This widget lets you set the height of the hook manually. Use the arrows to change the value.



Hook brake

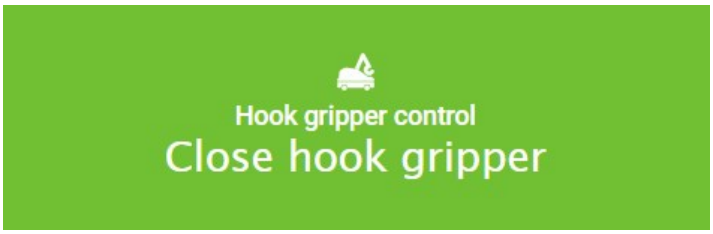
This widget lets you activate and deactivate the hook arm brake manually. The text in the widget shows the action that it executes when you click it. The text in the widget changes depending on the state of the hook brake. For example, if the brake is active (the arm is locked), the widget reads **Deactivate hook brake**, and clicking the widget deactivates the brake.

After you click the widget, it shows the current action and you have an option to undo the action until it is over. For example, if the brake is active and you click the widget, it shows **Deactivating... Click to undo**.



Hook gripper control

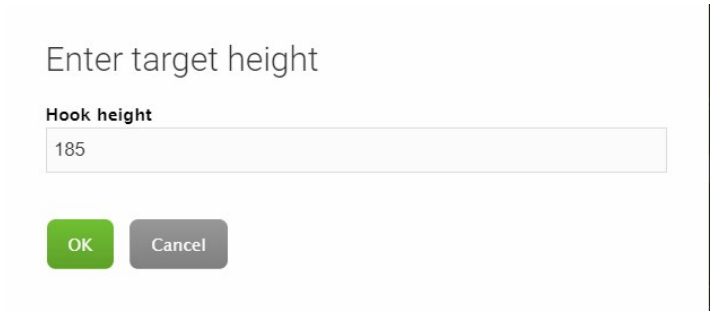
This widget lets you open and close the hook gripper. This widget shows the current action (closing or opening) and lets you undo it during execution.



Hook height

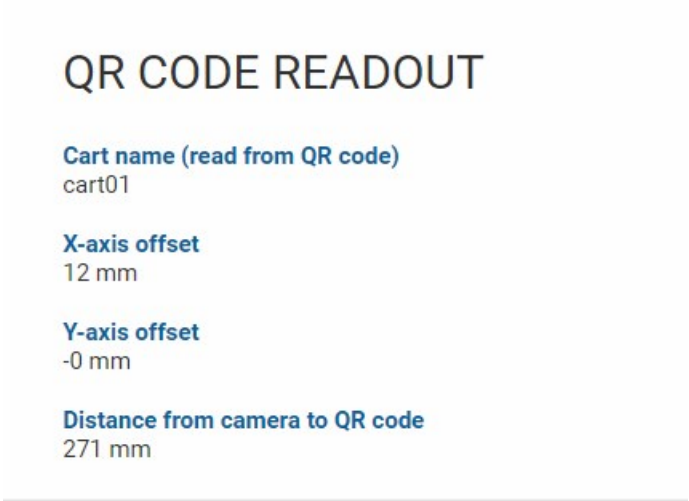
This widget lets you set the height of the hook manually. Use the arrows to change the value.

Clicking the height value opens the following dialog:



QR code readout

If the hook camera sees the QR code, this widget shows the name of the cart and the position of the QR code relative to the camera.



Hook information

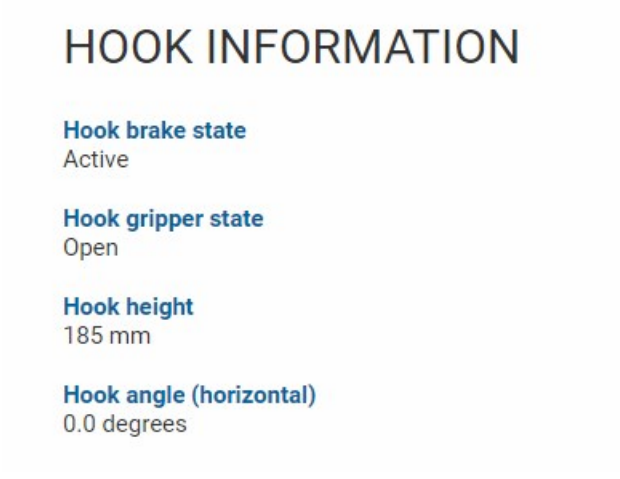
This widget shows the following information about the hook:

Hook brake state.

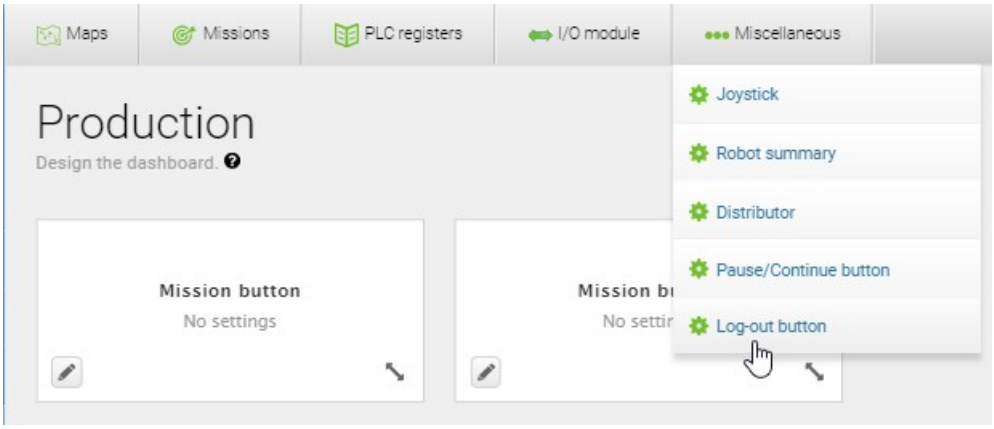
Hook gripper state.

Hook height.

Hook angle.



3.2.6. Miscellaneous



Joystick

Make one or more joysticks available directly on the dashboard. Different speeds can be selected for the joysticks; slow, medium or fast. The standard joystick in the top bar is fast, except when mapping where it runs medium speed.

Robot summary

The Robot summary widget makes it possible to have information about the robot on the dashboard: name, serial no., battery percentage, remaining battery time, uptime and moved distance.

Distributor

This widget shows information about the distributor if any distributor data has been entered in the Distributor data section under System > Settings.

Pause/Continue button

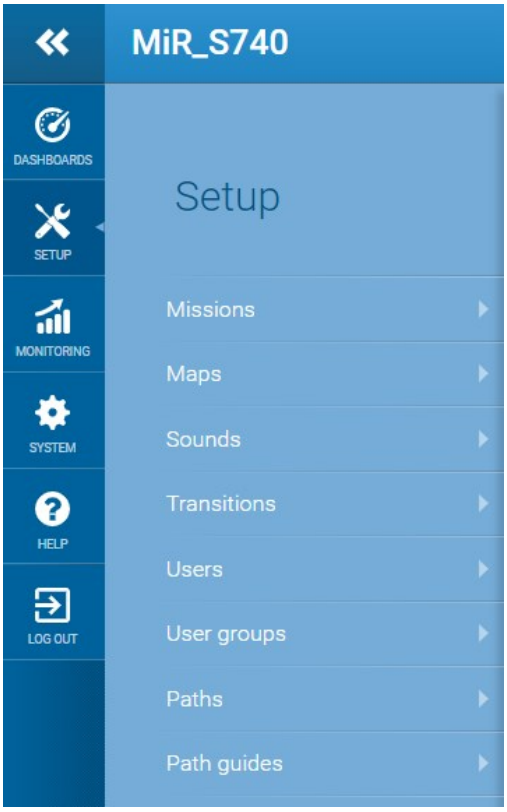
You can have a Pause/Continue button on the dashboard by adding a Pause/Continue button wizard. This toggle button is also available on the top bar of the robot interface, but may be inserted as wizard if you want it in a larger size.

Log-out button

The log-out button allows you to log off via the dashboard. This is useful on small devices where there is no other log-out button.

4. Setup

This section describes the items in the Setup menu.



The Setup menu contains the following items:

4.1. Missions

A mission is a predefined series of actions that the robot can be set to perform by the click of a button. A mission can be a simple transportation task between defined positions or a more complex job that includes both moving between positions and performing actions, such as opening an automatic door via Bluetooth signal, sounding a horn or sending an email on arrival at a position.

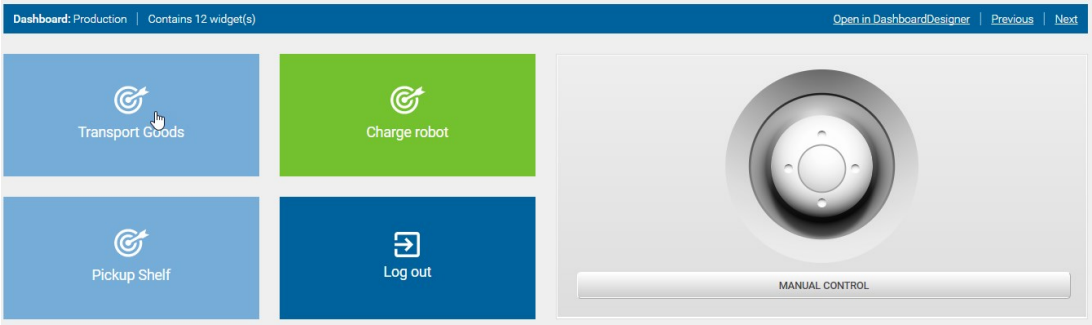
Missions are started easily by adding a given mission to the mission queue. The robot will perform the missions in the order they are added, and an operator may rearrange the queued missions if needed.

4.1.1. Start mission

You can start a mission in one of the following ways.

From a dashboard

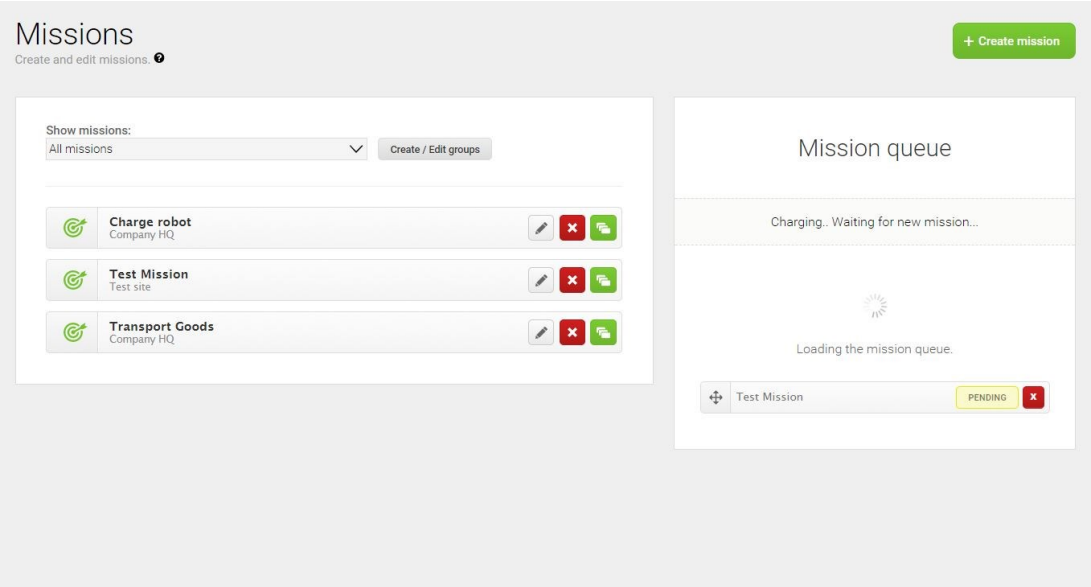
You can configure a Mission button widget on a dashboard.



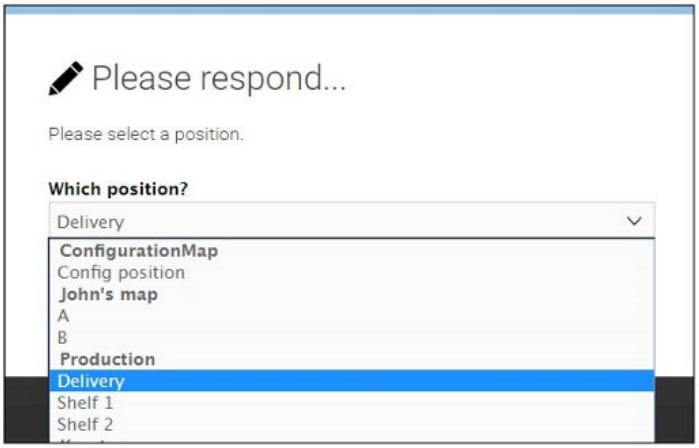
From the Missions menu

To start a mission:

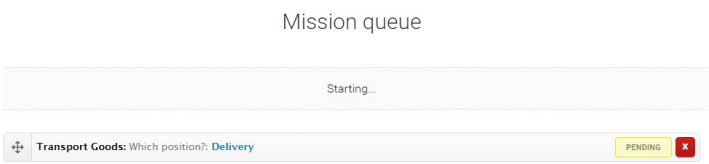
- Go to: Setup > Missions.
- Click the queue icon to add the mission to the mission queue.



If there are variable parameters in a mission, for example a variable position, you will be asked to select the position when adding the mission to the queue.



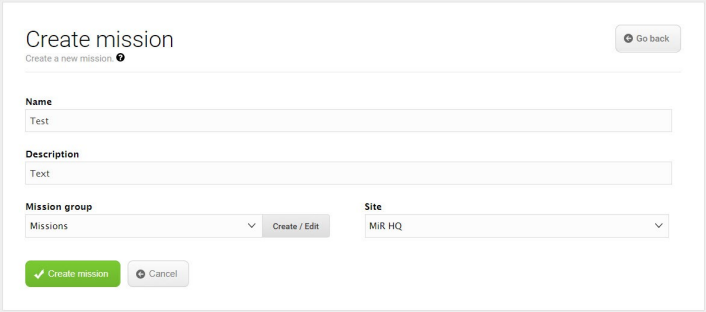
The selected parameters are shown in blue text.



4.1.2. Create mission

A mission is made up of actions such as: Move actions, logic actions, cart pick-up/delivery and sounds which can be put together as building blocks to form as many different missions as needed. Most actions have parameters to fill in, for example which position to go to. Instead of setting a fixed position, it is possible also to put in a variable position which means that the operator is asked which position the robot should go to every time the mission is added to the queue. This may be practical, for example if the robot should perform the same series of actions in different areas of the facility, e.g. picking up something from one place and delivering it to another.

Actions are grouped, and you can select which group the new mission should belong to or use the default Missions group.



The form contains the following elements:

- **Name**
  The name must be unique and is used to identify the mission.

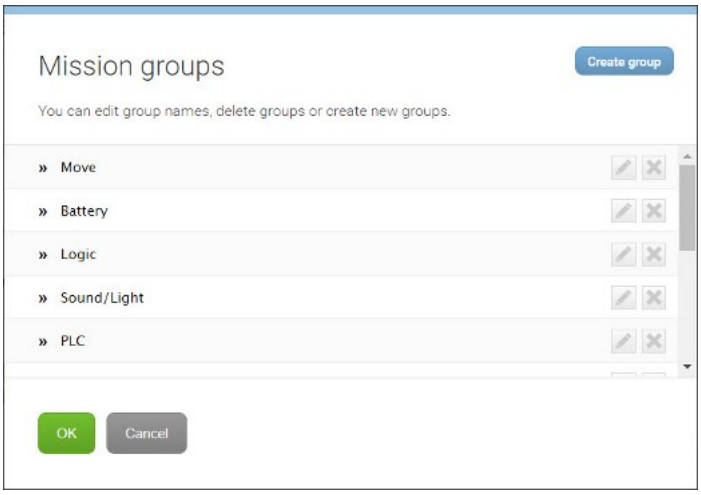
One way of naming missions is to select names that characterize the task that the robot should perform, e.g. “Go to charging station” or “Deliver spare parts”. Another way to name a mission would be to include “from” and “to” positions in the name, e.g. “Warehouse to production line 1”.

- **Mission group**
  Select which group you want the mission be placed in.
- **Description**
  Enter a short description of the mission (optional).
- **Site**
  If more than one site exists, select which site you want the mission belong to from the list.

Click **Create mission** to save the settings.

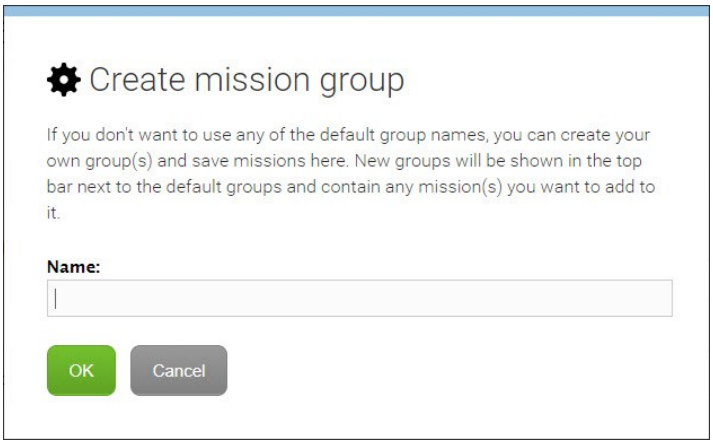
Mission groups

Each group has a number of pre-defined 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 an embedded mission of 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



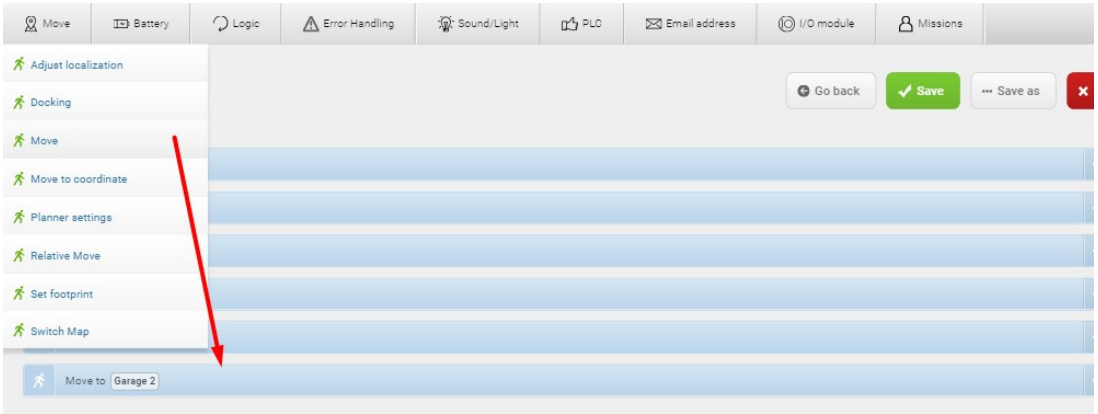
4.1.3. Mission editor

A mission is built from actions that you pick from the menus in the top bar. You can also pick already created missions and embed them in new missions. The idea is that such missions, typically limited to a specific purpose, for example to go to a charging station, can be shared among several larger missions that require the same behavior as part of the mission.

Actions and missions are grouped together in the top bar menus: All predefined actions are identified by a running-man icon. User created missions are placed together with actions in the group to which you append them and can be distinguished from actions by a target icon next to their names.

When you have picked the actions you want to build the mission from, you have a number of options:

1. Drag the actions up or down with the four-headed arrow at the far left of the action line to sort them in the desired order. The actions are executed in a top-to-bottom order.
2. Set the parameters for the selected action by clicking the gear icon at the far right of the action line.



4.1.3.1. Change mission settings

The name of the mission and the group it belongs to may be changed.

In the Mission editor window, move the mouse over the name of the mission and click on the gearwheel that appears.

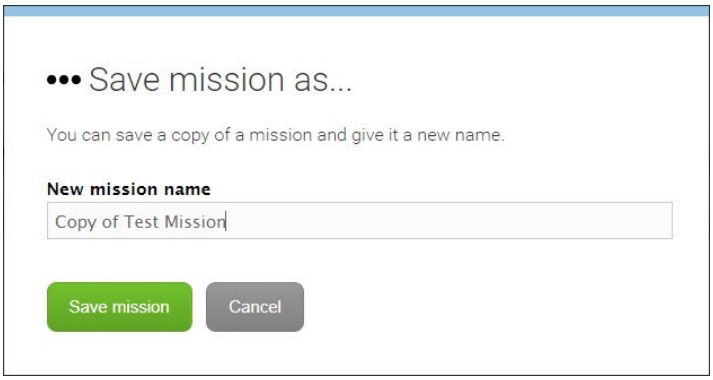
4.1.3.2. Save mission

When you have completed the missions; i.e. added all actions and sorted them in the wanted order, click **Save** to save the mission.

4.1.3.3. Save mission as

You can save a copy of a mission and give it a new name. That way it is easy to create a new mission based on the settings of an existing one.

