Operating guide (en)

Date: 02/2020

Revision: v.2.1

Copyright and disclaimer

Contact the manufacturer:

Mobile Industrial Robots A/S
Emil Neckelmanns Vej 15F
DK-5220 Odense SØ

www.mobile-industrial-robots.com
Phone: +45 20 377 577
Email: support@mir-robots.com

CVR: 35251235

Table of contents

1. About this document

This document contains the following information:

- How to install MiR Hook 100 and take precautions for safe use
- Product presentation

1.1 Where to find more information

At www.mobile-industrial-robots.com, several additional resources are available. To access more information, sign in to the Distributor site with your distributor account at http://www.mobile-industrial-robots.com/en/account/. The following resources are available:

- **Distributor site > Manuals**
  http://www.mobile-industrial-robots.com/en/account/manuals/
  This page contains the following resources:
  - **Quick starts** describe how you start operating MiR robots quickly. This document is in print in the box with the robots. Quick starts are available in multiple languages.
  - **User guides** provide all the information you need to operate and maintain MiR robots. User guides are available in multiple languages.
  - **Risk Analysis Guides** include guidelines on how to create a risk assessment of your robot solution.
  - **Commissioning guides** describe how to commission your robot safely and prepare it to operate in the workplace.
  - **Operating guides** describe how to set up and use add-ons, such as charging stations, hooks, shelf lifts, and pallet lifts.
  - **Getting started guides** describe how to set up products that are mainly software based, such as MiR Fleet and MiR AI Camera.
  - **Reference guides** contain descriptions of all the elements of the robot and MiR Fleet interface. Reference guides are available in multiple languages.
  - **REST API references** for MiR robots, MiR hooks, and MiR Fleet.
  - **MiR network requirements** specify the performance requirements of your network for MiR robots and MiR Fleet to operate successfully.

- **Distributor site > Download**
  http://www.mobile-industrial-robots.com/en/account/download/
  This page contains the following resources:
  - **Software** and **Product Release Notes** for your MiR product are displayed by selecting your product in the drop-down menu.
  - **CAD drawings** of MiR products are displayed by selecting **Show CAD-files**.
  - **Certificates** for the MiR products and Declarations of Conformity are displayed by selecting **Show Certificates**.
- **Distributor site > FAQ**
  https://www.mobile-industrial-robots.com/en/account/faq/
  This page contains frequently asked questions regarding MiR products.
- **Distributor site > How to**
  http://www.mobile-industrial-robots.com/en/account/how-to/
  This page contains how-to guides that describe how to perform specific tasks with MiR products.
- **Distributor site > Troubleshooting**
  https://www.mobile-industrial-robots.com/en/account/troubleshooting/
  This page contains troubleshooting guides to solve common issues with MiR products.
- **MiR Hook 100 product page**
  http://www.mobile-industrial-robots.com/en/products/mir-add-ons/mir-hook-100/
  This page contains specifications, pictures, and brochures for MiR Hook 100.

1.2 Version history

This table shows current and previous versions of this document and their interrelations with hardware releases.

Revision	Release date	Description	HW
1.0	2016-02-01	First edition.	
1.1	2016-02-04	General small corrections. Reworked section Commissioning on page 24.	
1.2	2016-04-10	Major update throughout the manual.	
1.3	2016-05-02	Added space requirements for pick-up and reverse parking.	

Revision	Release date	Description	HW
1.4	2016-09-20	Updated for software release 1.7. Configuration of hook missions made simpler.	
1.5	2016-10-11	Updated illustration for 4.1 and 4.3.	
1.6	2016-10-24	Appendix added: Updating the MiR Hook 100 software. Chapter 1: Notice added about requirements for light in the operation environment.	
1.7	2016-11-10	Description of driving space requirements changed	
1.8	2017-01-06	Updated for software release 1.8. Cart specifications changed. New section: Modifying the gripper on page 25	
1.9	2019-02-22	New version for MiR Robot Interface 2.0. Major update throughout manual. Includes both MiR Hook 100 and MiR Hook 200.	1.3
2.0	2019-08-27	Updated for hardware release 1.5.	1.5
2.1	2020-02-07	Updates in Usage on page 34.	1.5

2. Safety

Read the information in this section before powering up and operating MiR Hook 100.

Pay particular attention to the safety instructions and warnings.

NOTICE

Mobile Industrial Robots disclaims any and all liability if MiR Hook 100 or its accessories are damaged, changed, or modified in any way. Mobile Industrial Robots cannot be held responsible for any damages caused to MiR Hook 100, accessories, or any other equipment due to programming errors or malfunctioning of MiR Hook 100.

2.1 Safety message types

This document uses the following safety message types.

WARNING

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

CAUTION

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

NOTICE

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

2.2 General safety precautions

This section contains general safety precautions.

WARNING

MiR Hook 100 is not running on the correct software and is therefore not functioning properly. Risk of injury.

- Ensure that MiR Hook 100 is always running on the correct software.

WARNING

Contact with live parts can cause electric shock.

- Do not touch any internal components of MiR Hook 100 while it is powered.

WARNING

Entering an operating hazard zone intended for placing and picking up carts while the robot is operating in it may result in injury.

- Ensure that all nearby personnel are instructed to stay clear of operating hazard zones when MiR100 with MiR Hook 100 is in the zone.

WARNING

When MiR100 with MiR Hook 100 is turning while towing a cart, there is a risk of injury to personnel close to the cart.

- Instruct personnel to maintain a safe distance from the robot when it is turning while towing a cart.

WARNING

When driving MiR100 with MiR Hook 100 while the hook brake is released without being connected to a cart, the hook can rotate freely. Nearby personnel may be hit by the hook.

- Never release the hook brakes while the robot is driving without a cart.

2.3 Intended use

MiR Hook 100 is a partly completed machine as defined in the EU machinery directive and does not have a CE mark. A correctly installed MiR Hook 100 is covered by the CE mark of MiR100. However, a CE marked product does not guarantee a CE marked setup. It is the responsibility of the commissioner to commission MiR Hook 100 safely.