In the Mission editor window, select **Save as**.

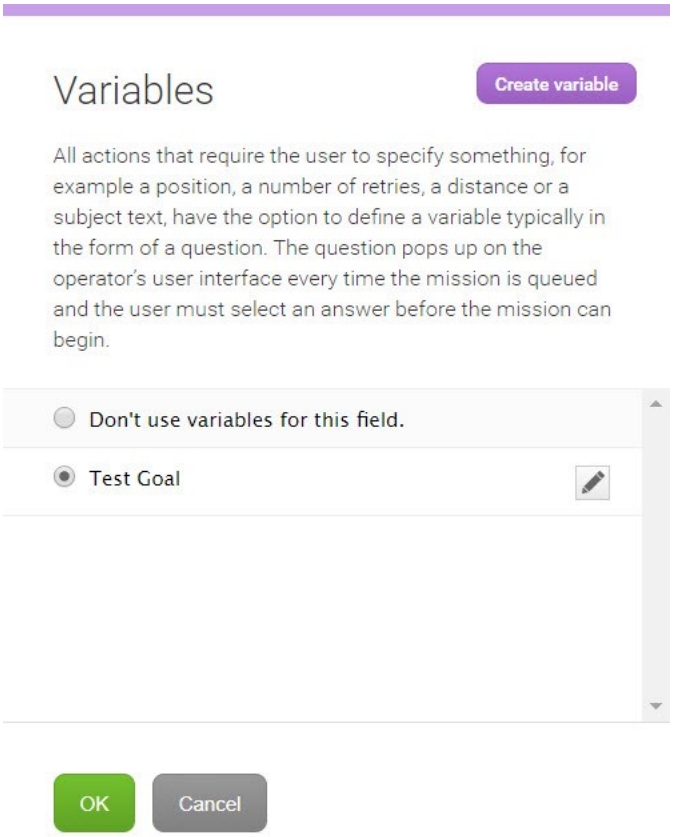


4.1.4. Mission actions

Actions used in missions are in the Groups tool bar at the top of the window.

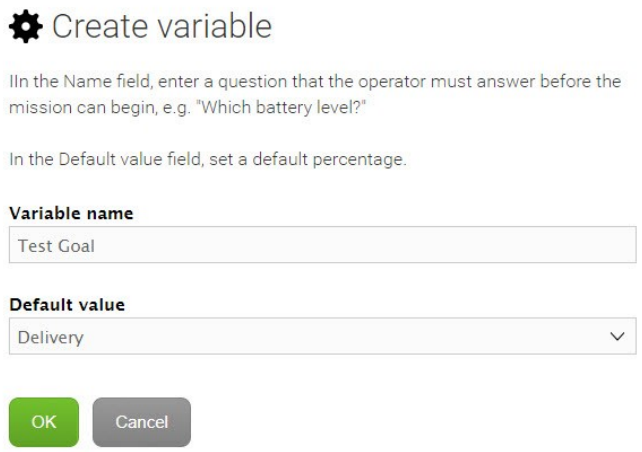
4.1.4.1. Variables

All actions that require the user to specify something, for example a position, a number of retries, a distance or a subject text, have the option to define a variable typically in the form of a question. The question pops up on the operator's user interface every time the mission is queued and the user must select an answer before the mission can begin.



4.1.4.2. Create variables

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.



4.1.4.3. Move

This group contains the following actions.

Adjust localization

An Adjust localization action adjusts the robot to the correct position in the map, for example if it has to move through an area with many dynamic obstacles where the localization is likely to drift.

Check position status

Positions of the following types can have states **free** or **occupied**:

- Robot position.
- Cart position.
- Shelf position.
- Pallet rack position.
- Staging position.

This action checks the state of the position for a given time. If the condition in the action is satisfied, the robot continues executing the mission. Otherwise the robot raises the error.
Example: Use this action for the following purposes:

- Check whether the load is on the pallet rack before docking to the rack.
- Check whether the cart is in position before picking it up with the hook.
- Check whether the target position is free.

Available fields:

Position

Select a position from the drop-down list, or select the XYZ icon to define a variable.

Option

Choose between checking for a position being empty or a occupied, or select the XYZ icon to define a variable

Timeout (seconds)

Enter the maximum time during which the robot checks the position status. If the position status does not match the option selected for this position (free, occupied, etc.) and the time expires, the robot shows an error.

Docking

A Docking action sets a position the robot should dock to, for example a charging station or a V, VL or L marker.

Available fields:

Marker

Select a marker from the drop-down list or select the XYZ icon to define a variable.

Move

A Move action defines a map position the robot should move to.

Available fields:

Position

Select a position from the drop-down list, or select the XYZ icon to define a variable.

Retries (Blocked Path)

Set the number of times the robot should try to reach the position if the path is blocked, or select the XYZ icon to define a variable. If, after the number of retries, the path is still blocked, the robot stops and produces an error message.

Distance threshold

Depending on how accurately the robot is required to position itself on the goal position, the threshold can be increased or decreased. The default is 0.1 m.

Move to entry position

Use this action to send the robot to an entry position. Entry positions are positions from which the robot can dock to markers, pick up carts, etc.

Available fields:

Position

Select a position from the drop-down list, or select the XYZ icon to define a variable.

Retries (Blocked Path)

Set the number of times the robot should try to reach the position if the path is blocked, or select the XYZ icon to define a variable. If, after the number of retries, the path is still blocked, the robot stops and produces an error message.

Distance threshold

Depending on how accurately the robot is required to position itself on the goal position, the threshold can be increased or decreased. The default is 0.1 m.

Entry Position

Select an entry position from the list, or select the XYZ icon to define a variable.

Move to coordinate

A Move to coordinate action defines a X, Y position on the map the robot should move to. The map's 0,0 position with 0 orientation were created in the moment the mapping started.

If in doubt of the map's 0,0 position and 0 orientation, you may create a fixed position with those values as a reference point for the Move to coordinate position you wish to create.

Available fields:

X

Enter the X (horizontal) map position the robot should move to, or select the XYZ icon to define a variable.

Y

Enter the Y (vertical) map position the robot should move to, or select the XYZ icon to define a variable.

Orientation

Enter the orientation in degrees, i.e. the way the robot should turn relatively to the 0-orientation when landing on the position, e.g. 5 for 5 degrees clockwise or -5 for 5 degrees counterclockwise, or select the XYZ icon to define a variable.

Retries (Blocked Path)

Set the number of times the robot should try to reach the position if the path is blocked, or select the XYZ icon to define a variable. If, after the number of retries, the path is still blocked, the robot stops and produces an error message.

Distance threshold

Depending on how accurately the robot is required to position itself on the goal position, the threshold can be increased or decreased. The default is 0.1 m.

Planner settings

A Planner settings action. The same changes can be made through Settings > Planner.

Available fields:

Planner settings

Planner settings contain three different action options: Desired speed, Path deviation and Path timeout.

Desired speed: Select the desired speed of the robot from the drop-down list. This adds flexibility to the control of the robot’s speed.

Path deviation: maximum distance that the robot is allowed to deviate from the path.

Path timeout: the amount of time where the robot keeps trying and will not deviate from the current path, e.g. if the path is blocked by an obstacle. A new path will not be created before the user set timeout has been reached.

Value

Change the desired speed of the robot (Default: 0.8, minimum: 0.1, maximum: 1.5 m/s).

Relative Move

A Relative move action is a move away from the robot's current position defined as an X-distance, a Y-distance and the final orientation. The X value is forwards/backwards (plus/minus) and the Y value is right/left (plus/minus). A relative move can be used for example to move the robot away from docking positions in narrow passages.

> **Note**
> When using a relative move, please be aware that the robot can move into forbidden zones and through walls in the map. The robot will still drive with collision detection and will not hit anything, but if there is a black line in the map and the wall does not exist in the real world, it will drive through it.

Available fields:

X

Enter a value in meters for how much the robot should move forwards or backwards from its current position, e.g. 1 for 1 meter forwards or -1 for 1 meter backwards, or select the XYZ icon to define a variable.

Y

Enter a value in meters for how much the robot should move to the left or right, e.g. 1 for 1 meter to the right or -1 for 1 meter to the left, or select the XYZ icon to define a variable.

Orientation

Enter a value in degrees for how much the robot should turn (yaw) when finalizing the relative move, e.g. 5 for 5 degrees clockwise or -5 for 5 degrees counterclockwise, or select the XYZ icon to define a variable.

Max Linear Speed

Enter a value in meters/second for the max. forward or backward speed during the relative move, or select the XYZ icon to define a variable.

Max Angular Speed

Enter a value in meters/second for the max. turn speed during the relative move, or select the XYZ icon to define a variable.

Collision Detection

Select the check box to set automatic collision detection to on. Collision detection may be turned off if the robot needs to turn around its own center in tight spaces, for example in an elevator. If collision detection is on, the robot will try to turn, but will go into emergency stop as soon as it detects the surrounding walls.

Set footprint

A Set footprint action makes it possible to change the robot's default footprint. This can be necessary, for example if the robot carries a top module with larger proportions than the robot's own or you want to extend the footprint when the robot tows a cart. The footprint is shown as a shadow around the robot on the map.

Available fields:

Footprint

Set the footprint, or select the XYZ icon to define a variable. Footprint values must be entered in meters and the format of the input should be [[x,y], [x,y], [x,y], [x,y]] defining coordinates from the center of the robot. If needed, e.g. when driving with carts, extra points may be added to the footprint. The default footprint sets a point in each corner of the robot: [[0.506,-0.32],[0.506,0.32],[-0.454,0.32],[-0.454,-0.32]]

Switch Map

A Switch map action is required if the robot needs to switch automatically from one map to another within a mission, for example if the robot is operating in a large site that includes more than one map. The maps must have overlapping areas where the robot can locate itself in the physical environment. Switch map actions are the basis for Transitions (Setup > Transitions) which handle map switches automatically once they are set up. The robot automatically chooses the start position when sent to a position in another map.

Available fields:

Entry Position

Select the position in the “to” map which the robot should start from after map transition, or select the XYZ icon to define a variable.

The Switch map action must be preceded by a move action to the position in the current map that physically overlaps the Goal position you select here. The overlap of the entry and goal positions in the physical area is important for the robot to localize itself in the new map.

4.1.4.4. Battery

This group contains the following actions.

Charging

A Charging action is used to make the robot go to a charging station for automatic battery recharge. The action is defined by setting a minimum charging time and a minimum charging percentage. When the first of those are reached, the action is completed. For example, if you set the minimum time to 30 minutes and the minimum percentage to 80%, the robot will charge for minimum 30 minutes or until it reaches a battery level of 80%. You may also choose to ignore either time or percentage.

A Charging action must be preceded by a Docking action where the robot moves to a previously defined charging position near the charging station.

Available fields:

Minimum Time

Set a minimum amount of time the robot should charge before it moves on, or select the XYZ icon to define a variable. The system will compare the set minimum time with the minimum percentage, and when the first of those two requirements is fulfilled, the mission continues.

You may skip defining a minimum time by selecting the Ignore value check box. The robot will then charge until the minimum battery percentage level is reached.

Minimum Percentage

Enter the minimum battery level the robot should charge to before it moves on, or select the XYZ icon to define a variable. The system will compare the set minimum percentage with the minimum time, and when the first of those two requirements is fulfilled, the mission continues. You may skip defining a minimum percentage by selecting the Ignore value check box. The robot will then charge until the minimum charge time is reached.

Charge until new mission in queue

Select this check box if you want the robot to continue charging until it receives a new mission. If selected, the robot stays in the charging station until it receives a new mission, but not until one or the other of the criteria for minimum time or minimum percentage is reached.

If deselected, the robot leaves the charging station when either of the two charging criteria are reached regardless of queued missions.

4.1.4.5. Logic

This group contains the following actions.

Break

A Break action is used to interrupt a loop action.

Continue

A Continue action is used to abort the rest of a loop action and continue from the start.

If

If actions make it possible to check battery level, number of pending missions, PLC registers or input from I/O modules and then define which actions or missions should be performed if the conditions return either true or false. You may use one or more actions or missions to define both True and False conditions.

Battery Percentage: An If action on battery percentage checks if the battery percentage is below, above or equal to a set limit and, depending on the result either sends the robot to a charging station or continues the mission. The True action could be a previously defined charging mission. The False action could be any alternative actions or missions, but may also be left blank. In that case, the robot will continue to the next step in the mission.

Pending missions: An if action on Pending missions checks if the number of pending (queued) missions is below, above or equal to a set number. You then set actions that define what the robot should do if the set condition returns True or False. An example could be to send the robot to a charging station if the number of queued missions exceeds a certain amount.

PLC Register: An If action on a PLC register checks if the register is set to a certain value, for example register 6=1 indicating that a lift is lowered when the robot arrives at a shelf. The True action (the lift is lowered) could then be a Wait for PLC Register action, for example wait for register 6 to reset to 0.

I/O input: An If action on an I/O input checks if the register is set to a certain value, for example register 6=1 indicating that a lift is lowered when the robot arrives at a shelf. The True action (the lift is lowered) could then be a Wait for PLC Register action, for example wait for register 6 to reset to 0.

Available fields:

Compare

Select either Battery Percentage, PLC Register, Pending Missions or I/O input, or select the XYZ icon to define a variable.

Module

Select an I/O module from the drop-down list, or select the XYZ icon to define a variable.

Index

For PLC registers: enter the required index number (Integer registers 1-100, Floating point registers 101-200), or select the XYZ icon to define a variable.

Operator

Select the arithmetic operator you want to use, or select the XYZ icon to define a variable.

Operators are arithmetic operators used to specify the compare mission, e.g. use the < operator to specify “If Battery percentage is below 50 percent”.

The available operators are:
== ‘equal to’
!= ‘not equal to’
> ‘greater than’
>= ‘greater than or equal to’
< ‘lesser than’
>= ‘lesser than or equal to’.

Value

Enter the value for the selected register, or select the XYZ icon to define a variable.

Loop

A Loop action makes it possible to have the robot repeat a mission either a specified number of times or ‘endlessly’ (until stopped by an operator). Drag actions or predefined missions into the loop action to define the sequence of actions the robot will repeat. A loop can be interrupted with a Break action.

Available fields:

Iterations

Set the number of times, the robot should run the loop, or select the XYZ icon to define a variable.

Content

Pause

A Pause action pauses the mission execution until an operator presses the Continue button.

This can be used in missions where the robot should wait for an operator to do something, for example placing items on the robot and manually sending the robot on to another position by pressing the Continue button.

Prompt User

A Prompt user action can be used when it is required to stop and ask the operator what the next step in the mission should be. The action consists of a Yes action, a No action and a Time-out action. The operator will be asked, for example, “Do you want to go to position X?”. If the operator answers Yes, the robot will go to position X. If the operator answers No, the robot will carry on to the defined No action, for example move to an alternative position. If the operator does not answer yes or no within a given time, the Time-out action will be executed, for example sending an email.

Available fields:

Question

Write a question which can be answered with a yes or a no, or select the XYZ icon to define a variable. The operator will be asked to answer yes or no to the question, and if the answer is no, the robot will carry on with the No action.

User group

Select which User group the mission is intended for or select the XYZ icon to define a variable.

Timeout (seconds)

Set a timeout for when the robot should continue if the user does not answer the question. If the timeout is reached, the robot will execute the actions in the Timeout scope.

Timeout (seconds)

Return

A Return action is used to abort a mission. It can be used, for example as catch action in a Try/Catch action.

Wait

A Wait action pauses the mission in a given period of time.

Available fields:

Time

Set an amount of time the robot should wait before moving to next action in the mission.

While

While actions make it possible to check battery level, number of pending missions, PLC registers or input from I/O modules and then define which actions or missions should be performed if the conditions return either true or false. You may use one or more actions or missions to define the “while” conditions.

Battery Percentage: A While action on battery percentage checks if the battery percentage is below or above a set limit and, depending on the result, either sends the robot to a charging station or continues the mission.

PLC Register: A While action on a PLC register checks if the register is set to a certain value, for example register 6=1 indicating that a lift is lowered when the robot arrives at a shelf.

Pending missions: A While actions on Pending missions checks if the number of pending (queued) missions is below, above or equal to the set number. You then set an action that defines what the robot should do if the set condition returns True. An example could be to send the robot to a charging station if the number queued missions exceeds a certain amount.

I/O input: A While action on an I/O input checks if the register is set to a certain value, for example register 6=1 indicating that a lift is lowered when the robot arrives at a shelf. The True action (the lift is lowered) could then be a Wait for PLC Register action, for example wait for register 6 to reset to 0.

Available fields:

Compare

Select either Battery Percentage, PLC Register, Pending Missions or I/O input, or select the XYZ icon to define a variable.

Module

Select an I/O module from the drop-down list, or select the XYZ icon to define a variable.

Index

For PLC registers: enter the required index number (Integer registers 1-100, Floating point registers 101-200), or select the XYZ icon to define a variable.

Operator

Select the arithmetic operator you want to use, or select the XYZ icon to define a variable.

Operators are arithmetic operators used to specify the compare mission, e.g. use the < operator to specify “If Battery percentage is below 50 percent”.

The available operators are:
== ‘equal to’
!= ‘not equal to’
> ‘greater than’
>= ‘greater than or equal to’
< ‘lesser than’
>= ‘lesser than or equal to’.

Value

Enter the value for the selected register, or select the XYZ icon to define a variable.

4.1.4.6. Error handling

This group contains the following actions.

Create Log

A Create log action is used to create user generated error logs. A Create log action can be generated as an error log (Monitoring > Error logs) under the module name User, showing the description entered here. This is useful in for example a try/catch action where a log is created when catching an unsuccessful try.

Available fields:

Description

Enter a description for the log type you want to create, or select the XYZ icon to define a variable. An example of a description could be “Mission x fail log”

Throw Error

A Throw error action is used to enter an error message that will be shown in the user interface when the mission is run.

Available fields:

Message

Enter the message you want displayed on the user interface when the mission is run, or select the XYZ icon to define a variable.

Try/Catch

A Try/Catch action is a way to reinforce missions by defining an alternative action if the first choice action fails. This will in many cases prevent a mission from discontinuing in case, for example a position is blocked. A Try/Catch action consists of one action Try which the robot should attempt to complete, and a second action Catch which is used in case the first one fails.

Available fields:

Try

Catch

4.1.4.7. Sound/Light

This group contains the following actions.

Show Light

A show light action sets a light that the robot will show at a given point in the mission. The action is a combination of light effect, speed, color and intensity.

Available fields:

Effect

Select a light effect from the drop-down list, e.g. 'Blink', or select the XYZ icon to define a variable.

Speed

Select a fast or slow speed from the drop-down list, or select the XYZ icon to define a variable.

Color 1

Select a color from the drop-down list, or select the XYZ icon to define a variable. If you select two different colors for Color 1 and 2, the robot will alternate between the two.

Color 2

Select a color from the drop-down list, or select the XYZ icon to define a variable. If you select two different colors for Color 1 and 2, the robot will alternate between the two.

Intensity

Set the intensity of the light, or select the XYZ icon to define a variable. The intensity is defined as a percentage where 100 is full intensity.

Timeout (seconds)

Set an amount of time the light should show, or select the XYZ icon to define a variable.

Play sound

A Play sound action sets a sound, for example a beep, a horn or a voice message that the robot will play at a given stage in the mission or for the whole duration of the mission. There is a selection of standard sound bites to choose from, or you can upload own sounds to the robot in the section Setup > Sounds.

Available fields:

Sound

Select a sound from the list, or select the XYZ icon to define a variable.

If you want to hear the sounds before selecting one, go to Setup > Sounds. You can hear the sounds on your computer by selecting the headset symbol.

Volume

Set the volume of the sound (0-100), or select the XYZ icon to define a variable. 100% is approximately 80 dB.

Mode

Select how the sound should be used in the mission:

Full length plays the sound from start to finish, starting at the point in the mission where it is inserted and ending when the sound file finishes.

Loop keeps repeating the sound file until the mission is completed.

Custom length plays the sound for the duration of time you set in the Duration window. If the set duration exceeds the duration of the sound file itself, the sound file will loop for the duration of the set time.
You can insert a Stop sound action anywhere in the mission. This will stop the playing of the current sound no matter which mode you have selected.

Duration

Set an amount of time the sound should play, or select the XYZ icon to define a variable.

Stop sound

Stop playing the current sound.

4.1.4.8. PLC

This group contains the following actions.

Set PLC register

A Set PLC register action is used to set a value in a register. The register can be set in three ways: Set: sets a value every time the mission is executed. Add: adds a value every time the mission is executed. Subtract: subtracts a value every time the mission is executed.

Available fields:

Register

Select a specific PLC register, or select the XYZ icon to define a variable. Registers 1 to 100 are reserved for integers and registers from 101-199 for floating point numbers.

Action

Select an action from the dropdown list, or select the XYZ icon to define a variable. The options are Set, Add and Subtract.

Value

Enter a value for the selected register, or select the XYZ icon to define a variable. If the selected register is between 1 and 100, the value must be an integer. If the selected value is between 101 and 200, the value must be a floating point number.