MiR Hook 100 is designed for MiR100. MiR Hook 100 is only intended to tow carts fulfilling the technical requirements found in Cart specifications on page 24 and is commissioned according to the guidelines found in Commissioning on page 24

NOTICE

A safe machine does not guarantee a safe system. Follow the Commissioning guide to ensure a safe commission.

MiR Hook 100 is intended to be commissioned indoors in a light industrial environment where public access is restricted. For a detailed description of the intended environment, see technical specifications on our website.

2.4 Users

MiR Hook 100 is only intended to be used by personnel that have received training in their required tasks.

There are three types of intended users for MiR Hook 100: commissioners, operators, and direct users.

Commissioners

Commissioners have received extensive training in the full use of MiR Hook 100 and have the following main tasks:

- Commissioning the product. This includes creating maps and restricting the user interface for other users and making brake tests with a full payload.
- Making the risk assessment.
- Determining the payload limit, weight distribution, safe fastening methods, safe loading and unloading of loads on MiR Hook 100 and ergonomic loading and unloading methods if relevant.
- Ensuring the safety of nearby personnel when the robot is accelerating, braking, and maneuvering.

Operators

Operators have thorough knowledge of MiR Hook 100 and of the safety precautions presented in the user guide of MiR100 and operating guide of MiR Hook 100. Operators have the following main tasks:

- Servicing and maintaining MiR Hook 100.
- Creating and changing missions and map positions in the robot interface.

Direct users

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

- Assigning missions to MiR100.
- Fastening loads to MiR Hook 100 properly.
- Loading and unloading from a paused robot.

All other persons in vicinity of MiR100 are considered indirect users and must know how to act when close to the robot. For example, they must be aware that visibly marked operating hazard zones must be respected.

3. Product presentation

MiR Hook 100 is a top application for our autonomous mobile robot MiR100 that handles fully automated pick-up and towing of carts with loads of up to 300 kg indoors within production facilities, warehouses, and other industrial locations.

The MiR Hook 100 robot identifies carts by QR markers and autonomously transports these carts to user defined positions. MiR Hook 100 can be incorporated into a fleet of MiR robots and can be easily redeployed to meet changing requirements.

Users operate MiR Hook 100 via a web-based user interface, which is accessed via a browser on a PC, smartphone, or tablet. The robot with a hook mounted can be set up to run a fixed route, be called on demand, or perform more complex missions.

The robot with MiR Hook 100 performs localization and navigation via a map, which can be created or imported the first time the robot is used. The internal map contains defined locations (office, product delivery, production hall etc.) that are used for logistical planning. While operating, the safety laser scanners ensure that the robot avoids dynamic obstacles (people, furniture) that are not mapped.

With the MiR Hook 100, you must provide the measurements of the carts as described in Cart specifications on page 24. Then, MiR Hook 100 can autonomously transport the defined carts. Built-in sensors, cameras, and integrated software enable MiR100 with MiR Hook 100 and a cart to safely maneuver around people and obstacles, and drive up ramps.

3.1 Main features of MiR Hook 100

The main features of MiR Hook 100 are:

- **Increase the efficiency of internal transportation tasks**
  MiR Hook 100 is ideal for a wide range of towing jobs, such as efficiently moving heavy products between locations in a manufacturing facility or warehouse, or moving linen and food carts in hospitals. This provides exciting new internal logistics options for heavy or unwieldy cargos.
- **Fully automated pick-up and towing of carts**
  MiR Hook 100 identifies carts by QR markers and autonomously transports them as you define. MiR Hook 100 can be incorporated into a fleet of MiR robots and can easily be redeployed to meet changing requirements.

- **Efficient transportation of heavy loads**
  The hook is designed to automate transportation of loads up to 300 kg across industries, allowing employees to focus on higher value activities.
- **User friendly and flexible**
  The web-based user interface, accessed from a PC, tablet, or smartphone, gives easy access to operation and monitoring of the robot with a hook and can be programmed without any prior experience. Different user group levels and tailored dashboards can be set up to suit the different users.
- **Safely maneuvers among people**
  With MiR Hook 100, you simply measure your cart and feed the data into the software. Built-in sensors, cameras and sophisticated software mean MiR100 with MiR Hook 100 and a cart can safely maneuver around people and obstacles and drive up ramps.

To read more about MiR Hook 100, go to www.mobile-industrial-robots.com.

3.2 MiR Hook 100 external parts

This section presents the parts of MiR Hook 100 that are visible on the outside.

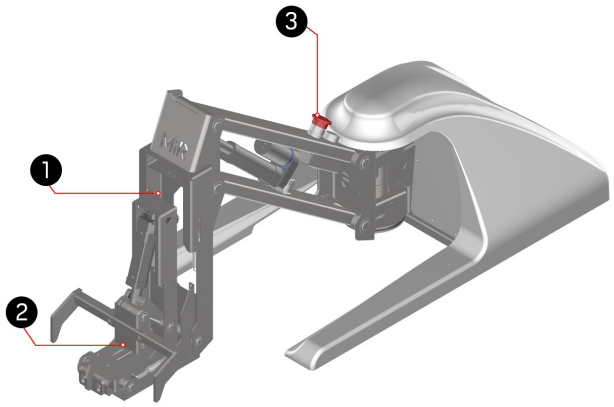


Figure 3.1. MiR Hook 100 external parts.

Pos.	Description	Pos.	Description
1	**3D camera:** Reads QR codes on carts.	2	**Gripper:** Attaches to the gripper bar on the cart to enable towing.
3	**Emergency stop:** Disarms the robot when pressed. Beneath is the button to rearm the robot.		

4. Installation

This section describes how to get started with MiR Hook 100. To be able to use MiR Hook 100 with MiR100, your robot must be running software version 2.6.0 or higher.

NOTICE

Read Safety on page 8 before powering up the robot.

4.1 In the box

This section describes the content of the MiR Hook 100 box.

The box contains:

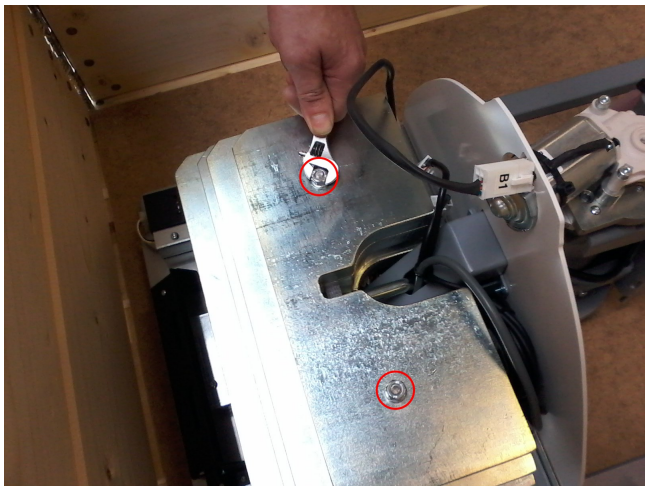
1. The MiR Hook 100.
2. 4 hex key bolts for mounting.
3. MiR Hook 100 document folder containing the printed documents.
4. Printed documents:
   - MiR Hook 100 Mounting guide.
   - CE declaration of incorporation.

4.2 Unpacking MiR Hook 100

This section describes how to unpack MiR Hook 100.

Keep the original packaging for future transportation of the hook.

1. Remove the pallet lid.
2. Remove the shield and cut the cord that holds the hook attached to the pallet.
3. Loosen the two highlighted screws and remove the four weights.



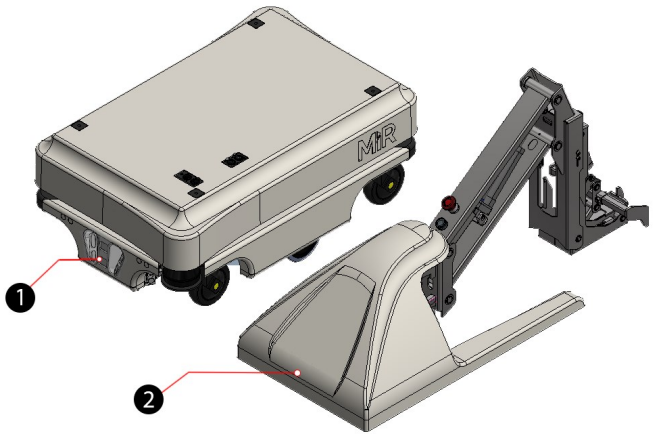
4. Remove the two screws in the front of the hook.

5. Remove the two screws on the back of the hook.

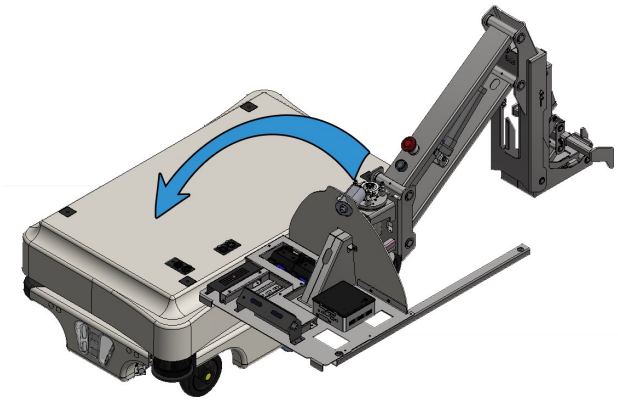
6. Remove the hook from the pallet.

4.3 Mounting MiR Hook 100

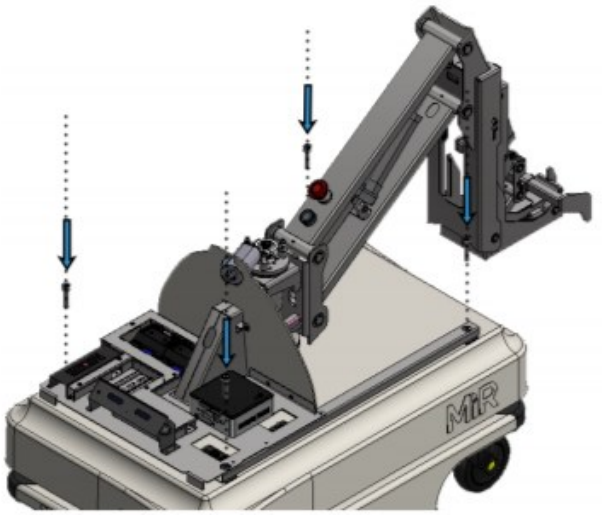
The photos illustrate how to mount a MiR Hook 100 (2) to a MiR100 (1).



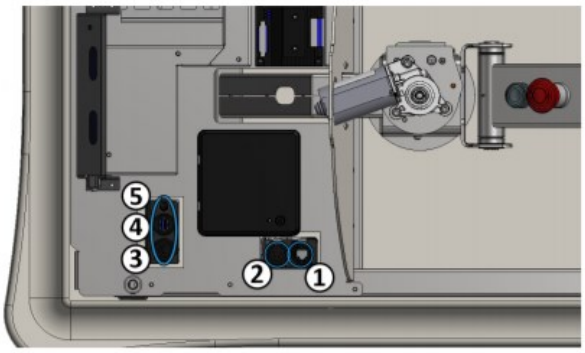
1. Remove the hook cover and lift the hook onto the robot, fitting the frame holes above the four mooring holes on the robot.