Wait for PLC register

A Wait for PLC register action is used to wait for a value and continue to the next action when the value is found in the set register.

Available fields:

Register

Select a specific PLC register, or select the XYZ icon to define a variable. Registers 1 to 100 are reserved for integers and registers from 101-199 for floating point numbers.

Value

Enter a value for the selected register, or select the XYZ icon to define a variable. If the selected register is between 1 and 100, the value must be an integer. If the selected value is between 101 and 200, the value must be a floating point number.

Timeout (seconds)

Define how long the robot should wait for the value in the set register before giving an error.

4.1.4.9. Email address

This group contains the following actions.

Send email

A Send email action is used to send email messages to selected recipients as part of a mission, for example to let an operator know that it has arrived at a specific location. Recipients must be set up in the Users section (Setup > Users) with an email address. Furthermore, an email account must be set up in the robot (System > Settings > Email configuration).

Available fields:

Recipient

Select a recipient from the drop-down list, or select the XYZ icon to define a variable. The recipients on the list come from the Users section.

Subject

Type a subject of the email, or select the XYZ icon to define a variable.

Message

Write the message that the robot should send to the selected email address when the mission is executed, or select the XYZ icon to define a variable.

4.1.4.10. I/O module

This group contains the following actions.

Connect Bluetooth

A Connect Bluetooth action is used when the robot must connect and stay connected to a Bluetooth module.

Available fields:

Module

Select a Bluetooth module from the drop-down list, or select the XYZ icon to define a variable. Bluetooth modules are set up in the Bluetooth relays section (Setup > Bluetooth relays).

Disconnect Bluetooth

A Disconnect Bluetooth action is used when the robot must close the connection to a Bluetooth module.

Set output

I/O action is used when the robot needs to send a command to an I/O module.

Available fields:

Module

Select an I/O module from the drop-down list, or select the XYZ icon to define a variable. I/O modules are set up in the section Setup > I/O modules.

Output

Enter which output port relay should be activated (1-4) , or select the XYZ icon to define a variable.

Operation

Set operation to On or Off, or select the XYZ icon to define a variable. For example: Select On if the I/O module is used to open a door.

Timeout (seconds)

Set an amount of time the relay should stay on, or select the XYZ icon to define a variable.

Wait for input

Wait for input action is used when the robot needs to wait for an I/O module to respond.

Available fields:

Module

Select an I/O module from the drop-down list, or select the XYZ icon to define a variable. I/O modules are set up in the section Setup > I/O modules.

Input

Enter the input port number or select the XYZ icon to define a variable.

Value

Set operation to On or Off, or select the XYZ icon to define a variable. For example: Select Off if the Wait for input action is used to stop a conveyor belt.

Timeout (seconds)

Define how long the robot should wait for the input to match the state set in Value before giving an error.

4.1.4.11. Cart

This group contains the following actions.

Pick up cart

Go to a position and pick up a cart.

Available fields:

Position

Select a position from the drop-down list, or select the XYZ icon to define a variable.

Cart

Select either a specific cart or “Any valid cart” from the drop-down list, if a specific cart is chosen and another cart is at the position the action will produce an error.

Place cart

Place the cart currently attached to the robot at a specific position.

Available fields:

Position

Select a position from the drop-down list, or select the XYZ icon to define a variable.

Release cart

Choose whether or not to release the cart after arriving at the position.

Reverse into place

You can choose to allow the robot to reverse into place. “Yes, with collision check” means that the robot will scan the area and check for obstacles before moving the cart to the drop-off position. "Yes, without collision check" means that the robot will move the cart into place without scanning for obstacles. This can be necessary when the robot docks into alignment fixtures.

4.1.4.12. Shelf

This group contains the following actions.

Pick up shelf

Go to a position and pick up a shelf.

Available fields:

Position

Select a position from the drop-down list, or select the XYZ icon to define a variable.

Shelf type

Select the type of shelf to pick up, or select the XYZ icon to define a variable.

Final movement

Select which movement to perform after picking up the shelf, “Auto” will choose either forward or backwards depending on whether or not there is room for the robot, “None” means no movement after picking up the shelf.

Place shelf

Place the shelf currently attached to the robot at a specific position.

Available fields:

Position

Select a position from the drop-down list, or select the XYZ icon to define a variable.

Final movement

Select which movement to perform after dropping off the shelf, “Auto” will choose either forward or backwards depending on whether or not there is room for the robot, “None” means no movement after dropping off the shelf.

4.1.4.13. UR

This group contains the following actions.

Run UR program

A Run UR program action is used to communicate with a Universal Robots application. The action starts a .urp file saved on the Universal robot. The program name is [program name].urp. Leave out .urp when you type the name. The MiR robot will continue until the given UR program has been executed.

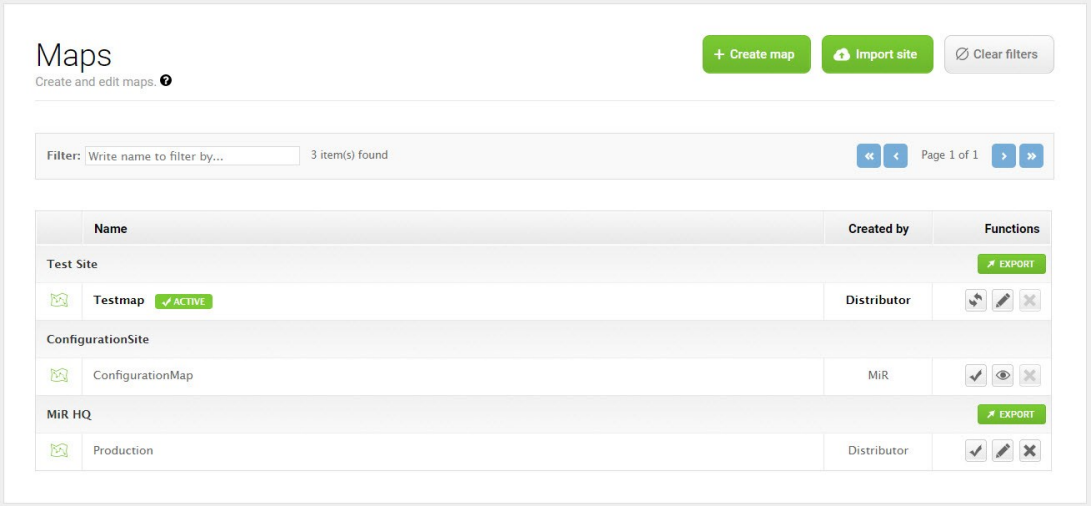
Available fields:

Program name

Enter the name of the UR program (without the urp extension), or select the XYZ icon to define a variable.

4.2. Maps

In the Maps section, you create or edit the maps the robots use to navigate by. All maps must belong to a site, which is the overall container for one or more maps used in the same facility. A site may, for example, have one map per floor or one per section of a large production hall. The important thing is that the maps are contained in the same site for the robot to be able to move from one map to another.



4.2.1. Import and export sites

A site can be exported and imported into other robots.

A site contains the following information:

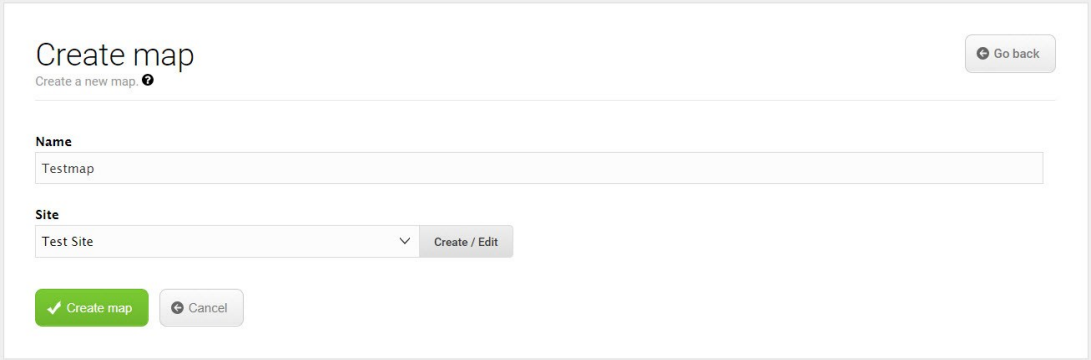
- Maps
- Users and User groups
- Added map features: positions, markers, walls, floors and all types of zones
- Paths
- I/O modules
- User-created sounds
- Carts, cart types and calibrations
- Shelf types
- Missions and Mission groups
- Dashboards
- Path guides

To export a site, simply click on the **Export site** button next to the site you want to export. The exported file is named [Site name]_[Robot name]_[SW version]_[Date].site

To import a site, click the **Import site** button and select the site file.

4.2.2. Create map

To create a map, first enter a name for the map and select the site, the map should belong to. When you press the Create map button, you are directed to the map draw and edit section where you find the tools to draw the map and add various features.



Name

Enter a name that describes the map.

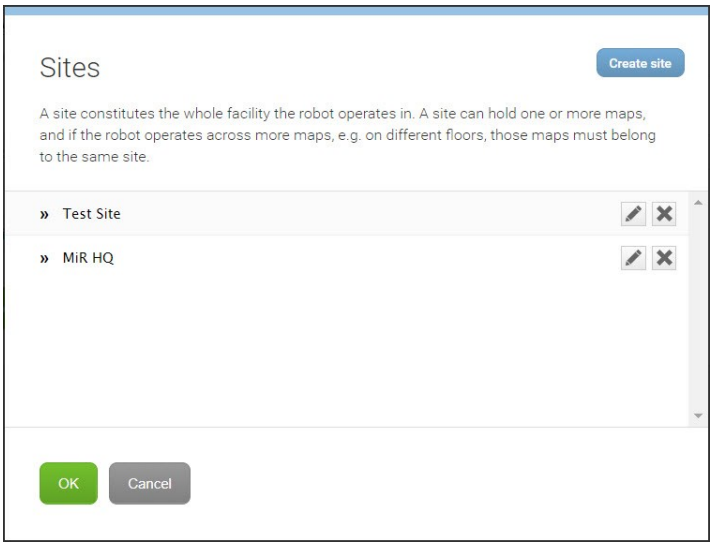
The name is used to identify a certain area of the site.

One way of naming maps is to select names that relate to the area of the map, e.g. Ground floor or Hall A.

Site

Select which site the map should be part of or click Create/Edit to create a new or edit the name of an existing site.

A site is the whole facility where the robot operates. A site can hold one or more maps, and if the robot operates across more maps, e.g. on different floors, those maps must belong to the same site.



Click **Create site** to create a new site. Name the site and click **OK**.

Click **Create map** to save the map.

4.2.3. Mapping tools

The built-in mapping functionality makes it possible to draw a map by manually driving the robot around the facility using the joystick while the robot uses the laser sensors to map the area.

Two mapping methods

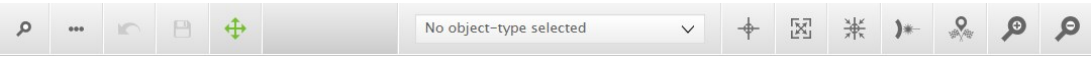
Recording of maps can be done using two different mapping methods: Hector (default) and Cartographer (new). Hector is the traditional method that records and compiles data in one map during the mapping. Cartographer is a newer method that records multiple smaller maps and then compiles those into one map after the recording session.

The tools used are the same for both methods, and when you start mapping you'll not be able to see which method is activated. However, to obtain the best result, there are different mapping patterns recommended for the two mapping methods.

- Hector: Mapping in a branch pattern, while going back over your own tracks several times.
- Cartographer: Mapping in a circular pattern and closing loops.

To change between the two mapping methods, go to System > Settings > Mapping.

The map editing tools are all found on the icon tool bar, and the drop-down list contains all the features you can add to your map. Different tools are displayed on the icon toolbar depending on which feature you have selected from the drop-down list.



When mapping, you can follow the mapping status in the top tool-bar.

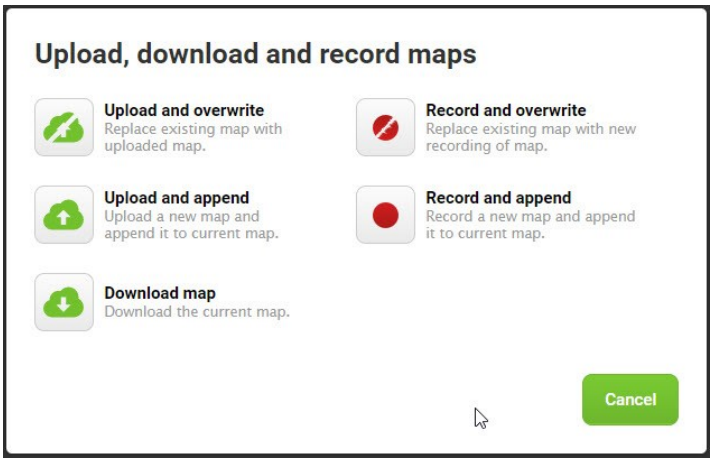
Mapping tools

Press the 3-dots icon to open the Upload, download and record map dialog. This toolbar has options for recording a new map or uploading/downloading existing ones.

You may upload a map from your computer in PNG format. For example, if CAD drawings of the facility are available, it is possible to use those instead of mapping the area with the robot, but you can also upload maps previously created with the robot and downloaded to your PC.

> **Note**
> When you download a map, only the recorded map data are saved, i.e. any added features such as positions and zones are not saved with the map file. If you want to save a map including all details, you should export the whole site to which the map belongs.

The Upload, download and record maps dialog has the following options.



- **Upload and overwrite**
  The Upload and overwrite option erases the existing map and replaces it with the map you upload.
- **Upload and append**
  The Upload and append option adds the uploaded map to the existing one.
- **Download map**
  The Download map option saves the map to your PC as a PNG file.
- **Record and overwrite**
  The Record and overwrite option erases the existing map and replaces it with the map you record.
- **Record and append**
  The Record and append option adds the recorded map to the existing one.

4.2.4. Recording a map

Press the red Record and overwrite or Record and append button to start the mapping engine. If you select Record and overwrite, you will be asked if you want to overwrite current data.

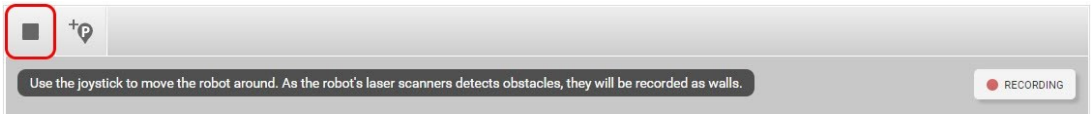
A blinking icon indicates that the recording has started, and you can now activate the joystick and start moving the robot around the area.

> **Note**
> The joystick switches to medium speed when used during mapping. This ensures better coverage of the mapped area.

As the robot moves, the laser scanners will detect physical obstacles, and those will be recorded in the map as walls. In the editing afterwards, you can remove all obstacles that should not stay on the map, e.g. carts or boxes that were present at the time of recording but will not stay permanently.

During mapping, you may add positions based on the current position of the robot. If necessary, the positions can be edited after the mapping is finished.

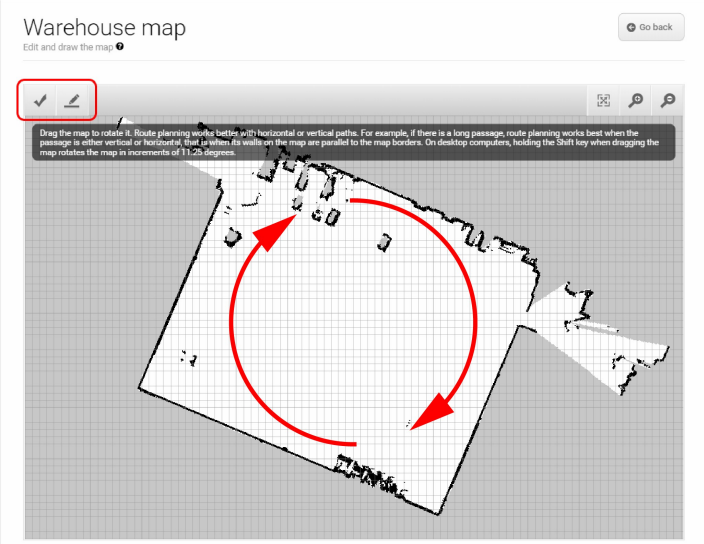
To stop the mapping engine, press the square icon in the upper left-hand side corner or the recording window.



After the mapping engine stops, you can rotate the map and align it using the grid.

Drag the map to rotate it. Route planning works better with horizontal or vertical paths. For example, if there is a long passage, route planning works best when the passage is either vertical or horizontal, that is when its walls on the map are parallel to the map borders.

On desktop computers, holding the **Shift** key when dragging the map rotates the map in increments of 11.25 degrees.



When you have finished the editing, press the check mark in the upper left-hand side corner to save the map. You'll be asked if you want to activate the new map. If you do this, you'll be able to see the robot in the map and may create positions using the robot's live-view.

> **Note**
> The grid and the rotation feature will only be present this one time.

4.2.5. Editing a map

When the map recording is done, complete the map by removing unwanted “noise”, adding virtual walls, preferred or unpreferred drive zones, positions and much more to get a reliable map that allows the robots to maneuver smoothly and efficiently in the area.

Left-hand side tool bar

The left-hand side tool bar has the basic tools for saving, undoing and navigating in the map you are working on. Furthermore, different tools appear on the tool bar depending on which map layer you select from the Object types drop-down list. These are presented on the following pages.

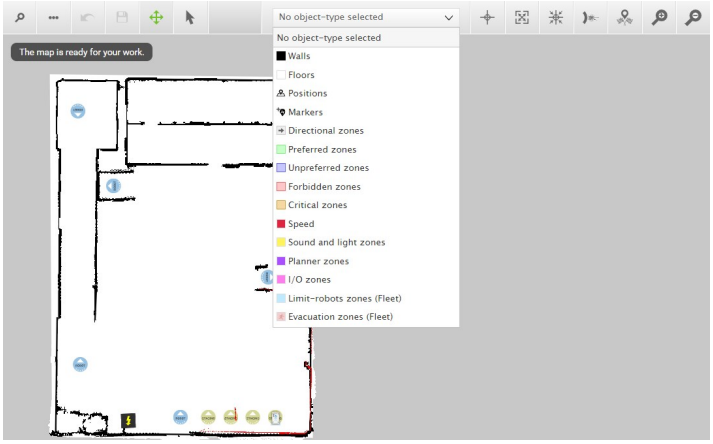
The toolbar contains the following elements:

- **Find position**
  Select the magnifying glass to search for a position on the map.

- **Download, upload and record map**
  Click to upload, download and record maps.
- **Undo icon**
  Press one or more times to undo your last operation(s). While you are drawing a shape or line in the map, the Undo tool is not available. But as soon as you finish by clicking the check mark, you can undo the whole shape or line.
- **Save icon**
  Click to save the changes to the map. For the changes to take effect, you'll need to reload the map.
- **Navigate icon**
  Click to view the map with all added details, and drag to move the view.

Select object

From the list, select which part of the map you want to edit. Walls and Floors lets you remove unwanted objects and add nice straight lines to create a more legible map. The other objects define where and how the robot should move, or not move



Right-hand side tool bar

The right-hand side tool bar has tools for controlling the map view and synchronizing the robot's position with the map view.

- **Send robot to target**
  Click to move the robot to any map location. Can be used if you want to move the robot to spot without having to create a position.
- **Show the whole map**
  Click to zoom out to view the whole map.
- **Keep robot in center**
  Click to view the robot in the center of the window. Otherwise the map is centered.

- **Adjust robot position**
  Click one or more times to adjust the robot in the map.When the red lines showing the scanner's live view align with the map lines (e.g. walls), the robot is adjusted. It may be necessary to first set the start position (see below).
- **Set robot's start position**
  When you activate a map, the robot's actual position in the physical environment must be synchronized with the map. This is done by trying to align the robot's live sensors (shown as red flickering lines) with the black lines of the map. Click somewhere on the map that matches the robot's physical location as much as possible, and rotate the robot icon to turn the robot correctly, then click the Adjust robot position icon a couple of times until the lines overlap. Setting the start position might require a couple of retries.
- **Zoom in**
  Zoom in on the map.
- **Zoom out**
  Zoom out on the map.

4.2.6. Object types

4.2.6.1. Walls

When mapping, physical objects detected by the scanners are recorded as "walls" in the system. Apart from real walls, these objects could also be shelves, chairs, tables and even people passing by. Some of these recordings are regarded as "noise" and will, if they are not removed, potentially send the robot on unnecessary detours during its path planning. It is therefore recommended to remove the objects that are not permanent.

Use the Eraser or the Erase by selection-tool to remove unwanted obstacles from the map. Use the Draw new line tool to add new walls to the map, and replace the coarse pixelated lines. The tool works by adding lines between each point you add to the map. Click the check mark when the line is done.

Use the Select shape or line tool to change an added object. You can add extra points or move the existing ones to change the shape. To erase a whole shape, select the Erase shape or line-tool and click on a shape to delete it.

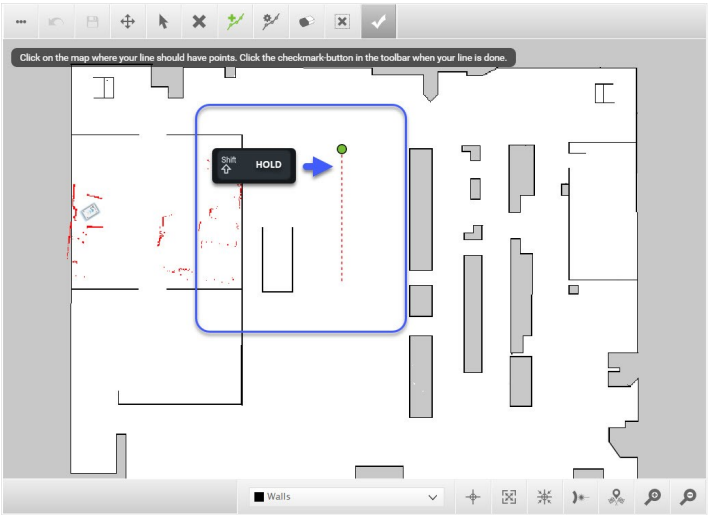
4.2.6.2. Floors

When mapping, the floor is created automatically. You can use the Floor tool to touch up the existing floor, for example if the mapped floor contains gray areas, which the robot is not able to pass. You may also add a whole new floor on top of the existing one

Use the Eraser or the Erase by selection-tool to remove unwanted areas of the floor from the map.Use the Draw a new shape tool to add new a new floor or patch up the exiting one. The tool works by filling the area between each point you add to the map with gray color. You may add as many points as needed and drag to move them in the map. Click the check mark when the shape is done. The gray shape will be converted to white indicating that it represents floor.

Use the Select shape or line tool to change an added object. You can add extra points or drag the existing ones to change the shape. To erase a whole shape, select the Erase shape or line tool and click on a shape to delete it.

Hold down the shift key while drawing a line or an area if you want straight lines.



4.2.6.3. Positions

Positions are defined as X-Y coordinates in the map and are used as part of missions.

Positions are used either as destination positions or as via positions on a route. To define a position, select the Position tool, click somewhere on the map and rotate the icon until the arrow points in the direction you want the robot to orient to when landing. In the dialog window that opens, it is then possible to adjust the position and the orientation manually or click the Use robot position button to use the current position of the robot.

If two or more positions of the same kind overlap, it is easy to select underlying ones by clicking and selecting the position from a list.

> **Note**
> The Use robot position button is available only if you are editing the currently active map.

Optional positions:

- Hook positions for picking up and dropping off carts become available if a hook is applied.
- Shelf positions for picking up and placing shelves become available if a shelf lift is applied.
- Staging positions used as waiting positions become available when the robot is part of a fleet.

> **Note**
> Hook, Shelf or Fleet must be enabled in the Features section under System > Settings before the positions can be viewed.

4.2.6.4. Markers

Markers: Markers are position types used by the robot to dock to physical V, VL or L shaped objects. Markers are used for example to make the robot dock to a conveyor belt or a charging station. To define a marker, first place the robot either facing front or rear to the V, VL or L marker, depending on how you want it to dock to the marker. For Charging station markers, the robot must always be placed facing front. When you select the Marker tool, the

quickest way to set the position is to use the Detect marker button. If the robot can detect the marker, the position, offset and orientation fields will automatically fill. Otherwise move the robot a bit closer, and try again. The values can be adjusted manually afterwards if required.

> **Note**
> The Detect marker button is available only if you are editing the currently active map.

You can see and edit the entry position of a marker by clicking on the marker and selecting Show entry position (s). The entry position stays visible until you click again and select Hide entry position(s).

4.2.6.5. Directional zones

Directional zones let you organize the motion of robots by specifying the directions in which the robots can move in specific zones. When you create a directional zone, you specify its direction, and the map shows the direction with arrows drawn on the zone.

When a robot is in a directional zone, the following rules apply to the motion of the robot:

- The robot is not allowed to move in the direction opposite to the direction of the arrow.
- The robot can move perpendicular to the direction of the arrow or at any angle less than 90°to the arrow.

There are two types of directional zones: directional shape and directional line. A directional shape is a shape on the map with a direction defined. The direction on a shape can have any value from 0° to 360° with an increment of 45°.

A directional line is a line with a direction defined. The direction of a line is from one of its ends to the other end.

To work with directional zones: In the map editor, in the drop-down menu, select Directional zones.

Creating a directional shape

To create a directional shape:

- In the toolbar, click Draw a new shape and create a shape by placing points on the map.
- To specify the direction of the zone: In the toolbar, click Select the direction of a directional zone. The Select direction dialog appears. Click a direction to select it and close the dialog.
- Click the check mark to finish editing the zone.

Creating a directional line

To create a directional line:

- In the toolbar, click Draw a new line and create a line by placing points on the map.
- Click Line settings to change the width of the line. Use one of the presets or enter a custom width. Click Close when done.
- Click the check mark to finish editing the line.

To reverse the direction of a line, select a line and click Reverse direction in the toolbar.

Directional zones in combination with forbidden and unpreferred zones let you organize efficient robot traffic.

One-way lanes

When a robot moves in a long corridor, it places itself in the middle of the corridor. If there is another robot going in the opposite direction, the two robots may block each other's way. A way to solve this issue is to create a configuration for robots with two lanes and a lane separator, similar to a street with two lanes and a solid (or dashed) white line. The following steps describe how to create such configuration using directional zones:

- Create a thin forbidden zone in the middle of the corridor parallel to the corridor walls. This is the lane separator.
- Create directional zones on both sides of the forbidden zone. Make the directions of the zones opposite.

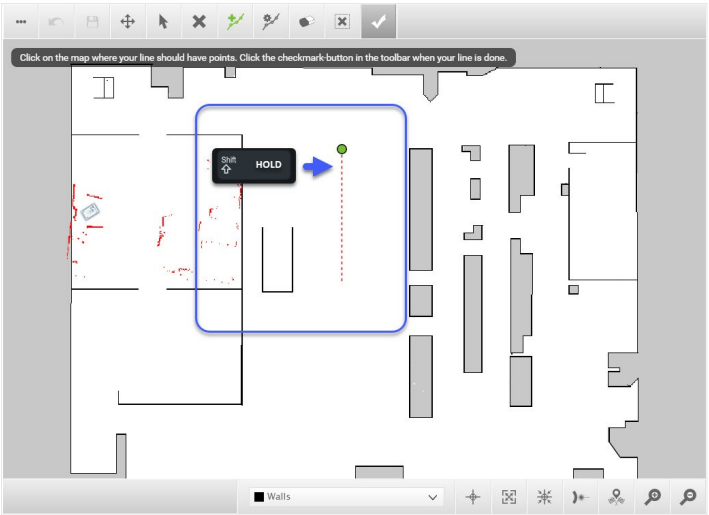
With such a configuration, robots going in the opposite directions use different lanes and do not get in each other's way. Replacing the forbidden zone with an unpreferred zone gives robots more space for maneuvers.

4.2.6.6. Preferred, Unpreferred, Forbidden and Critical zones

Zones are actions that are automatically triggered when a robot enters the area in which one of these actions apply. The zones apply both when the robot operates autonomously and when it is in driven in manual mode. It is possible to create overlapping zones so that multiple events have affect at the same time, e.g. blinking and slowing down the speed of the robot when it drives in a certain zone.

Each zone has its own color in the map. To add a zone, select it on the drop-down list, then select the shape or line tool on the icon bar and draw the shape or line where you want it on the map.

Hold down the shift key while drawing a line or an area if you want straight lines.



Select the check mark on the tool bar to finish the shape or line. To edit or remove a shape or line, select the type, e.g. Preferred zones, on the drop-down list. Then, to edit, select the Select shape or line tool and select object to edit. You can change a shape or line by pulling the points, add extra points or change the thickness of a line. To add extra points, first click on an existing point, then click where you want to add the point and pull to change the shape if needed. To delete a line or shape, select the Erase shape or line tool and select the object to delete.

Preferred, Unpreferred, Forbidden and Critical zones are drive zones that are used to control the robot's global planner when it calculates paths between positions

Preferred zones

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

Unpreferred zones

The robot tries to avoid an unpreferred zone but may go into it if there are no other possibilities.

Forbidden zones

The robot never enters a forbidden zone.

Critical zones

The sensors are turned off, allowing the robot for example to move through a narrow doorway without entering emergency stop. As soon as the robot leaves the zone, the sensors are turned on again.

4.2.6.7. Zone settings

Zone settings allow the user to customize a certain zone to their needs. One or more actions can be set. While the robot is in the zone, it will perform the actions. When the robot leaves the zone, it will go back to the default settings.

The following zones have zone settings.

4.2.6.8. Speed zones

The robot slows down or increases its speed when driving in the zone. Slowing down may be used if driving in a zone with many people, and speeding may be used to traverse a zone free of people and obstacles quickly.

Zone settings

- Speed zones
  The desired default speed of the robot. The value can be changed here, by a mission actions or a REST call. (Default: 0.8, minimum: 0.1, maximum: 1.5 m/s)

4.2.6.9. Sound and light zones

The robot can play a sound and/or blink when driving in the zone. May be used to warn people about the presence of the robot.

Zone settings

- Light
  A show light action sets a light that the robot will show at a given point in the mission. The action is a combination of light effect, speed, color and intensity.
- Sound
  A Play sound action sets a sound, for example a beep, a horn or a voice message that the robot will play at a given stage in the mission or for the whole duration of the mission. There is a selection of standard sound bites to choose from, or you can upload own sounds to the robot in the section Setup > Sounds.

4.2.6.10. Planner zones

The robot can turn off the laser scanners and localize with encoders, decrease the field of view to run smoothly in populated areas, optimize the time and distance of paths and ignore obstacles.

Zone settings

- No-localization
  The robot turns off the laser scanners and uses encoders only to localize. Useful for special driving like ramps.
- Look-ahead
  Decreases the robot's field of view to help it run smoothly in populated areas.
- Path deviation
  Maximum allowed distance that the robot can deviate from the path. Default is 0,5. Minimum is 0. Maximum is 3.
- Path timeout
  The amount of time the robot keeps trying and will not deviate from the current path, if the path is blocked by an obstacle. A new path will not be created before the timeout has been reached.
- Ignore obstacles
  The robot detects all obstacles with the 3D camera, but they are ignored with this action. This is useful if you experience problems with the robot stopping in front of windows because of sunlight.

4.2.6.11. I/O module zones

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

Zone settings

- I/O module
  I/O modules (Bluetooth and WISE) are used for receiving and giving input and output to be able to communicate with e.g. doors, elevators, pallet lifts etc.
- PLC registers
  A Set PLC register action is used to set a value in a register. The register can be set in three ways: Set: sets a value every time the mission is executed. Add: adds a value every time the mission is executed. Subtract: subtracts a value every time the mission is executed.

4.2.6.12. Limit-robots zones (Fleet)

Applies only when robots are controlled by MiRFleet. Only one robot at a time may enter the zone. Used to keep a zone clear of other robots, for example in areas where MiRHook robots unload and pick up carts.

Zone settings

- Limit-robots
  Limit the number of robots driving in the same zone. Used to keep a zone clear of other robots, for example in areas where MiRHooks unload and pick up carts.

4.2.6.13. Evacuation zones (Fleet)

Evacuation zones make it possible to evacuate all robots in case of an emergency situation.

One or more evacuation zones can be marked up on the map and will appear on a list under **Evacuation zones**. It is possible to evacuate one certain zone or all zones at once.

Select **Evacuate all zones** to evacuate all zones (in the top bar or under Evacuation zones) or select **Evacuate** next to a specific evacuation zone to evacuate that zone. All robots will leave the selected evacuation zones and go to the nearest evacuation positions.

To give the all clear when the emergency is over, remove the ticks from the boxes from one or more zones under **Evacuated**. When the all clear has been given, the robot(s) will wait at their Evacuation position(s) for new missions.

Evacuation zones should only be used in case of an emergency as all missions are discontinued.

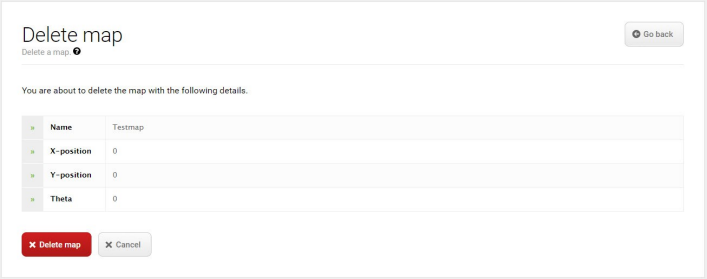
Note: There must be at least one evacuation position per robot when Evacuation zones are applied.

Zone settings

- Evacuation zones
  Evacuation zones make it possible to evacuate all robots in case of an emergency situation.

4.2.7. Delete map

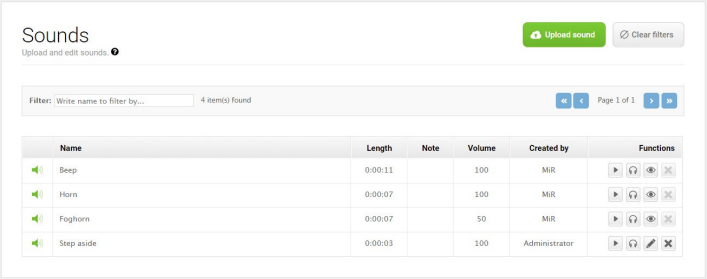
You can delete maps that are created by you or another member of the user group you belong to.



4.3. Sounds

In the Sounds menu, you can upload new sounds to the robot or edit the volume and length of the sounds.

Sounds are used in missions and can be used as alerts: “Please step aside” or to attract peoples attention for example when the robot has arrived at a position.



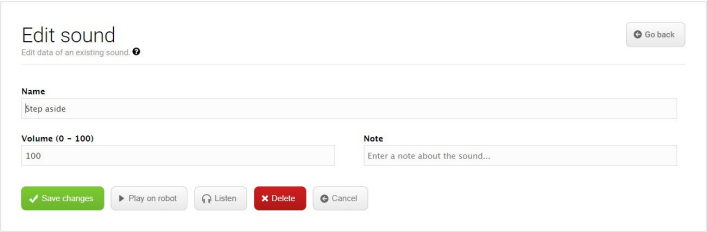
4.3.1. Edit sound

You may rename any of the user added sounds on the robot and adjust the volume.

Press the Play on robot button to listen to the sound on the robot itself.

Press the Listen button to listen to the sound on your computer.

Note: The volume can only be checked by playing the sound on the robot itself.



The **Edit sound** dialog contains the following fields:

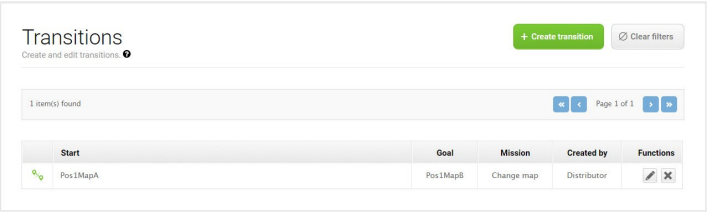
- **Name**
  You may change the names of user uploaded sounds. The names of the standard system sounds cannot be changed.
- **Volume (0-100)**
  The maximum of 100 is approximately 80 dB.
- **Note**
  You can write a small note about the selected sound (optional).
- **Delete**
  You can delete user uploaded sounds from the robot.
- Select **Save changes** to save the settings.

4.4. Transitions

Transitions are used to handle changeovers from one map to another within the same site. Map transitions are used, for example where two adjoining production halls have separate maps.

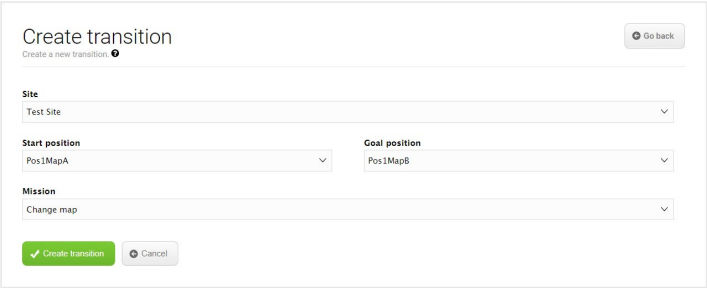
A transition entry consists of two robot positions, a start and a goal position, one in each map at a physical point where the two maps overlap. Furthermore, it requires pre-defined missions including Switch map actions. Going from map A to map B and from map B to map A requires two different missions.

Once the transition is set up in the user interface, the robot handles switches from one map to another automatically. You just set up your mission as you would in a single map-environment, and the system will include the switch positions, the switch map mission and the transition action invisibly. The transition is visible only in the way that the robot stops for a short while at the switch positions while positioning itself in the new map.



4.4.1. Create transition

To create a transition, select a start position and a goal position in two different maps at a point where the maps overlap. The positions must have been predefined as Robot positions in the two maps.



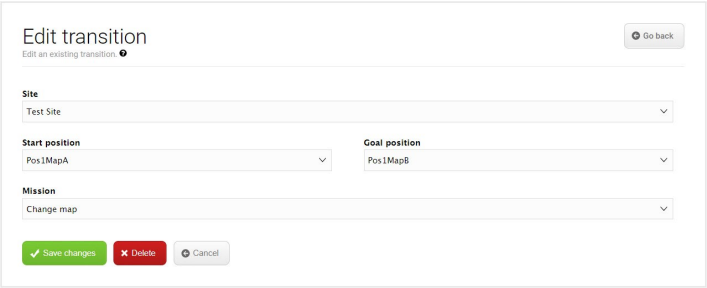
The **Create transition** dialog contains the following fields:

- **Site**
  Select the site in which the two maps are represented.
  Both maps must be part of the same site for a map transition to be possible.
- **Start position**
  Select the start position of the transition.
  The start position must be of the type Robot position and have been created in advance in a place where the two maps overlap. Start and goal positions must be placed on the exact same spot physically but named differently, for example "Map A_posA" and "MapB_posA" to indicate the relation between the two.
- **Goal position**
  Select the goal position of the transition.
  The goal position must be of the type Robot position and have been created in advance in a place where the two maps overlap. Start and goal positions must be placed on the exact same spot physically but named differently, for example "Map A_posA" and "MapB_posA" to indicate the relation between the two.
- **Mission**
  Select a mission that includes a switch map action.
  The switch map mission must have been created in advance and include two Switch map actions: the first switch map action must include the "from" map and the defined Start position, and the second one must include the "to" map and the defined Goal position.

Select **Create transition** to save the settings.

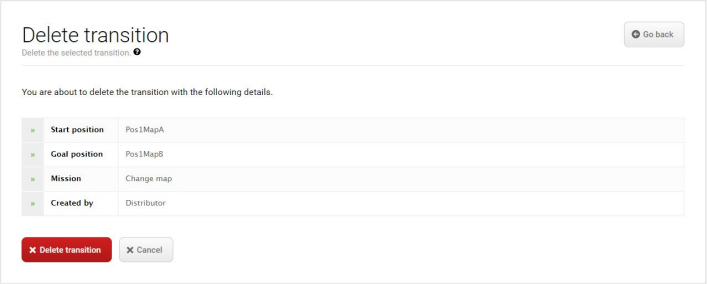
4.4.2. Edit transitions

To edit a transition you must select a start position and a goal position in two different maps at a point where the maps overlap. The positions must have been predefined as Robot positions in the two maps.



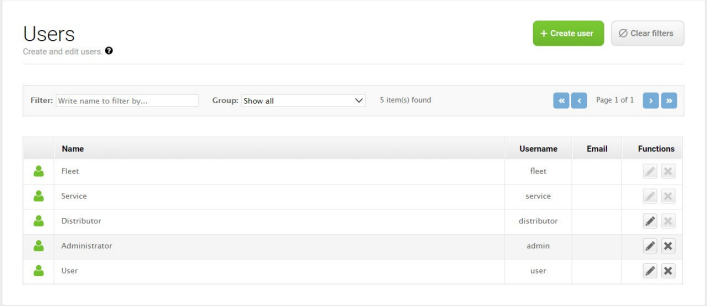
4.4.3. Delete transitions

You can delete transitions that are created by you or another member of the user group you belong to.
If you delete a transition, the start and goal positions, and attached mission are deleted as well.



4.5. Users

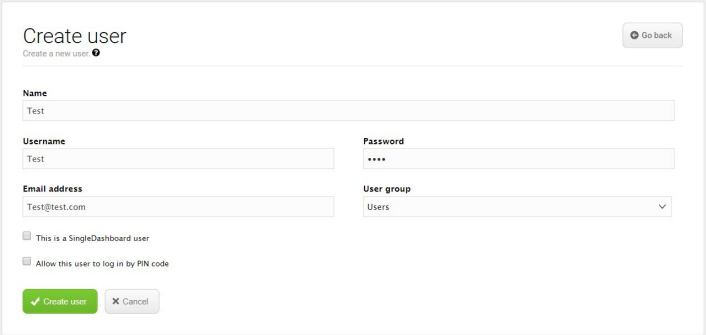
All users of the robot - from daily operators to system administrators - must have a user profile in the system.
Users are administered in the Users section where you set up, edit and delete system users.