2. Mount the frame with the four bolts. Tighten the bolts with a torque of 47 (Nm) / [34.5 ft-lb].

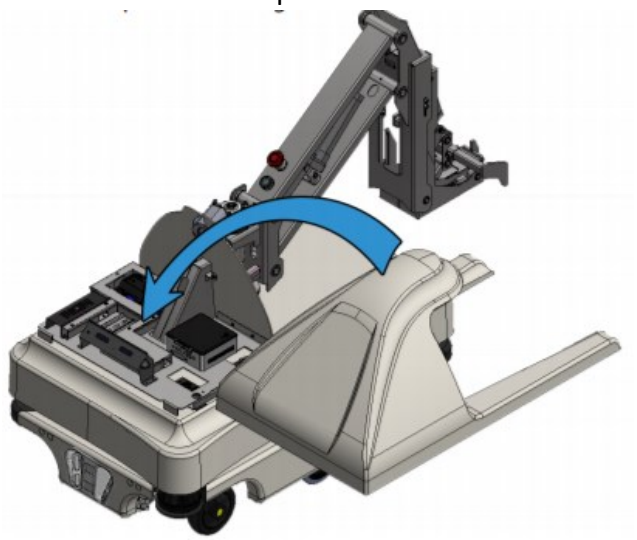


3. Connect cables and mount the antenna:



Pos.	Description	Pos.	Description
1	Network cable (from robot to hook PC)	2	Application hardware cable
3	Emergency stop cable	4	USB cable for top camera
5	Antenna connector		

4. Place the cover on top of the hook frame. The cover is held in place with magnets.

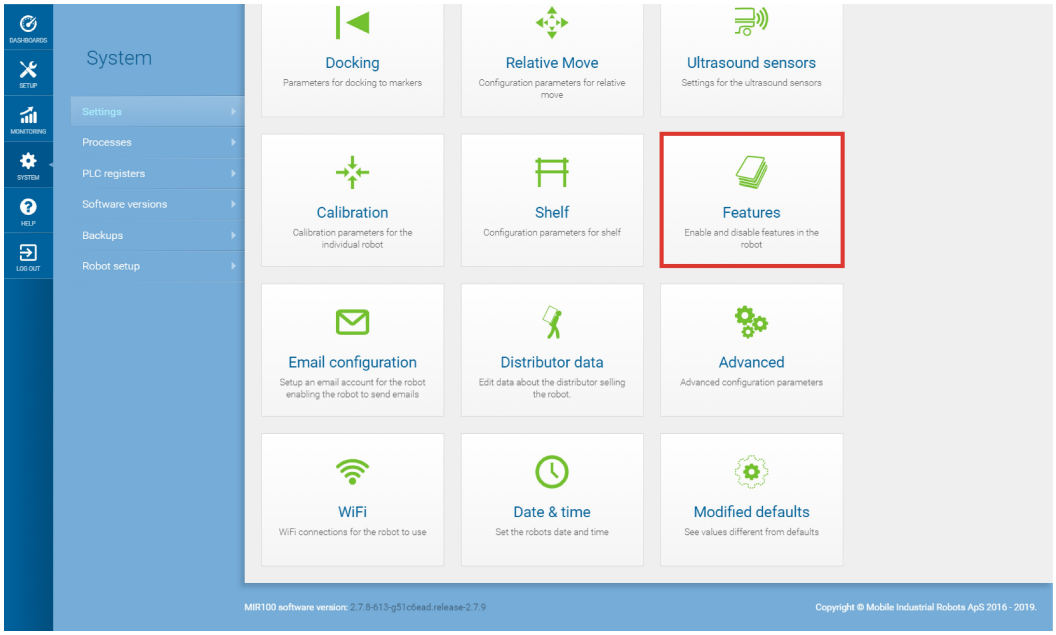


5. The hook is now mounted on the robot.

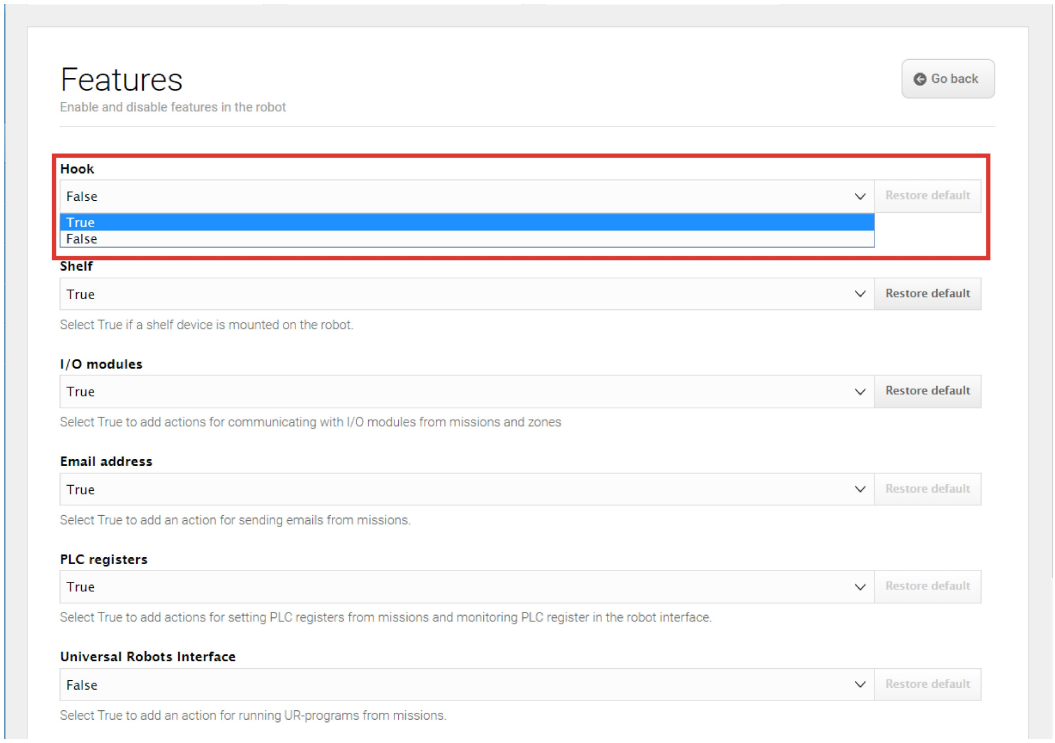
4.4 Enable MiR Hook 100 feature

To access the MiR Hook 100 settings and mission menus, you must first enable them.