4.5.1. Create user

In Create Users you set up new users by entering master data such as name, email, login credentials and access rights. Access rights are given by associating each user with a User group that delimits which sections of the user interface the user has access to.

Note: User groups should be defined prior to setting up Users.



The Create user dialog has the following fields:

- **Name**
  Enter the name of the user, e.g John Smith.

  The name is shown in the upper right-hand corner of the web interface when the user is logged in and is not to be confused with the Username.
- **Username**
  Enter the name that the user should use to log in to the system, e.g. John.
- **Password**
  Enter a password that the user should use to log in to the system. Passwords are case sensitive.

  Users can change their own password when logged in by selecting their login name in the upper right-hand corner of the window and changing the password in the window that pops up.
- **Email address**
  Enter the user's email address.

  Email addresses can be used as part of a mission, for example to notify a user about a completed mission.
  See Create mission (Setup > Missions > Create Mission).
- **User group**
  Select a user group for the user. Each user must be attached to a pre-defined user group. The user group specifies which parts of the system the user has access to.

  User group permissions are defined for each system command or feature and are granted as read-only or write permissions.

- **SingleDashboard user**
  Select the check box if the user's only task is to control the robot(s) from a dashboard, for example if the user's task is to start missions from a tablet attached to a top module.

  Single dashboard users do not have access to any other parts of the user interface.

  Select a dashboard for the SingleDashboard user.

  When the SingleDashboard user logs in, the selected dashboard will be the one that's available to this user.
- **PIN code**
  Select the check box if the user is allowed to enter the system using a PIN code.

  Enter a 4-digit PIN code.

  Each PIN code user must have a unique code.

Select **Create user** to save the settings.

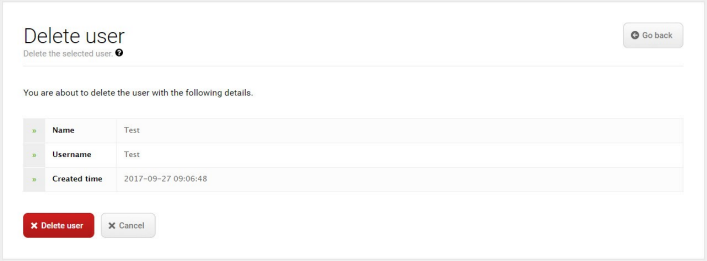
4.5.2. Edit user

In Edit user you can change the settings of a user's profile.

Any of the settings can be changed, except for the password. If a user wants to change password, he or she can select the login name in the upper right-hand corner of the window and changing the password in the window that pops up.

4.5.3. Delete user

When you select Delete user, only the user's master data as shown below disappear. All possible settings and updates made in the system by the user in question stay unchanged.



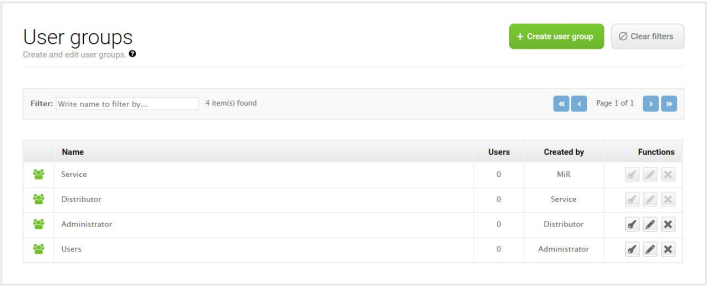
4.6. User groups

The User groups section, is used to create user groups and assign permissions to each group.

A user group defines which sections of the user interface users have access to and whether the access rights should involve viewing only or give full write access. To edit permissions for a group, click the key icon next to the name of the user group to open the User group permissions section.

The MiR user interface comes with a number of default user groups:
- Distributors have full read/write access to the user interface and can administer the permissions of the Administrators and Users groups.
- Administrators per default have full read/write access to the user interface and can administer the permissions of the Users group.
- Users per default have access to view the whole user interface and permission to create and edit dashboards. Users with write access to the User groups section, e.g. Administrators may also create additional user groups.

Related items: When setting up users in the Users section, each user must be assigned to a user group.

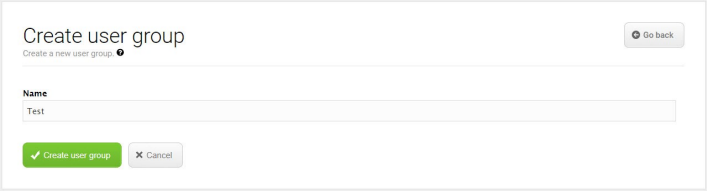


4.6.1. Create user group

Fill out the name field to create a new user group.

Besides the default user groups, you can create as many additional user groups as needed. The number of user groups needed depends on how many different tasks and permission levels are required. Several users carrying out the same tasks can belong to the same user group.

You can give permissions to all sections of the user interface that you have access to.



- **Name**
  The name must be unique and is used to identify the group of users it represents.One way of naming user groups is to select names that characterize the tasks of the users in the particular group. For example, a group of users operating the robot by starting and queing missions could be named Operators.

Select **Create user group** to save the settings.

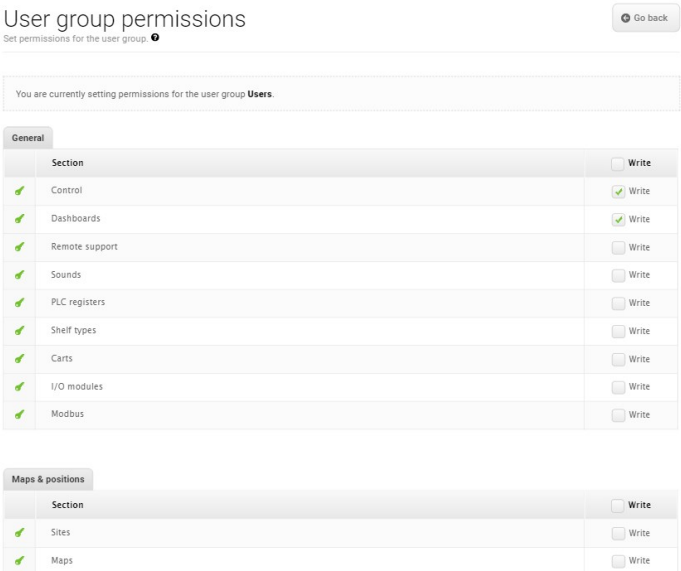
User group permissions

Permissions can be given to all parts of the system that are available to the user group, the creator belongs to.

> **Note**
> It is not possible to edit user group permissions for your own user group, but only for other user groups administered by your user group.

Select which sections of the system the user group should have access to. User group permissions are divided into groups of related items, e.g. Maps and positions, and you can select a whole group or individual items in a group.

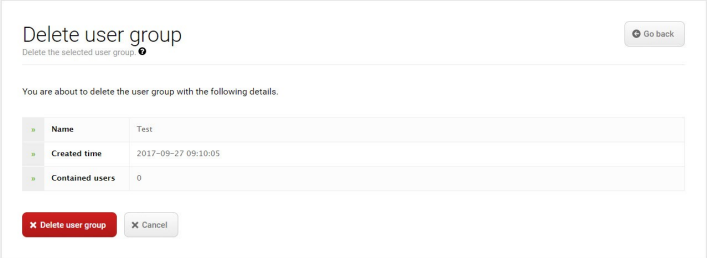
The user group will have access to all the items you select for the group. All other items will be visible but not editable to the users of the group.



4.6.2. Delete user group

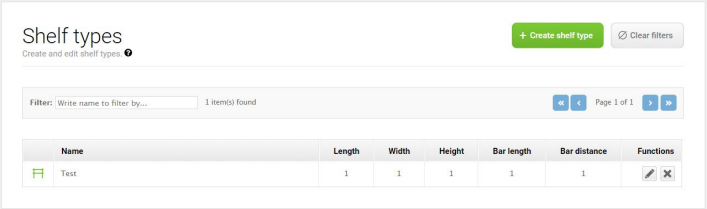
A User group can be deleted by users that belong to the group which created the group. When you delete a user group, all users belonging to that group will be deleted as well.

If you want to keep one or more users of the group you are about to delete, then go to the Users section and associate those users with a different user group.



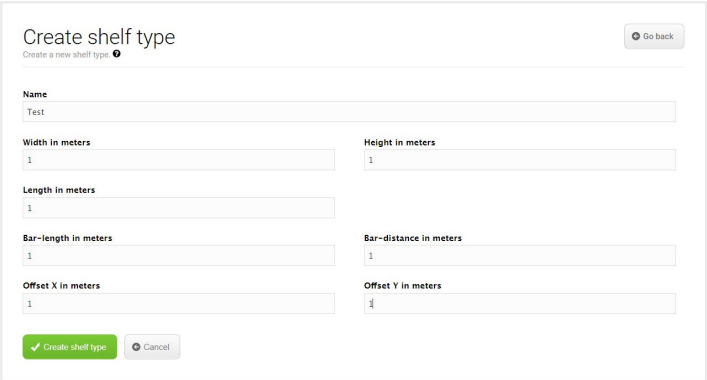
4.7. Shelf types

To set up the robot for lifting, moving and placing shelves or tables, shelf types - unique names and dimensions - must be set up in the robot interface. This will enable the robot to dock and undock correctly, and to plan routes taking the shelf size into account.



4.7.1. Create shelf type

To create a shelf type, you must enter the dimensions of the shelf plus two offsets (X and Y) which the robot uses to fine-adjust its position when docking under the shelf.

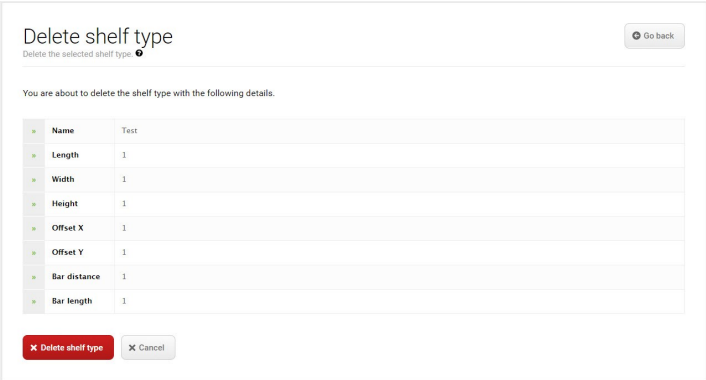


- **Name**
  Enter a name for the shelf or table.
  The shelf name must be unique and is used to identify the shelf type.Shelf types are used in missions when shelf actions are defined.
- **Width in meters**
  Enter the width of the shelf in meters with up to two decimals.
  The value must represent the outer width of the shelf.Maximum width is 1.2 m (47”).
- **Height in meters**
  Enter the height of the shelf in meters with up to two decimals.
  The value must represent the height from floor to the lower edge of the shelf.Minimum and Maximum heights depend on the lifting device.
- **Length in meters**
  Enter the length of the shelf in meters with up to two decimals.
  The value must represent the outer length of the shelf.Maximum length is 1.2 m (47”)
- **Bar-length in meters**
  Enter the length or the two side bars in meters with up to two decimals.
  The entered value must represent the length of one side bar.Minimum length is 0.5 m (20”)Maximum length is 0.7 m (28”)
- **Offset x in meters**
  Enter an X-offset in meters with up to two decimals.
  An X-offset is used to fine-tune the robot’s position when docking under the shelf.Minimum offset value is 0.
- **Offset y in meters**
  Enter a Y-offset in meters with up to two decimals.
  A Y-offset is used to fine-tune the robot’s position when docking under the shelf.Minimum offset value is 0.

Select **Create shelf type** to save the settings.

4.7.2. Delete shelf type

You can delete shelf types that are created by you or another member of the user group you belong to.

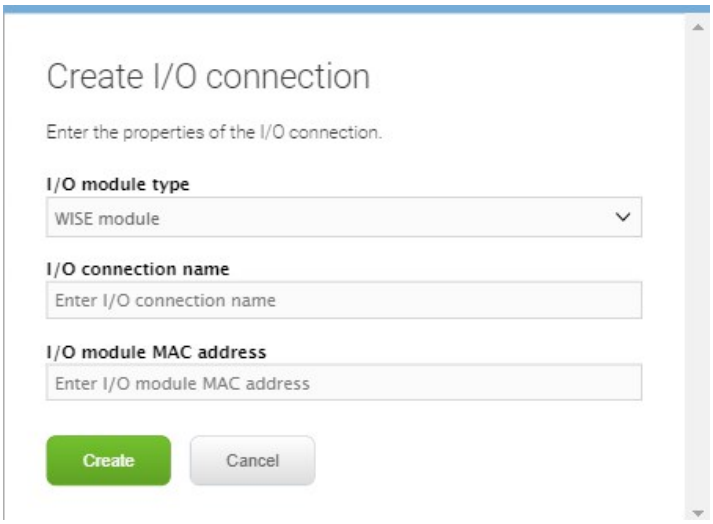


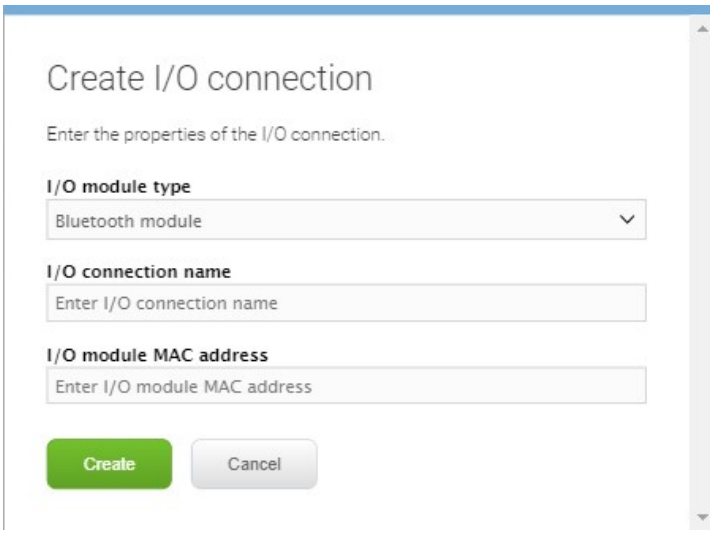
4.8. I/O modules

I/O modules (Bluetooth and WISE) are used for receiving and giving input and output to be able to communicate with e.g. doors, pallet lifts etc. WISE modules work in the range of 0-3. Bluetooth modules work in the range of 1-4.

4.8.1. Create I/O connection

To create an I/O connection, you must choose an I/O module type (Bluetooth or WISE) and enter a name and an IP address.

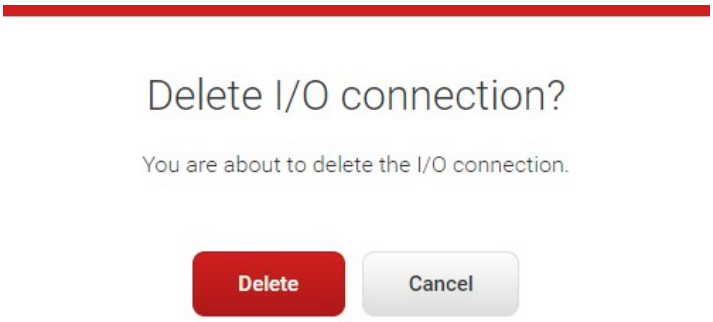




Select **Create** to save the settings.

4.8.2. Delete I/O connection

You can delete I/O modules that are created by you or another member of the user group you belong to.



4.9. Paths

Paths are saved routes between two positions.

The first time the robot runs the route between two positions, the calculated path is saved and used every time the robot runs the same route, thereby saving time for route calculation. A path is automatically recalculated only in the event that one of its positions is modified.

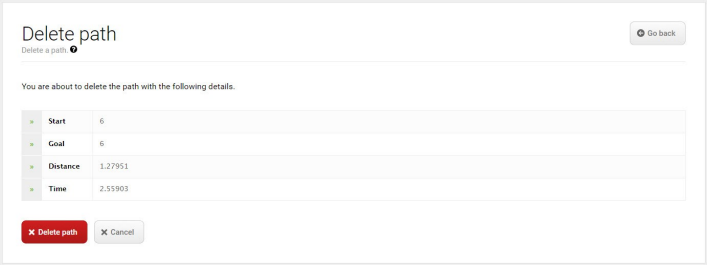
If you find that an automatically calculated path is unnecessarily long, for example if the robot had to go around a dynamic obstacle at the time it was created, you may delete it, and the robot will then calculate a new path the next time it runs between those two positions.

Paths can also be created manually by drawing Preferred zones in the Maps section. To do this, you must first delete any automatically created paths between the affected positions before the preferred zone will take effect.

- **View a path**
  The path is shown as a dotted line between two positions on the map. The view can be used to check if calculated paths look appropriate.

4.9.1. Delete path

Paths may be deleted if you want the robot to recalculate the route between two positions or if you have manually created a preferred path on the map.



4.10. Path guides

A path guide makes it possible to define paths that the robot(s) should follow between two positions. Path guides can be very useful in locations where you want the robot to follow a certain path for example along a wall. In environments where multiple robots operate, an obvious application of path guides would be to create right-hand

drive paths where two robots can pass each other without stopping to recalculate each time they meet. This is done by creating one path guide going from A to B and another one in the opposite lane going from B to A.

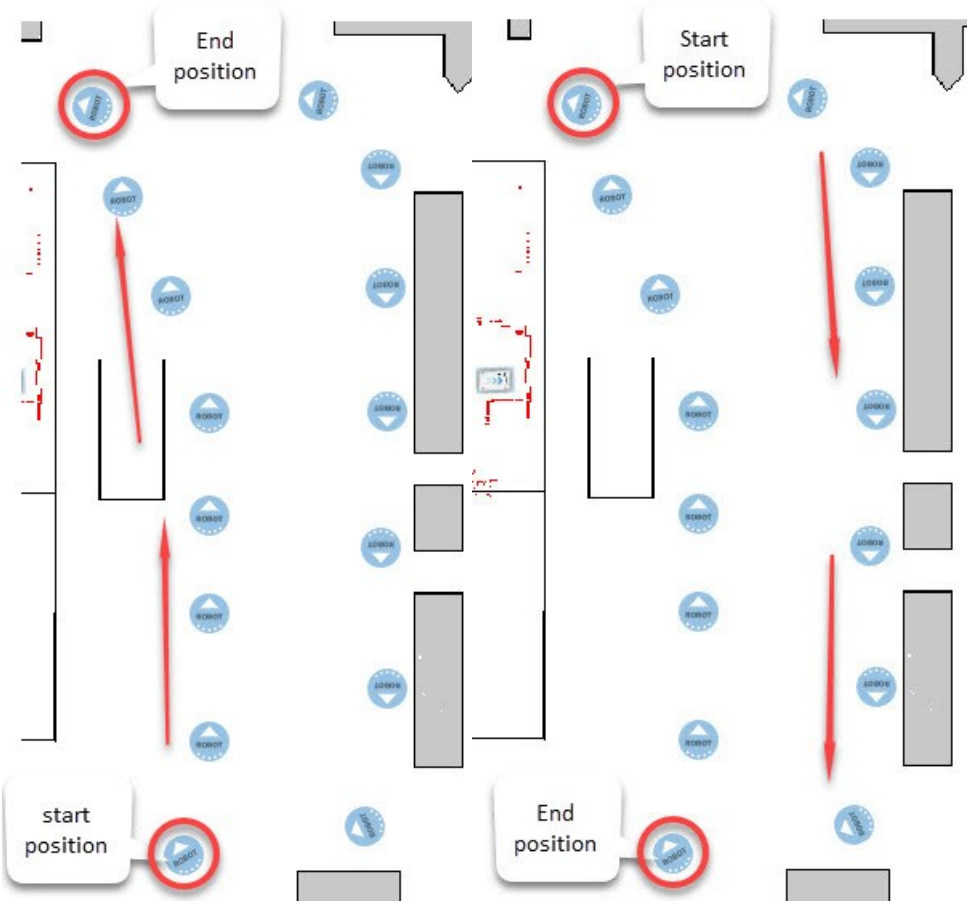
To create a path guide, you must first create a number of robot positions, waypoints, on the map. The positions must be placed on the path in succession, for example with a distance of 3-5 meters and they must be oriented in the driving direction.

When the positions are made, you create the path guide. A path guide consists of one or more start positions, one or more goal positions and a number of waypoints in between. You may use the same path to go between more start and goal positions.

Note! When you set up missions that include positions used as start and end positions, the robot will automatically use the path guide.