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



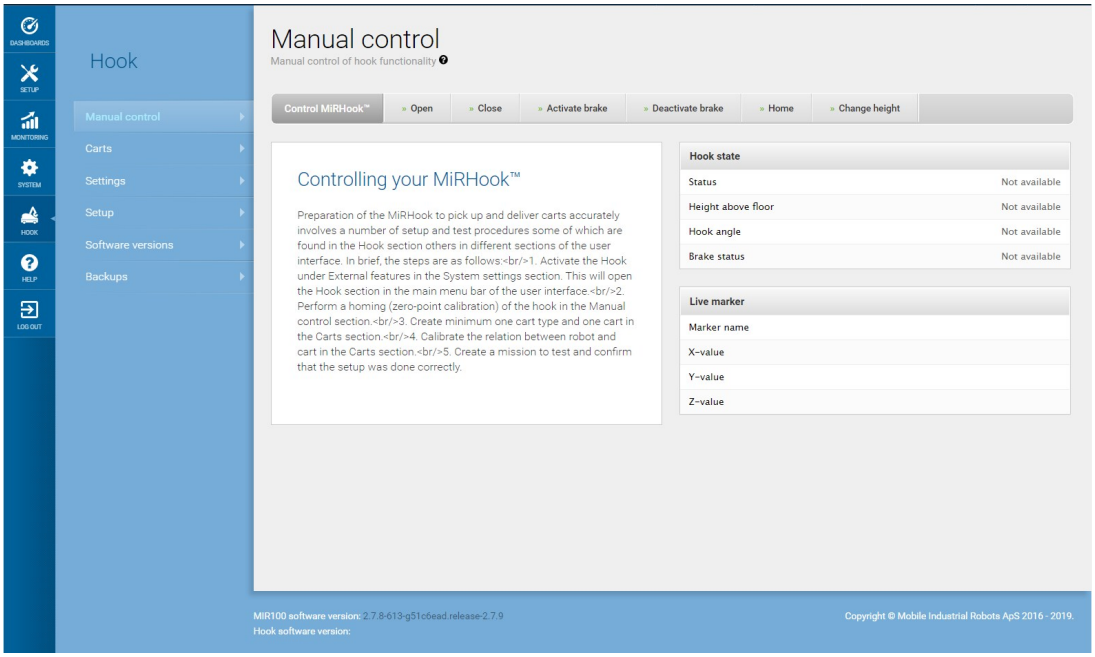
2. Under **Hook**, select **True**.



4.5 Manual test

To ensure that MiR Hook 100 is correctly mounted to MiR100, you must run the hook through a few tests.

Under **Hook > Manual control**, select the following listed actions, and verify that the hook performs as described:

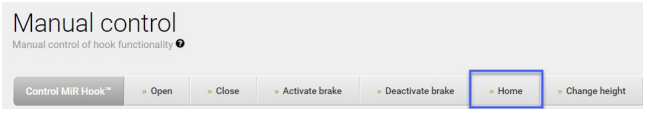


- **Open**: opens the hook gripper.
- **Close**: closes the hook gripper.
- **Deactivate brake**: allows horizontal movement of the hook arm. Always deactivate the brake when driving a robot with a cart is coupled to it.
- **Activate brake**: prohibits horizontal movement of the hook arm. Always activate the brake when driving a robot that does not have a cart coupled to it.
- **Home**: sets the hook to home position (390 mm height).
- **Change height**: sets the current height of the arm.

4.6 Homing

A homing raises the hook to its topmost position and is used as a zero-point calibration of the hook. Homing must be performed as the first action to center the arm.

1. In the Robot interface, go to **Hook > Manual control**.
2. Under **Hook** actions, select **Home**, and wait until the hook stops moving.



3. Select **Deactivate brake**.
4. Manually push the arm close to 0 degrees.
5. Select **Activate brake**.
6. Homing is now complete.

5. Commissioning

This section describes how to get started with MiR Hook 100.

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

Only relevant personnel should be present during commissioning.

5.1 Cart specifications

MiR Hook 100 can accommodate carts with the following dimensions:

- Width: between 400 mm and 1500 mm
- Height: maximum 2000 mm
- Length: between 500 mm and 2400 mm

In addition, the carts must have a gripper area / gripper bar at the front, bottom part of the cart (typically a square tube). This is illustrated in *Figure 5.1*, where the required dimensions are labeled with letters. The required dimensions are listed below:

A. Height position: 80 to 350 mm above thefloor
B. Length: minimum 350 mm
C. Width: 15 to 25 mm

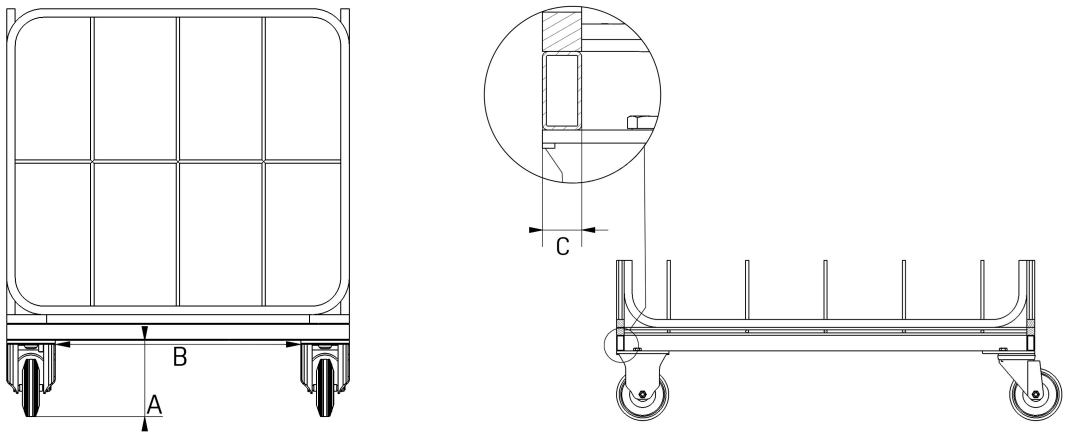


Figure 5.1. Front view of a cart (left), and side view of a cart (right).

For the robot to be able to locate and identify carts, a QR-marker must be fixed on the front of the cart, see QR markers on page 32.

Wheel configuration of the cart

The carts must be fitted with two rigid and two caster swivel wheels. The two rigid wheels can either sit on the front or the back of the cart.