Two examples

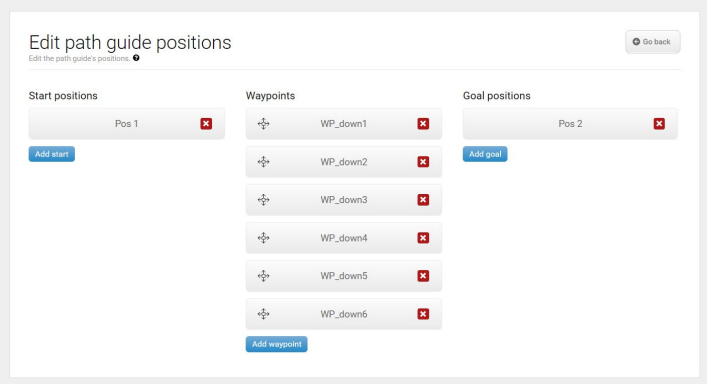
The two examples below illustrate how robots avoid planning around each other every time they pass each other while crossing the production hall.



Path guide 1 forces the robot to follow one lane going south to north, and Path guide 2 forces the robot to follow another lane going north to south. The same two positions are used for start and end positions but reversed in the two path guides.

4.10.1. Create a path guide

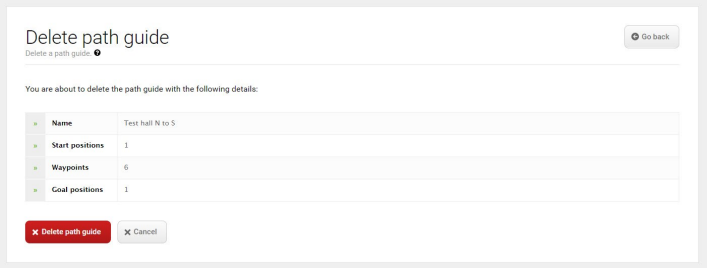
To create a path guide, first enter a name for the path guide and select the map it should belong to. When you press the Create path guide button, you are directed to the section where you select start and goal positions as well as the waypoints that make up the path guide between them.



- **Add start**
  Select one or more start positions for this path guide.
- **Add waypoint**
  Select the waypoints created for this path guide.
  Note! The waypoints must have been created pointing in the driving direction.
- **Add goal**
  Select one or more end positions for this path guide.

4.10.2. Delete path guide

You can delete path guides that are created by you or another member of the user group you belong to.



5. Monitoring

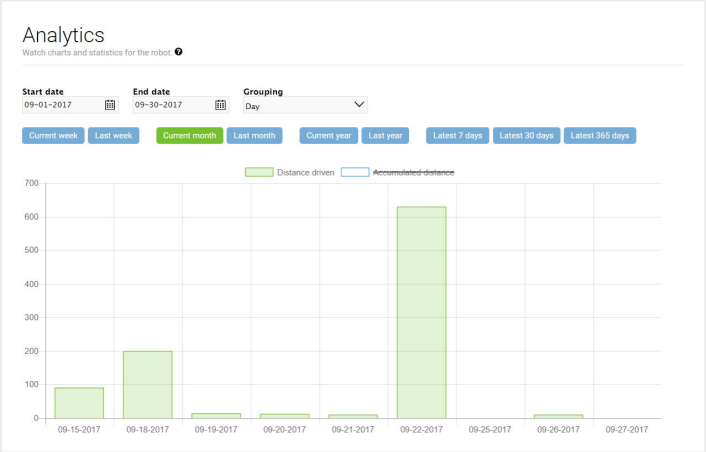
This section describes the items in the Monitoring menu.

The Monitoring menu contains the following items:

5.1. Analytics

Analytics gives a graphic overview of the robot's driven distance over a specified period of time.

You can select a period either by specifying a fixed start and end date or by clicking on one of the buttons spanning from current week to the last 365 days. In addition, you can choose whether to see a chart per day or per month, and you can see a graph showing the accumulated distance for the selected time period in addition to the default bar graph view.

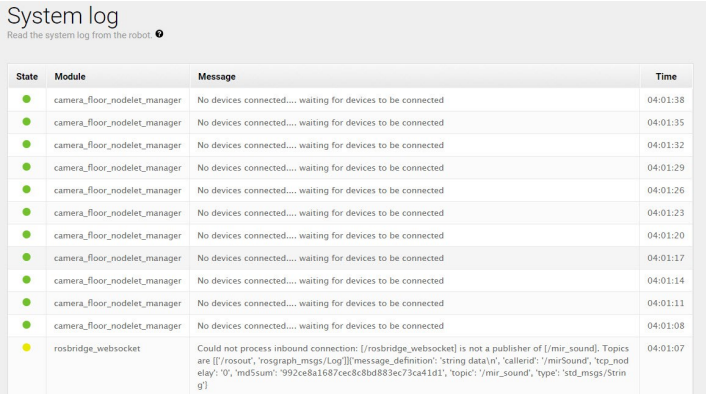


- **Start date**
  Select the first day of the period you want to see.
- **End date**
  Select the last day of the period you want to see.
- **Grouping**
  Select per Day or Month to set how you want to view the graph.

5.2. System log

The system log contains events that are logged by the operating system components. The system log contains information about system state at a given time (shown by color-codes), the affected module, a short explanation and a time stamp.

The system log is mainly used by system supporters for troubleshooting.


System log
Read the system log from the robot.

State	Module	Message	Time
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:38
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:35
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:32
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:29
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:26
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:23
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:20
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:17
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:14
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:11
	camera_floor_nodelet_manager	No devices connected.... waiting for devices to be connected	04:01:08
	rosbridge_websocket	Could not process inbound connection: [/rosbridge_websocket] is not a publisher of [/mir_sound]. Topics are [['/rosout', 'rosgraph_msgs/Log']]{'message_definition': 'string data\n', 'callerid': '/mirSound', 'tcp_nodelay': '0', 'md5sum': '992ce8a1687cec8c8bd883ec73ca41d1', 'topic': '/mir_sound', 'type': 'std_msgs/String'}	04:01:07

The System log table has the following columns:

- **State**
  State is a visual color-indication of the system state at the time of logging.
- **Module**
  Module indicates in which module the logged event has taken place.
- **Message**
  The message is a short description of the logged event.
- **Time**
  The time the event was recorded; hh:mm:ss.

5.3. Error logs

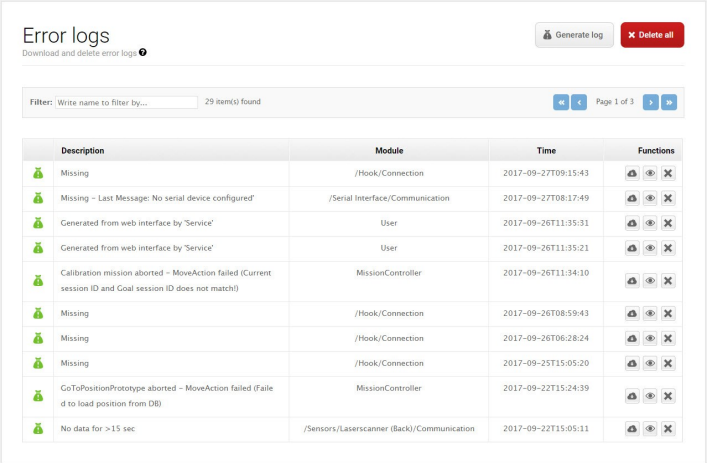
The error log is a list of all detected system errors. Each entry is shown with a description, an indication of which module is affected and the time when the error occurred.

When further examination of a log entry is required, it can be downloaded in an encrypted file format and sent to MiR Support. Each file contains detailed information plus a recording of the last 30 seconds of robot action(s) before the error occurred.

It is also possible to create a user generated log with a recording of the last 30 seconds of the robot's actions.

Click the Generate log button to record the last 30 seconds of the robot's actions.

Click Delete all to delete the entire error log.



The Error logs table has the following columns:

- **Description**
  A short description of the logged event.
- **Module**
  Shows which of the robot's modules has caused the error, e.g. /Hook/Connection.
- **Time**
  Shows the exact time the error occurred.
- **Download**
  Click the Download icon to download the log entry in an encrypted file format.

- **Delete error log**
  Log entries can be deleted individually by clicking the x-icon next to the selected entry.

5.4. Hardware health

The Hardware health section allows you to check the condition of the robot's hardware components such as motor controllers, lasers scanners and cameras.

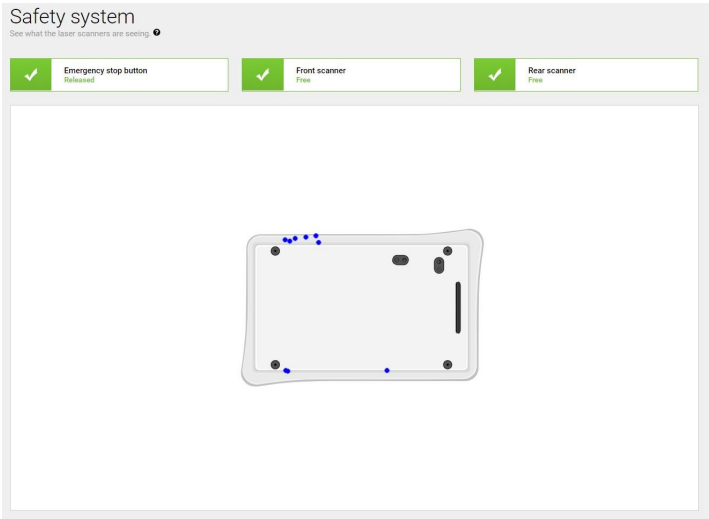
The components are grouped under Computer, Motors, Power system, Safety system and Sensors, and if the Modbus feature is enabled, a Modbus group will be added as well. If all sub components are OK, the group will be marked with a green dot and OK whereas if one or more components in a group are not in perfect condition, the group will be marked with a yellow or red dot and read Warning or Error.

To find out more about the condition, you can expand the group by clicking the arrow next to the group name and see which components are not functioning correctly and why. Each sub component can be further expanded into one or more sub parts for further information on the condition.

5.5. Safety system

Safety system provides a live view of the input from the laser scanners and the state of the emergency stop button.

The purpose of the feature is mainly to be able to check if the robot has stopped unexpectedly due to a physical obstacle, or if someone has manually engaged the emergency stop button.



Emergency stop

Released (green) indicates that the emergency stop button is not engaged.

Activated (red) indicates that the button has been manually engaged.

Front scanner

Free (green) indicates that the laser scanner is not seeing any obstacles.

Blocked (red) indicates that a physical obstacle is blocking the scanner.

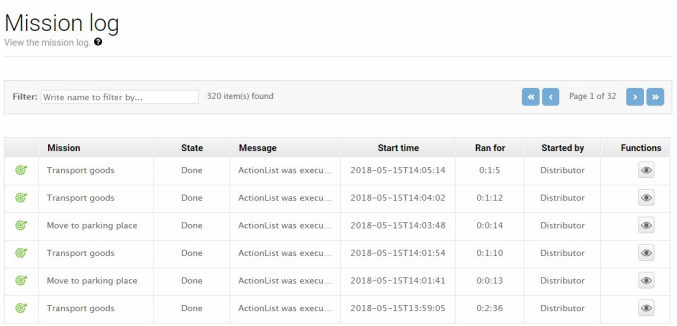
Rear scanner

Free (green) indicates that the laser scanner is not seeing any obstacles.

Blocked (red) indicates that a physical obstacle is blocking the scanner.

5.6. Mission log

The mission log contains the list of all missions that the robot has executed and the mission that is running now. Click the eye icon in the Functions column to see the list of actions executed in a particular mission.

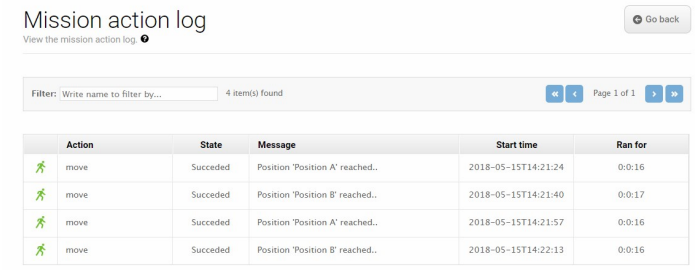


The mission log contains the following columns:

- **Mission**
  The name of the mission.
- **State**
  The current state of the mission.
- **Message**
  A service message associated with the mission.
- **Start time**
  The start time of the mission.
- **Ran for**
  The duration of the mission.
- **Started by**
  The user or service that put the mission into queue.
- **Functions**
  The icons in this column let you view the action log for a particular mission.
  Entering a text string in the Filter field shows the missions where either the mission name or the state contains the entered string.
  Clicking the eye icon in the Functions column opens the Mission action log for a certain mission.

5.6.1. Mission action log

The mission action log contains the list of actions that the robot has executed within the selected mission, and the action that the robot is executing now.

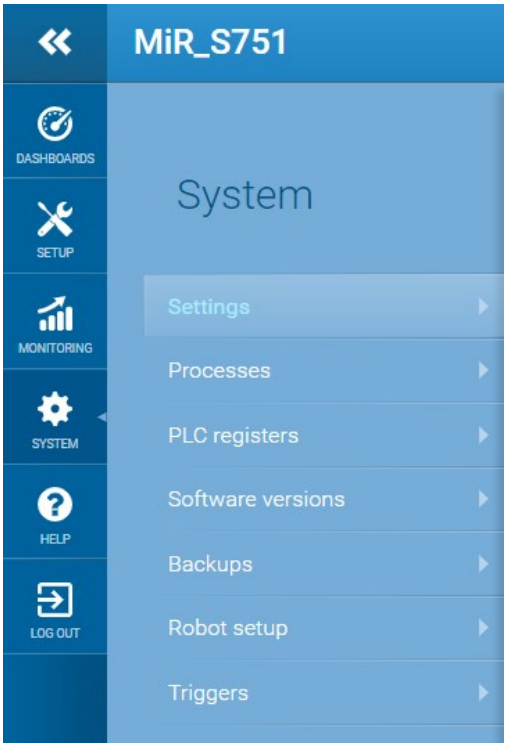


The mission action log contains the following columns:

- **Action**
  The name of the action.
- **State**
  The current state of the action.
- **Message**
  A service message associated with the action.
- **Start time**
  The start time of the action.
- **Ran for**
  The duration of the action.
  Entering a text string in the Filter field shows the actions where either the action name, the state, or the message contains the entered string.

6. System

This section describes the items in the System menu.

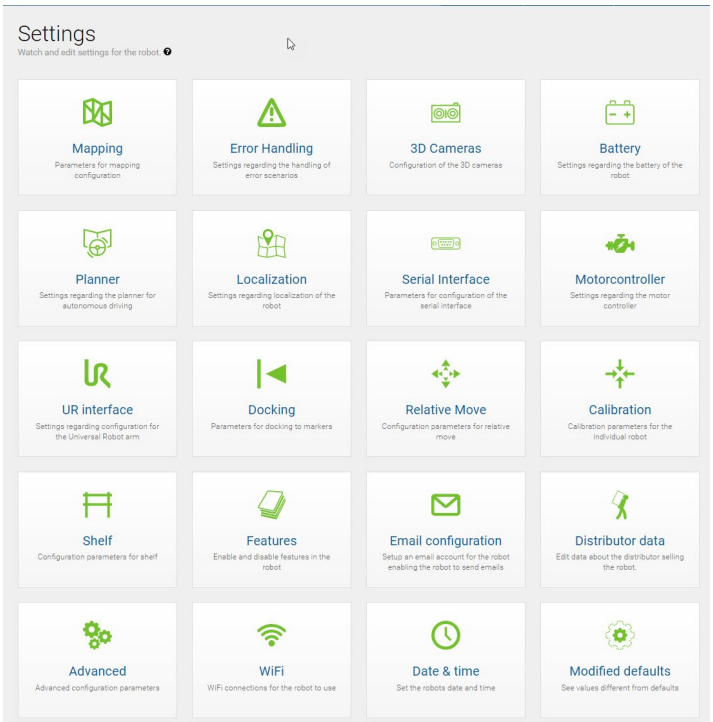


The System menu contains the following items:

6.1. Settings

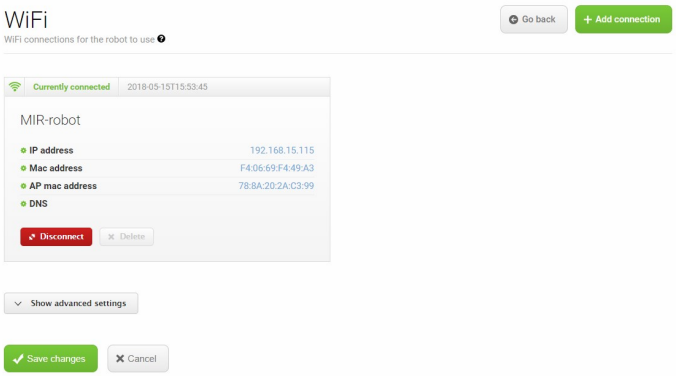
The Settings section contains the MiR robot parameter settings.

The settings are divided into sub group, and all parameters have context help texts.



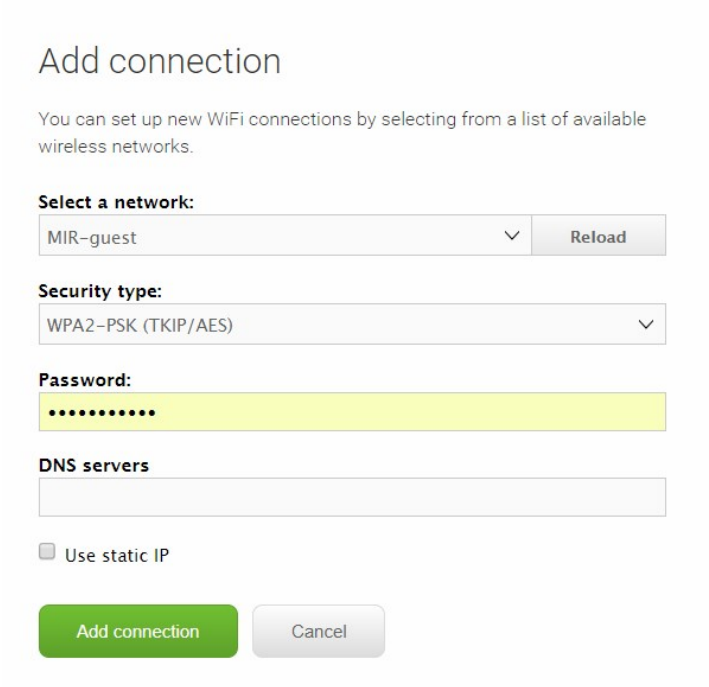
6.1.1. WiFi

In the WiFi section you can see current wireless networks on the robot, add new and delete existing ones.



Add connection

You can set up new WiFi connections by selecting from a list of available wireless networks.

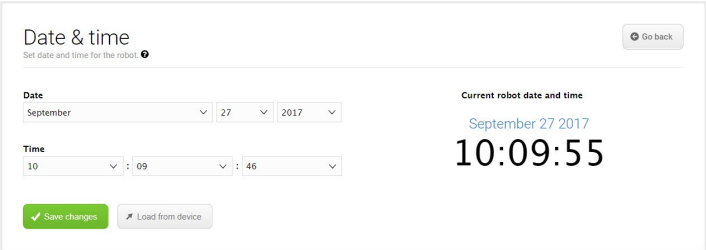


The Add connection dialog contains the following fields:

- **Select a network**
  Select the network you want to connect to from the list of available networks. If you cannot see the network you are looking for, try clicking the Reload button.
- **Security type**
  Select a security protocol.
- **Password**
  If required, enter a password to be used as log-in to the network.
- **DNS servers**
  Enter DNS servers using the format: xxx.xxx.xxx.xxx. Use the semicolon (;) as the delimiter.
- **Use static IP**
  To use a static IP address, select this check box and fill in the following fields: IP address, Netmask, Gateway.

6.1.2. Date and time

You can set the system date and time manually by entering values in the fields, or automatically by selecting **Load from device**. The latter option sets the system time to the time of the computer connected to MiR robot.



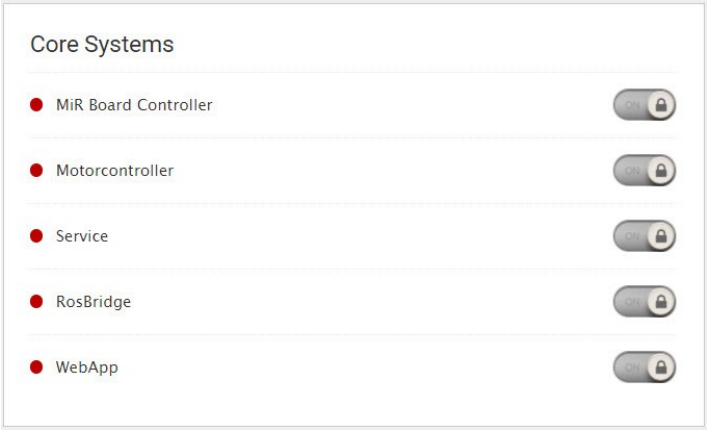
6.2. Processes

The Processes section displays the software modules that control the system processes on the robot. The modules are grouped according to functionality and, unless locked, each element in a group can be turned on and off individually.

As a rule, processes are turned on and off automatically as they apply. Therefore, the buttons should be used with care and only in the rare case that they are not turned on or off automatically or for test of a module, e.g. the top camera.

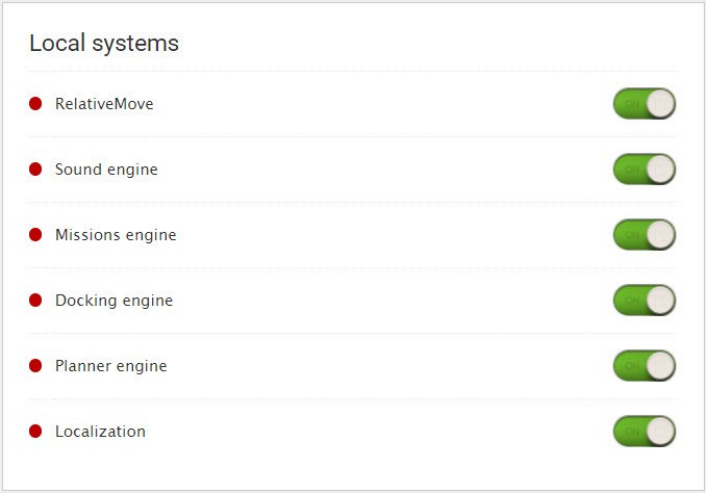
Core systems

Core systems is a group of modules that control the core functionalities of the robot.



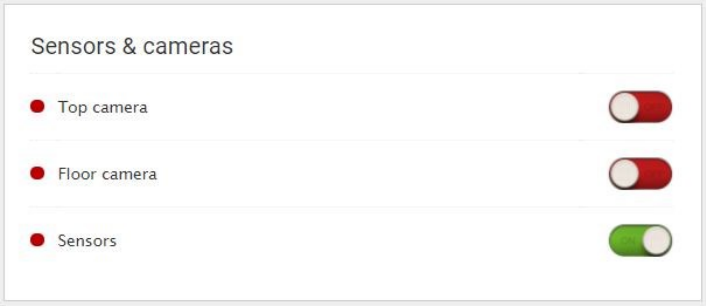
Local systems

Local systems is a group of modules that the robot uses when in operation, e.g. missions and local and global planners. Localization handles the AMCL navigational system and odometry. These two systems calculate the position of the robot on the map in which it is currently located.



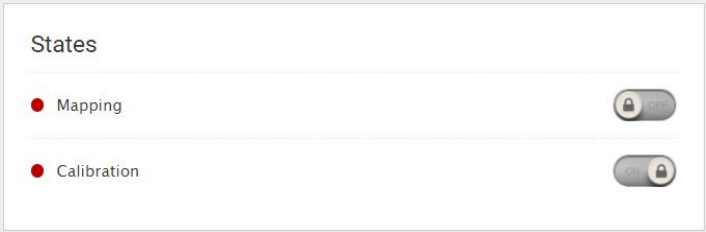
Sensors & cameras

Sensors & cameras is a group of sensor modules:
Top camera and Floor camera handle sensor data from the cameras.
Sensors handles data from the laser scanners.



States

States covers mapping and calibration modules.
Mapping is turned on during mapping of a new site. It creates a map based on the manual driving of the robot, recording walls and obstacles in the mapped area.
Calibration is turned on during IMU calibration of the robot's lasers and odometry.



Options

Options is a group of modules that are turned on individually when an optional feature is applied, e.g. a Bluetooth unit.

6.3. PLC registers

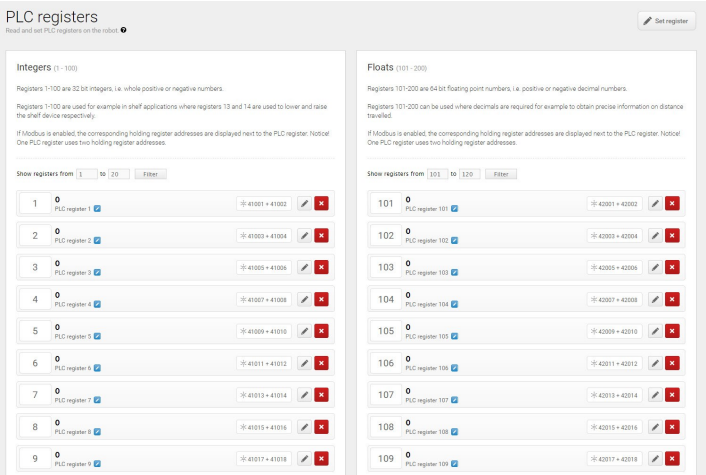
The PLC registers feature is only visible in the System menu if it has been enabled in Features.

PLC registers can be accessed through a serial interface using the robot's USB port (via RS232 adapter) or through a REST interface using the robot's Ethernet connection. Registers are used for handshake signals for example communication between a robot and a conveyor PLC.

In the PLC registers section you can create and edit values for PLC-controlled devices. Registers are shared by missions in which PLC registers are used to either set a value or wait for a value.

You may change the default PLC register labels by clicking the small pen icon next to the label and enter a text that describes what the particular register should be used for. For example registers 8 and 9 could be labeled "Lower shelf" and "Raise shelf".

Tip! PLC registers can also be set through a dashboard widget.



The **PLC registers** page contains the following sections:

- **Integers**
  Registers 1-100 are 32 bit integers, i.e. whole positive or negative numbers.Registers 1-100 are used

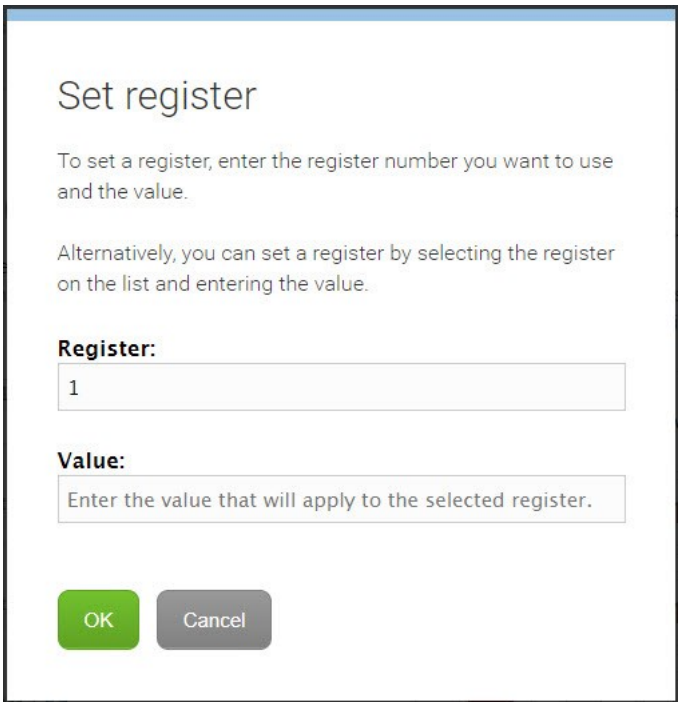
for example in shelf applications where registers 13 and 14 are used to lower and raise the shelf device respectively.If Modbus is enabled, the corresponding holding register addresses are displayed next to the PLC register. Notice! One PLC register uses two holding register addresses.

- **Floats**
  Registers 101-200 are 64 bit floating point numbers, i.e. positive or negative decimal numbers.Registers 101-200 can be used where decimals are required for example to obtain precise information on distance travelled.If Modbus is enabled, the corresponding holding register addresses are displayed next to the PLC register. Notice! One PLC register uses two holding register addresses.

Set register

To set a register, enter the register number you want to use and the value.

Alternatively, you can set a register by selecting the register on the list and entering the value.



Delete register

You may delete a register by clicking the Delete icon. Note, that you delete only the register value, and not the label.

To set a register, enter the register number you want to use and the value.

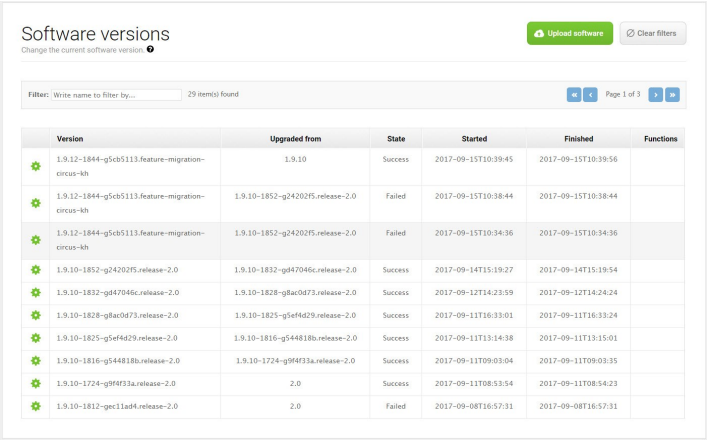
Alternatively, you can set a register by selecting the register on the list and entering the value.

6.4. Software versions

In the Software versions section, you can update the robot to run the newest software and see a list of all previous versions installed on the robot.

Click the Upload software button, select the software file on your computer to start the upload. You can follow the upgrade process on-screen. When finished, turn the robot off and on, and log on to the interface again. The robot is now ready to operate with the new software version.

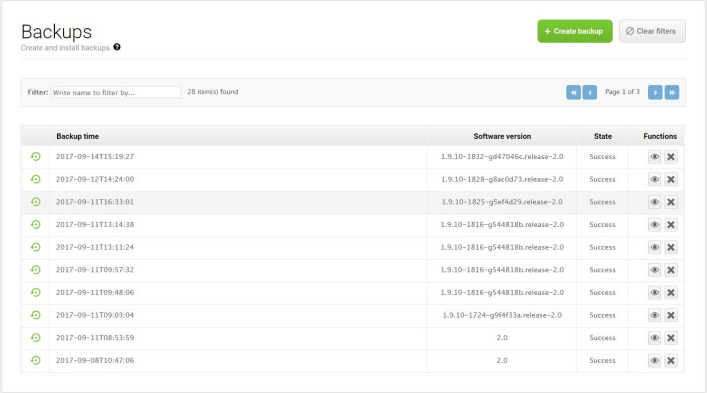
Note: If a hook is mounted on the robot, the hook must be updated to the same software version. Go to Hook > Software versions and follow the same procedure as for updating the robot.



6.5. Backups

In the Backups section, you can create a backup of the current system state and restore to a previous version of the software.

Click the Backup to create a backup of the current version. It can be useful to create a backup (snapshot) if you want to be able to revert to the exact state of the current software including data such as settings, missions, reports etc. at a later stage.



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

6.5.1. Delete backup

Backups may be deleted individually. Click the Delete backup button to remove the selected file from the system.

6.6. Robot setup

This section contains the robot configuration and calibration properties.

Configuration

You can edit the name of the product in the **Name** field.

Serial shows the 15-digit serial number of the robot. The serial number is also found in the Help section under Robot information and on the product label on the robot.

Configuration	
Name	MiR_noname
Serial	

Laser scanners

In the Laser scanners group you find the serial numbers of the front and rear laser scanners and the functions for activating and swapping the two scanners.

The Detect button is used by the system to identify the two scanners. It should be used with great caution as it will make the robot move backwards when it should move forwards and vice versa.

The Swap button swaps the front and rear laser scanners. It should be used with great caution as it will make the robot move backwards when it should move forwards and vice versa.

3D cameras

The 3D cameras group shows the status of the floor camera and, if applied, the top camera.

Serials

The Serials group lists the serial numbers of the robot's hardware components, e.g. NUC, BIOS and SSD hard drive.

Charging relay

The Charging relay buttons turn the robot's internal charging relay on or off. The charging relay is used when automatic charging is carried out by connecting the robot to a charging station.

Inertial measurement unit

The IMU gain (Inertial Measurement Unit) is a calibration of the gyro's 360 degree rotation. To calibrate the gyro, press the Start calibration button and make sure the robot has enough space to rotate around itself. The robot will start spinning on the spot while the progression of the calibration is shown in percentage. After a couple of minutes the calibration is finished and you get to decide if you want to keep the new calculated value. If the value deviates significantly from the original one, it will show in red color and you can choose to discard the calibration and restore to the default value.

Note
To perform the calibration the robot must have an active map.

Laser scanner calibration

The Laser scanner calibration is a calibration of the laser scanners to improve the robot's docking precision. To calibrate, place the robot approximately 2 m in front of a wall, and select the Calibrate front scanner or Calibrate rear scanner button. The robot now moves to a start position. Measure the distance from the front of the laser scanners to the wall and enter the distance in the dialog box in robot the interface. Follow the instructions in the interface, until the calibration is completed.

For detailed instructions on how to calibrate the scanners, see the how to-article Calibrate the laser scanners in the How to section of the MiR website.

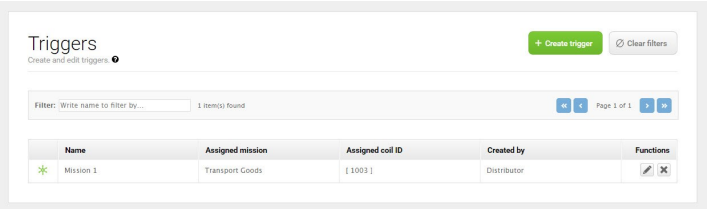
After a calibration, the robot must be restarted.

6.7. Triggers

The Triggers feature is only visible in the System menu if it has been enabled in Features.

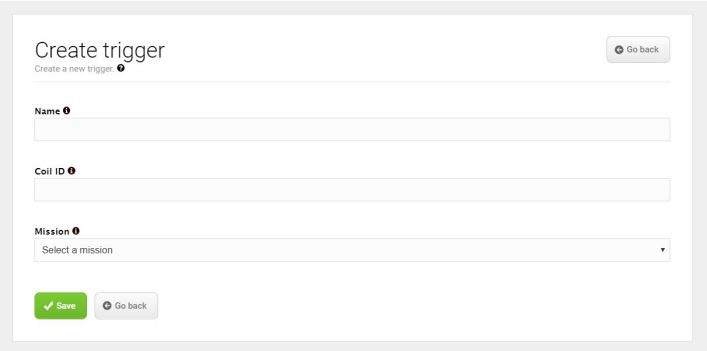
The robot can be set up to use Modbus TCP/IP communication. In the Triggers section you can set up links between robot missions and Modbus coil IDs which will enable remote devices to add missions to the robot's mission queue.

Before you can establish a Modbus connection and create triggers, the Modbus feature must be activated under Features in the System > Settings section.



6.7.1. Create trigger

To create a trigger, first enter a unique name, then enter a coil ID between 1001 and 2000, and finally assign the mission you want the robot to perform when the coil is activated.



The **Create trigger** dialog contains the following fields

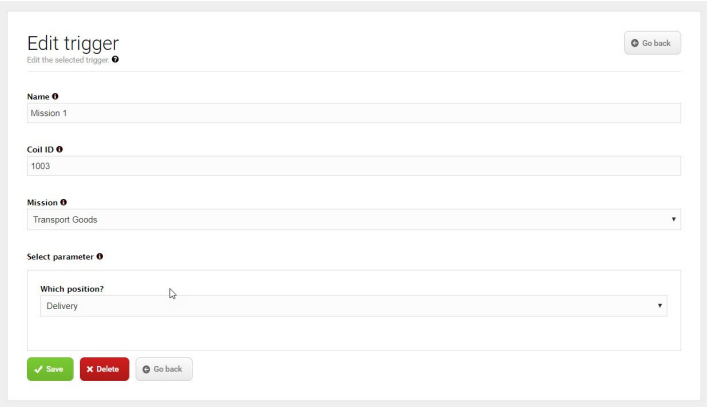
- **Name**
  Enter a name that describes the trigger.

- **Coil ID**
  Enter a coil ID that should be used for this trigger. The number must be an integer between 1001 and 2000.
  An integer is a whole positive or negative number.
- **Mission**
  Select the mission that you want the robot to perform when the coil is activated.
- **Select parameter (variables only)**
  Select the parameter that should be used for this mission.Variable parameters are displayed if the selected mission was created with a variable parameter, for example for positions.

Select **Save** to save the settings.

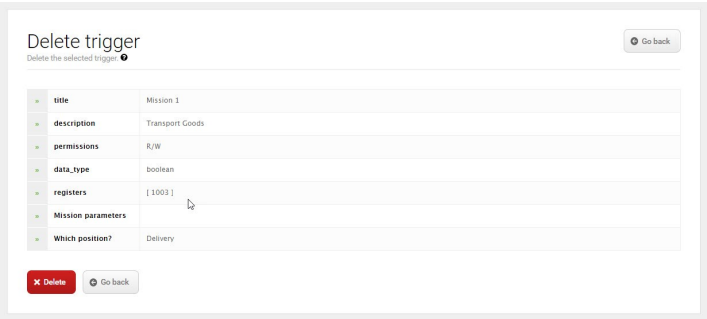
6.7.2. Edit trigger

Edit details of the selected trigger. You can rename the trigger and change the coil ID and/or the mission that the robot will perform when the coil is activated.



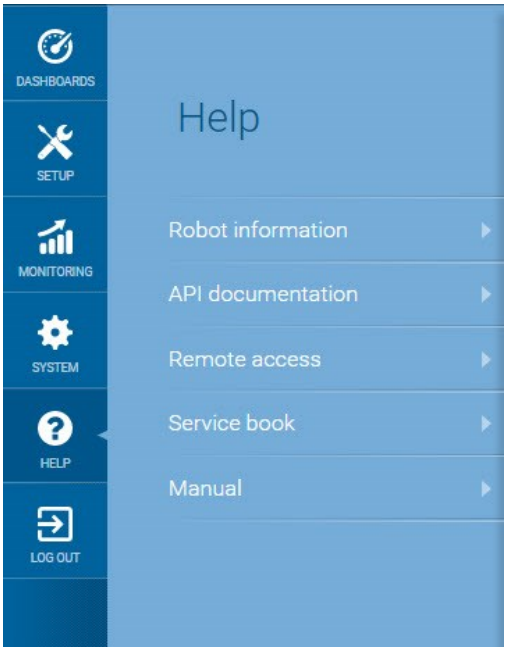
6.7.3. Delete trigger

You can delete triggers created by you or another member of the user group you belong to.



7. Help

This section describes the items in the Help menu.

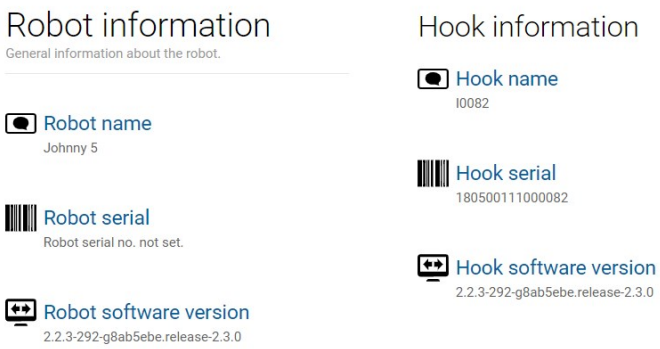


The Help menu contains the following items:

7.1. Robot and Hook information

This menu item contains the following information:

- **Robot name**
  This field shows the Robot name.
- **Robot serial**
  This field shows the robot serial number.



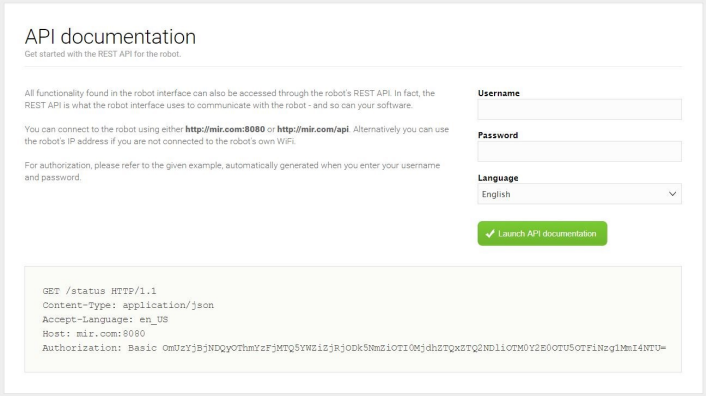
7.2. API documentation

All functionality found in the robot interface can also be accessed through the robot's REST API. In fact, the REST API is what the robot interface uses to communicate with the robot - and so can your software.

You can connect to the robot using either **http://mir.com:8080** or **http://mir.com/api**. Alternatively you can use the robot's IP address if you are not connected to the robot's own WiFi.

For authorization, please refer to the given example, automatically generated when you enter your username and password.

Select **Launch API documentation** to get the list of available commands. Clicking a particular command opens the dialog with extra details and the **Try it out** button.