Whether the robot performs better towing a cart with rigid wheels on the front or the back depends on the maneuvering conditions on the individual site and should be assessed before the gripper bar is fixed.

In general, the following rules of thumb apply:

Two rigid wheels on the back and two swivels on the front

With this configuration, the turning radius of the robot and the cart is larger, but the driving is more stable. Reverse parking is easier.

Two swivels on the back and two rigid wheels on the front

With this configuration, the turning radius of the robot and the cart is smaller, making it ideal for areas with tight corner passages.

5.2 Modifying the gripper

It is possible to modify the gripper, if the length or thickness of the cart is slightly out of the specification. Refer to *Figure 5.2* to identify the parts required to modify the gripper. The gripper length can be altered by unscrewing the upper gripper (1) and changing the length between the arms. The lower-gripper (2) can be modified to enable a greater gripper area thickness. This is done by removing the lower-gripper (3) and adding spacers to the mounting of it(4).

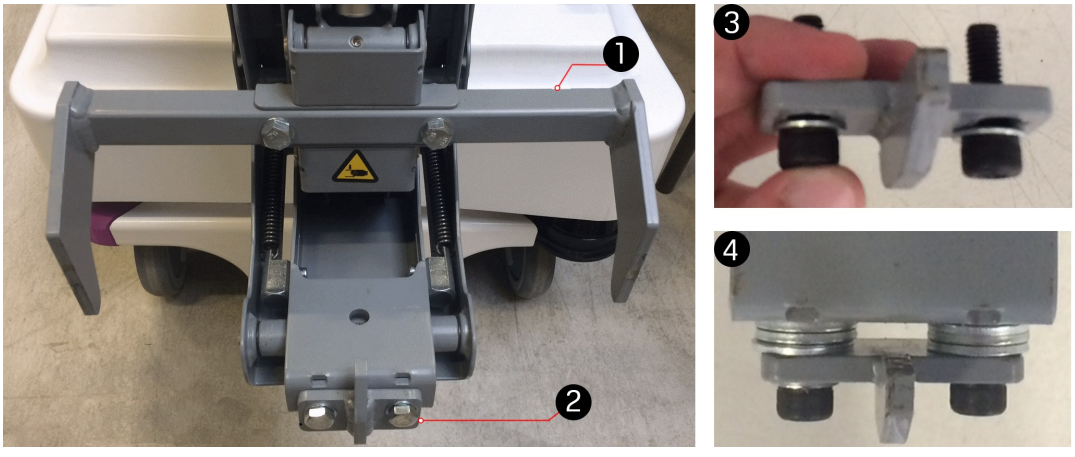


Figure 5.2. Parts included for gripper modification

5.3 Space requirements

This section describes the additional space the robot requires to correctly execute various maneuvers when operating with an attached cart.

NOTICE

The areas where the robot picks up and places carts must be marked as operating hazard zones. Use the striped yellow and black lines in the illustrations in this section to see where to mark the operating hazard zones.

Pick up a cart

As system operator, you are responsible for ensuring that MiR100 with a hook mounted has enough space to pick up a cart. When preparing to pick up a cart, the robot moves in front of the given cart position so the center of the robot is 1.7 m from the center of the cart position. The robot turns around and orients itself so the hook camera is able to read the QR marker before backing towards the cart. If misaligned more than 5 degrees, the robot will fail to pick up the cart and will abort the action.

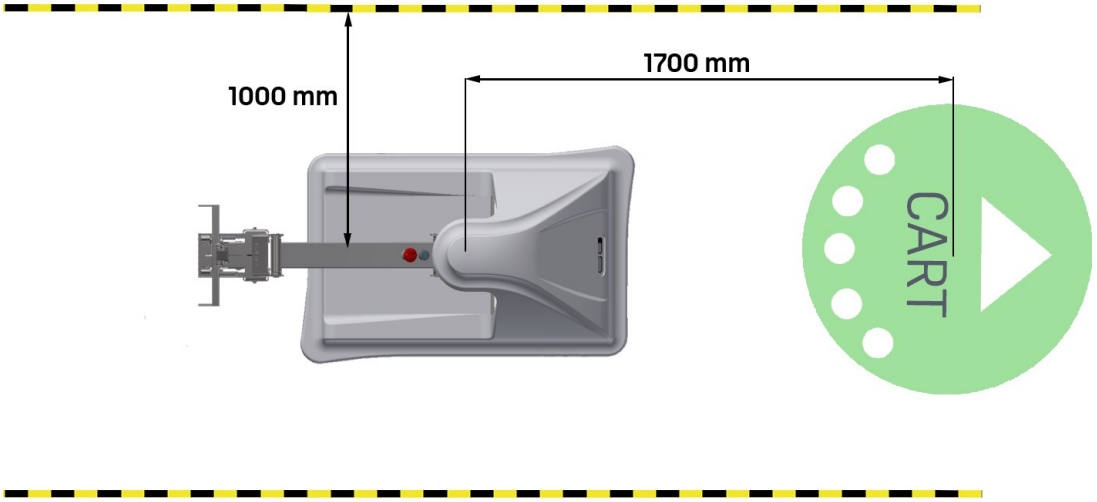


Figure 5.3. Recommended minimum free space around the robot for picking up carts. If a cart position is only used for picking up carts, mark the area as an operating hazard zone as shown in the illustration. If carts are also placed at this position by MiR robots, see *Figure 5.6*.

Make sure the space around the robot is clear, as the alignment is done without checking for obstacles. We recommend at least one meter of cleared area to either side of the robot as shown in *Figure 5.3*.

Drive with a cart

Once a cart is attached to MiR100, the robot does not reverse when driving to another position, see Safety on page 8. As a result, its dynamic obstacle avoidance capabilities are somewhat restricted compared to when a cart is not attached. The system operator needs to keep this in mind when choosing where to run MiR Hook 100.

Turn a corner

The space required to turn a corner depends on the combined length of the robot and cart; a square measuring the total length of the robot and cart plus 500 mm is the recommended minimum space when turning a corner. This is depicted in *Figure 5.4*.

Less than 500 mm may work in areas with no or few dynamic obstacles.

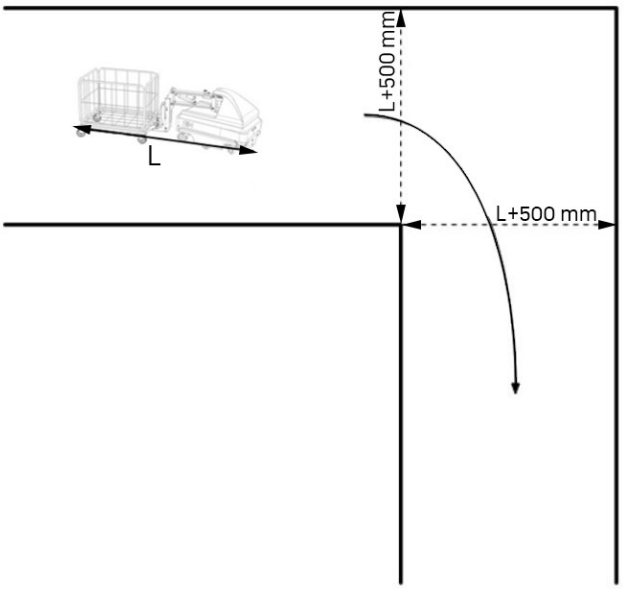


Figure 5.4. To safely turn corners, it is recommended to ensure that there is a free square space measuring the total length of the robot and cart plus 500 mm.

Driving pattern and sensitivity to dynamic obstacles depend on whether the front or rear wheels of the cart are rigid. If the corner space is limited, test which works best in the individual case.

Park a cart

To park a cart, the robot needs at least 500 mm of space to either side of the cart. In addition, it cannot safely park the cart closer than 250 mm to any obstacles behind the cart. However, the robot can pick up a cart parked closer than 250 mm to any obstacles behind it.

The robot is able to park and pick up carts at an angle of less than 5° between the cart and the robot.

Figure 5.5. Minimum free space required around the cart to safely park it.

Park a cart in reverse

The commissioner is responsible for ensuring that under normal operation, MiR100 with a hook mounted has enough space to park the cart. The space required is a square in front of the position equal to the total length of the robot and cart plus 500 mm (the same required square area when turning a corner). The area must be marked as an operating hazard zone. This is shown in *Figure 5.6*.

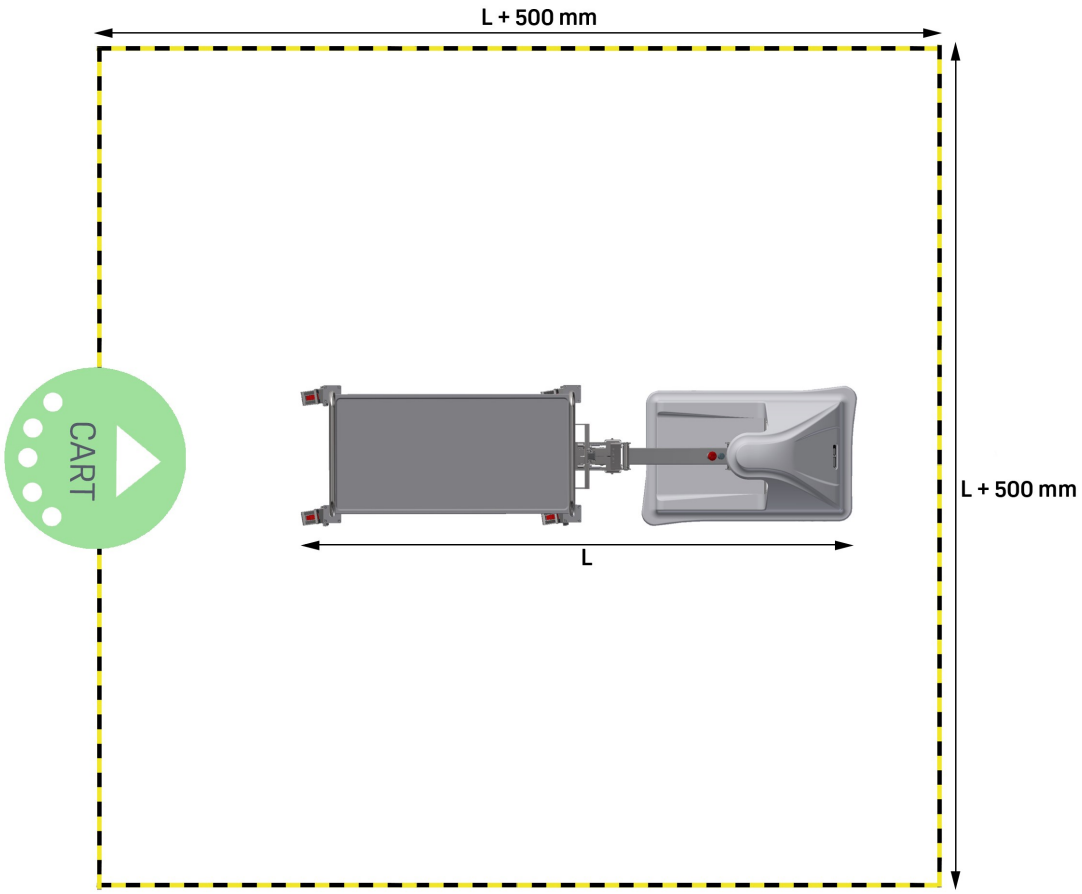


Figure 5.6. The black and yellow striped lines mark the required space for the robot to safely place a cart. L represents the length of the robot plus the cart. This are must be marked as an operating hazard zone.

The following steps describe how the robot reverses and parks the cart at the cart position.