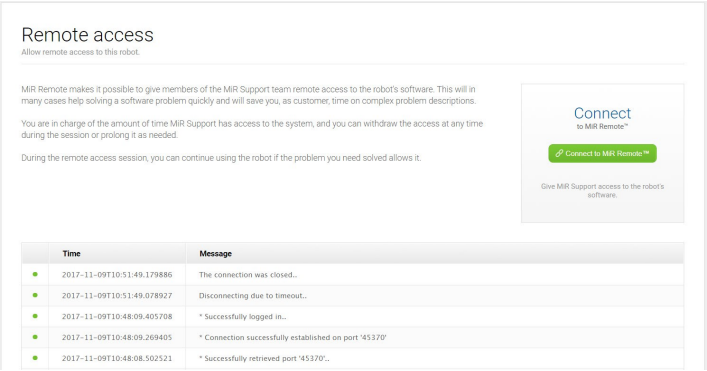


7.3. Remote access

MiR Remote makes it possible to give members of the MiR Support team remote access to the robot's software. This will in many cases help solving a software problem quickly and will save you, as customer, time on complex problem descriptions.

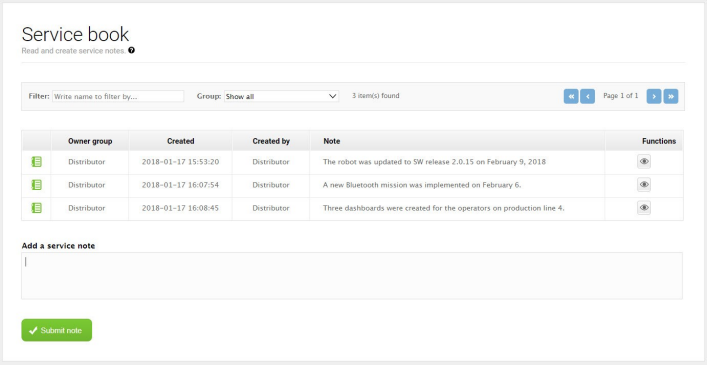
You have command of the remote session, which means that you can retrieve access at any time by clicking the Disconnect button.

During the remote access session, you can continue using the robot if the problem you need solved allows it.



7.4. Service book

In the service book you can enter notes about the robot for example about changes made in the robot. The notes can be read by all user groups and cannot be deleted.



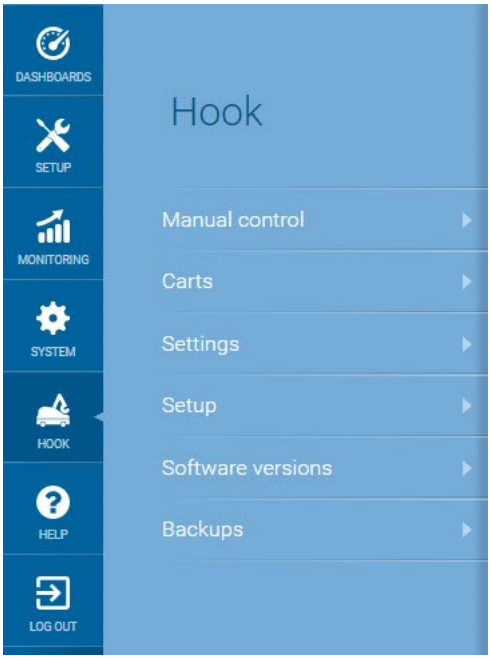
7.5. Manual

A copy of this reference guide is available in the interface. To access the guide, go to: Help > Manual.

8. Hook

The Hook menu is only visible if you enable it in System > Settings > Features.

This section describes the items in the Hook menu.



The Hook menu contains the following items:

8.1. Controlling MiRHook

Preparation of the MiRHook to pick up and deliver carts accurately involves a number of setup and test procedures some of which are found in the Hook section others in different sections of the user interface. In brief, the steps are as follows:

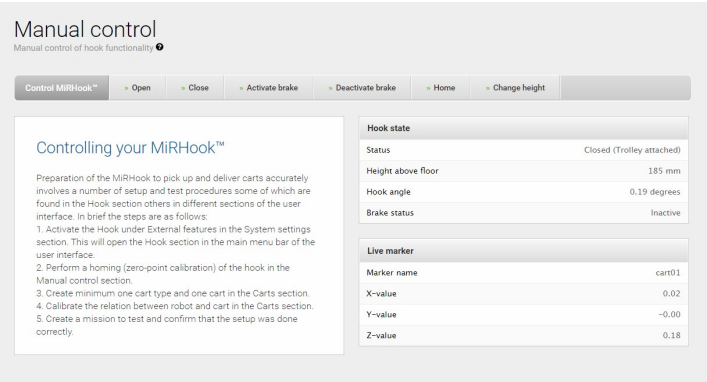
1. Activate the Hook under External features in the System settings section. This will open the Hook section in the main menu bar of the user interface.
2. Perform a homing (zero-point calibration) of the hook in the Manual control section.
3. Create minimum one cart type and one cart in the Carts section.
4. Calibrate the relation between robot and cart in the Carts section.
5. Create a mission to test and confirm that the setup was done correctly.

8.1.1. Manual control

The manual control section lets you perform the following actions:

- Open and close the gripper.
- Activate and deactivate the hook brake.
- Perform homing (maximum height calibration).
- Change the height of the hook manually.

The Hook state section provides information on the position of the hook and the status of the gripper and the brake. The Live marker section shows the QR code readout.



Note
For more detailed instructions on setting up the hook, see MiRHook Technical Documentation. For instructions on mounting a hook mechanically, see the MiRHook Mounting guide.

Open / Close

Use these buttons to open or close the hook gripper.

Activate / Deactivate brake

Activate or deactivate the hook brake. The hook brake locks the hook arm and prevents it from swinging horizontally.

Activating the hook brake makes it easier to perform the cart calibration since even small hook movements may affect calibration.

NOTICE
Do not drive the robot in manual mode with the brake activated as this may damage the motors or the brake.

Deactivate the brake if you need to move the hook arm manually.

Home

Use the Home function to hoist the hook to its highest position. The homing function is used to calibrate the Hook height encoder. The robot raises the hook arm to its maximum height and resets the encoder.

Change height

Use the Change height function to lower or hoist the hook to a set position. The function should be used to find the entry, lock and drive heights for a specific cart. Note down the heights and use them when you create a new cart in the system.

Hook state

This group shows the following information:

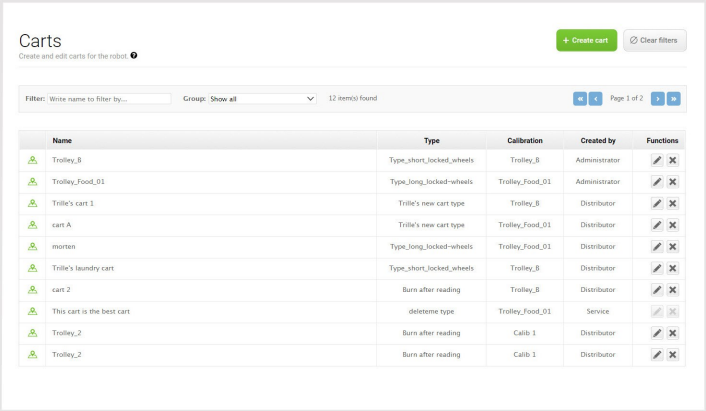
- Status: The status of the hook gripper.
- Height above floor: The height of the gripper above the floor.
- Hook angle: The angle of the hook. 0 degrees is the angle at which the hook arm is parallel to the robot.Use this readout to align the hook arm.
- Brake status: The status of the hook arm brake.

Live marker

This group shows the information that the hook camera reads from the QR code

8.2. Carts

All carts that are to be used with the MiRHook must be set up in the robot interface.

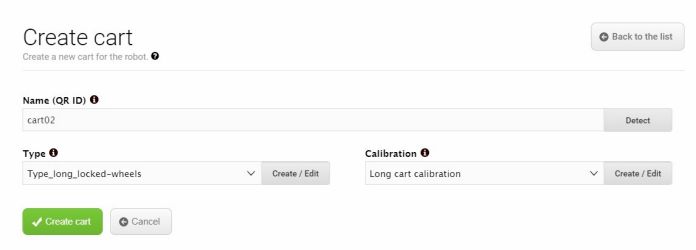


The setup includes carts, cart types and calibration of the relation between cart and MiRHook:

- Cart types are common types sharing the same length, width and height.
- Carts are individual carts based on a cart type and specifications of entry, grip and drive heights plus the ID of the QR code attached to the cart.
- Calibrations define the entry, lock and drive heights of the hook when it picks up a particular cart.

8.2.1. Create cart

Each tow cart to be used with the MiRHook must be individually specified. The name must be the exact QR code name and all carts must be attached to a cart type specifying length, width and height.



The **Create cart** dialog contains the following fields:

- **Type**
  Select the type of cart that fits the cart you are about to create, or press Create/Edit to create a new type.

  The cart type must match the length, width and height of the cart you are creating.

  For more information, see Type below
- **Calibration**
  Select an existing calibration or press Create/Edit to create a new one.

  The calibrations list shows details of the calibrations that are already available in the system. You may edit or delete existing calibrations or create new ones.

  A calibration consists of a name, the exact position of the MiRHook in relation to the cart when picking up, and the entry, lock and drive heights of the hook.

  For more information, see Calibration on page 93

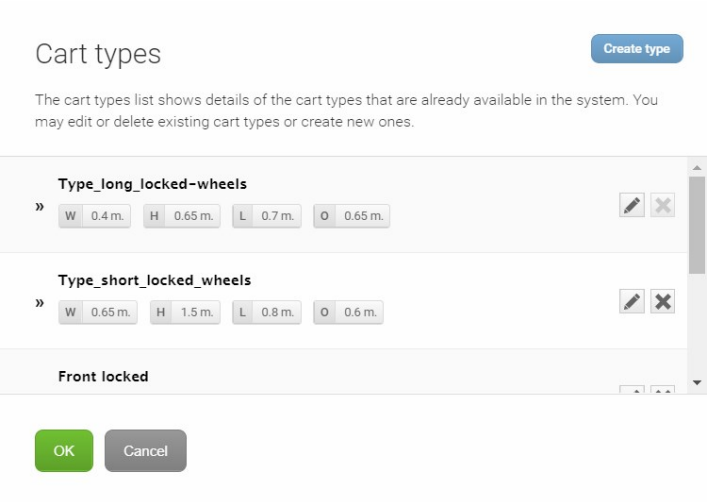
Click **Create cart** to save the settings.

8.2.2. Type

All carts must be attached to a named cart type, specifying length, width, height and locked wheels offset of the cart.

Click the **Create/Edit** button to open the Cart types window.

The cart types list shows details of the cart types that are already available in the system. You may edit or delete existing cart types or create new ones.



8.2.3. Create cart type

The **Create cart type** dialog contains the following fields:

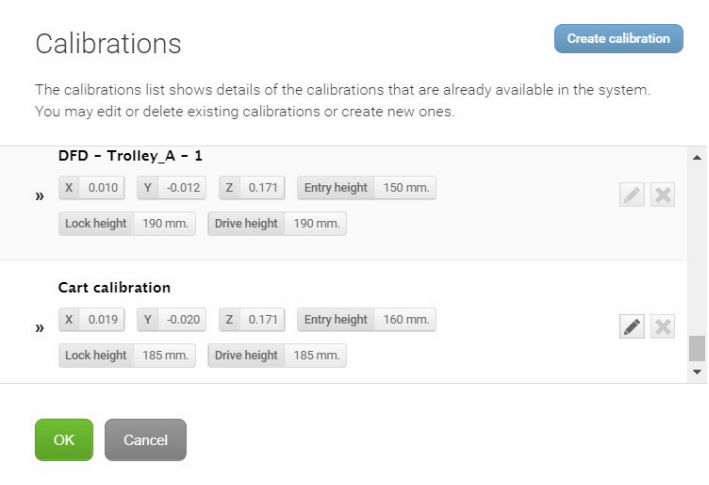
- **Name**
  Enter a name for the cart type you are about to create.
  The name must be unique and is used to identify a group of carts.
  One way of naming cart groups is to select names that characterize the tasks of the carts in the particular group. For example tall cage-type carts used for laundry transport could be named Laundry carts.
- **Width in meters**
  Enter the width of the cart type in meters.
  Measure from side to side of the cart.
- **Height in meters**
  Enter the height of the cart type in meters.
  Measure from floor to the highest point of the cart.
- **Length in meters**
  Enter the length of the cart type in meters.
  Measure the length from rear end to the gripping bar.
- **Locked wheels offset in meters**
  Enter the offset in meters.
  Measure the distance from the line going through the centers of the locked wheels to the front of the gripping bar.

Note
The locked wheels can be either at the front or the back of the cart. For information on towing different types of carts, see MiRHook Technical Documentation.

Click **OK** to save the settings.

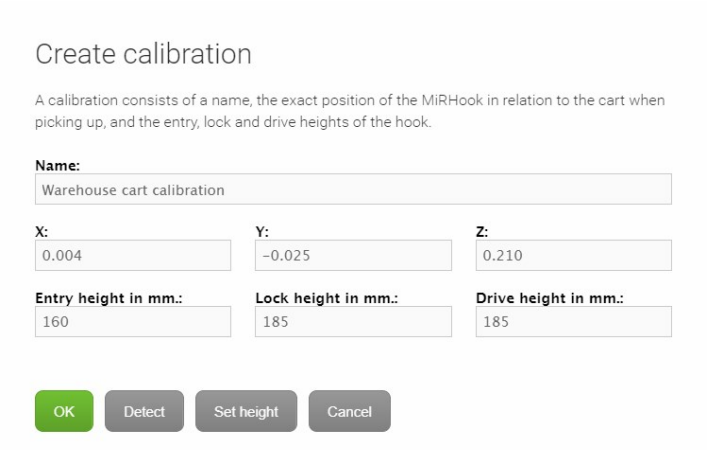
8.2.4. Calibration

The calibration specifies the entry, lock and drive heights the MiRHook should use to pick up a specific cart. As part of the calibration, the hook camera detects the QR code's position on the cart. This information is used by the MiRHook to position itself precisely every time it picks up a cart. So once calibrated, the QR code should not be moved on the cart, and if it happens the calibration must be redone.
Calibrations can be reused by multiple carts. This simply requires that the QR codes are placed in the exact same positions on the carts sharing the calibration and that the carts are of the same type.



Create calibration

A calibration consists of a name, the exact position of the MiRHook in relation to the cart when picking up, and the entry, lock and drive heights of the hook.



The **Create calibration** dialog contains the following fields:

- **Name**
  Enter a name for the calibration you are about to create.
  The name must be unique and is used to identify a specific calibration that can be used by the same cart types and with the QR code attached in the exact same position.

- **X-Y-Z**
  The X-Y-Z positions show the location of the 3D hook camera in relation to the QR code as soon as the camera can detect the QR code.
  Click on the Detect button to live-update the positions every time you move the MiRHook. The camera should point as closely to the middle of the QR code as possible and have a distance of approximately 16 cm to the QR code. This means X and Y should be as close to 0 as possible, and Z should be approximately 160.
- **Entry height in mm**
  The hook's current height is automatically shown in the Entry height in mm field. To change the height, press the Set height button and enter a new height in mm.
  The entry height is the height the hook will use to go under a cart before gripping it. The height should be measured as the distance between the floor and the bottom plate of the hook. It will typically be set to about 50 mm lower than the lock height.
- **Lock height in mm**
  Set the height the hook should raise to, to grip and lock to the cart.
  The height should be set so that the lower gripper hook is right under the gripping bar of the cart without lifting the wheels.
  If you are unsure of the lock height, you may go to the Manual control section to find the correct height by using the Change height, Close and Open functions.
- **Drive height in mm**
  The drive height can in almost all cases be set to the same value as the lock height.

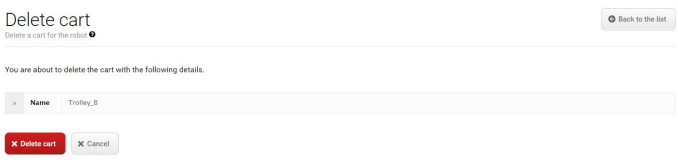
Click **OK** to save the settings.

8.2.5. Edit cart

Change the name of the cart, the name must correspond to a specific QR code, or use the Detect button to auto-fill the Name field using the camera live view.

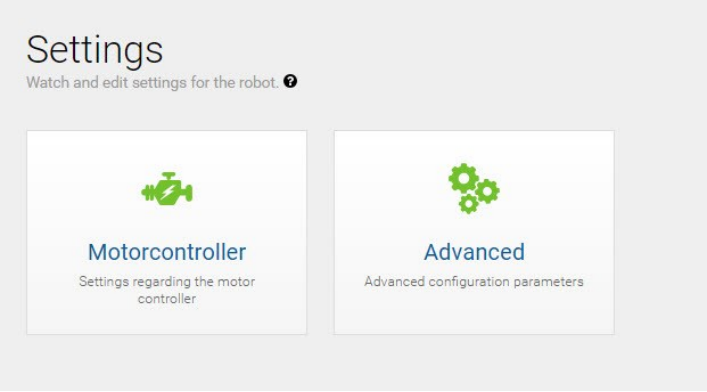
8.2.6. Delete cart

You can delete carts that are created by you or another member of the user group you belong to.



8.3. Settings

All settings of the robot are found and may be edited in the Settings menu. The Robot setup section is divided into sub groups.



8.3.1. Motorcontroller

The settings in this group are intended for service technicians.

This group contains settings related to the motors in MiRHook. The motors control the following parts:

- The hook brake.
- The hook gripper.
- The hook height actuator.

8.3.2. Advanced

The settings in this group are intended for service technicians.

This group contains calibration parameters and limits.

8.4. Setup

In the Setup section you can change the name of the hook, find serial numbers of hook and its integrated components. Finally, the hook encoder can be zero calibrated, for example if the encoder has been replaced.

Configuration
In the Configuration group you may change the name of the hook and read the serial number.

Serial
Shows the 15-digit serial number of the robot. The serial number is also found in the Help section under Robot information and on the product label on the MiRHook.

Motor controllers
The motor controllers group lists the serial numbers of the motor controllers for actuator and brake.
The magnifier icon is used to automatically find and enter the number of a motor controller, for example if it has been replaced.
If both serial numbers should be re-entered, first disconnect one of the controllers and click the magnifier icon on the one that is not disconnected, then reconnected the controller and click the magnifier icon on the second

controller.
Note: Be sure to select the correct motor controller when you click on the magnifier icon, as the system will not automatically detect if they are swapped.

Serials
The Serials group lists the serial numbers of hook hardware components, e.g. NUC, BIOS and SSD hard drive.

Hook encoder offset
The hook encoder group shows the horizontal angle of the hook arm and makes it possible to make a new zero calibration of the hook by clicking the Set 0-value button.
Note: The hook encoder has already been zero-set from the factory, and it should only be performed again if the encoder has been replaced.

Hook angle
Hook angle shows a live view of the hook's horizontal position.

Offset
Offset shows the hook angle offset value. Default is 0.

9. Modbus register reference

The tables in this chapter list the possibilities for the robot to communicate with external PLC devices through Modbus TCP/IP.

9.1. Status messages

Title	Description	Permission	Data type	Registers
Software version	Robot software version	R	int16array	[4001, 4002, 4003]
Mode	The current mode of the robot	R	int16	[4004]
State	The current state of the robot	R	int16	[4005]
Error code	The last error registered on the robot. 0 if no errors were detected.	R	int16	[4006]
Battery level	Remaining charge [%]	R	int16	[4008]
Uptime	The robot's uptime	R	int32	[4009, 40010]
Distance run	The distance run by the robot from the beginning of time.	R	float32	[40011, 40012]
Position X	Position X in global coordinates	R	float32	[40013, 40014]
Position Y	Position Y in global coordinates	R	float32	[40015, 40016]
Position Orientation	Orientation of the robot in global coordinates [degrees].	R	float32	[40017, 40018]
Length of mission queue	Number of missions pending or executing.	R	int16	[40019]

9.2. PLC triggers

Title	Description	Permission	Data type	Registers
PLC integer	Value of PLC register	R/W	int32	[41001,41002]...[41199, 41200]
PLC float	Value of PLC register	R/W	float32	[42001,42002]...[42199, 42200]

9.3. Mission triggers

Title	Description	Permission	Data type	Coils
Trigger name	Description of trigger	R/W	Boolean	[1001]...[2000]

9.4. Action commands

Title	Description	Permission	Data type	Coils
Continue robot	Address of the coil used to trigger the Continue action on the robot	R/W	Boolean	[1]
Pause robot	Address of the coil used to trigger the Pause action on the robot	R/W	Boolean	[2]
Cancel current mission	Address of the coil used to cancel the ongoing mission, if any	R/W	Boolean	[3]
Clear mission queue	Address of the coil used to clear the entire mission queue	R/W	Boolean	[4]
Clear error	Address of the coil used to clear the errors on the robot.	R/W	Boolean	[5]
Continue robot	Address of the coil used to trigger the Continue action on the robot	R/W	Boolean	[6]