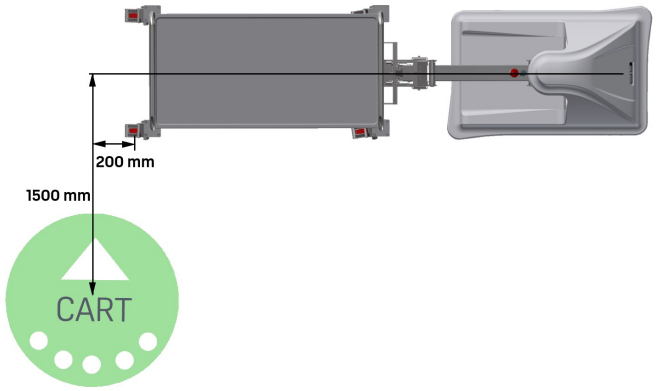


Figure 5.7. Position of the robot and cart before it parks to the cart position.

- The robot moves to a position where the distance from the center of the cart position and the robots center line is 1500 mm. The robot should also be oriented perpendicular to the direction of the cart position (see *Figure 5.7*).
- The robot checks if the placement space is free and then moves with the cart so that the fixed wheels on the cart are 200 mm from the center line in the placement position (see *Figure 5.7*).
- The robot now moves itself with the cart so it is parallel to the direction of the cart position and is ready to reverse into the position.
- When reversing with a cart, the robot will both warn with a loud beeping sound and a flashing yellow light.

CAUTION

When reversing, make sure that the space around the robot is clear. It is mandatory to mark the cart areas as operating hazard zones, where only authorized personnel is allowed. Refer to the image above for the recommended measurements.

Accuracy

The robot places and picks up carts with an accuracy of 200 mm radius from the specified position and with an angle difference less than 10° relative to the specified position, as shown in *Figure 5.8*.

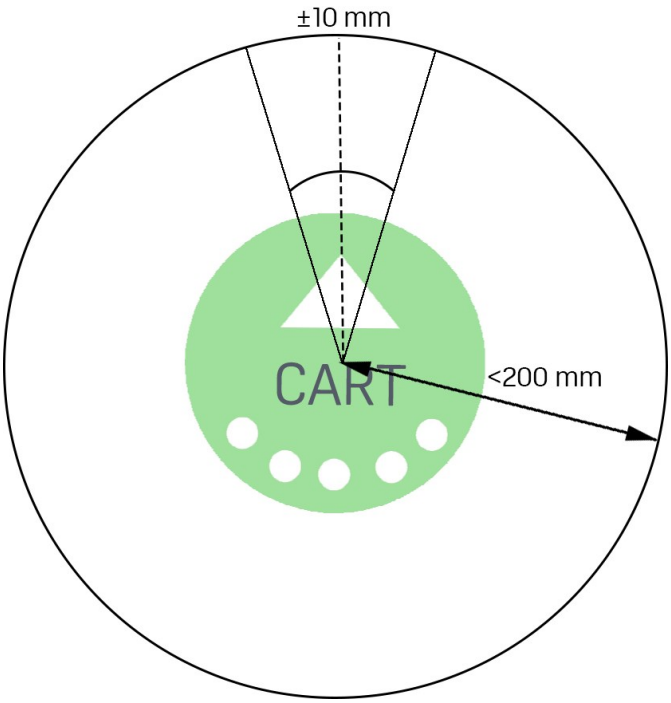


Figure 5.8. The accuracy of MiR Hook 100.

Each cart is identified by its QR-marker. If several carts share the same QR-marker, the carts must be identical, and the QR-marker must be placed within +/- 5 mm precision on all carts.

5.4 Safety precautions when operating with carts

Each individual application of MiR Hook 100 requires its own safety evaluation.

The robot cannot detect objects between the robot and the cart, and it cannot detect objects behind the cart (the robot does not reverse as part of the route; however, it can reverse when parking a cart). For the same reason, it is not possible to drive more than one cart at a time. In other words, it is not allowed to chain carts together.

Two sets of depth cameras are installed at the front of MiR100. These are used to detect objects at a maximum height of 1800 mm and a maximum distance of 1950 mm. The cameras do not detect object within 50 mm of the lenses.

When driving with a cart, the maximum speed of the robot is 1.5 m/s.

MiR Hook 100 can move carts with a total payload (incl. the weight of the cart itself) of 300 kg when driving on a horizontal, flat, and clean concrete surface with an incline of less than 1%. When driving on a surface with an incline between 1% and 5%, the maximum payload is 200 kg.

5.5 QR markers

A QR marker is needed for MiR Hook 100 to identify the individual carts. The QR code contains the dimension of the marker and a unique name. The format is **SizeUnit-Name**.

- Size: the length of one of the sides of the quadratic QR code.
- Unit: the measuring-unit of the size, for example mm (millimeters) or in (inches) etc.
- "-": Remember the hyphen (-) which separates size and unit from the name.
- Name: a unique name displayed in the system.

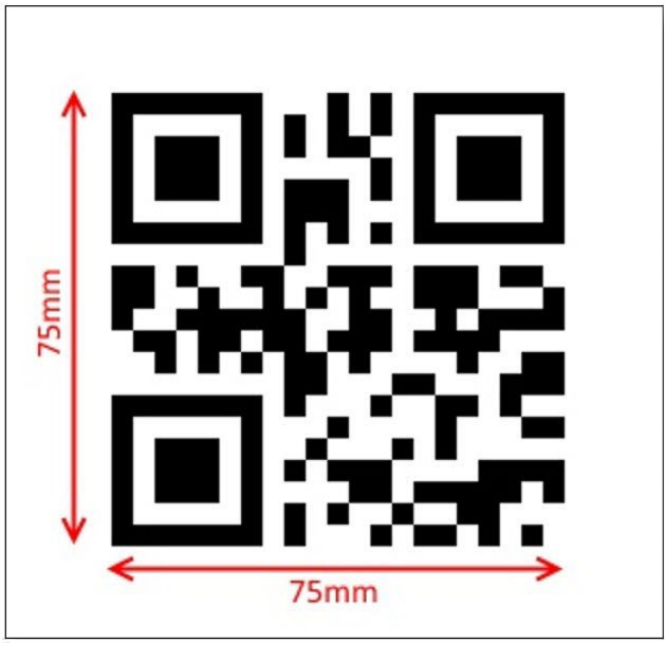


Figure 5.9. This QR code reads "75mm-Cart_A".

The recommended size of a QR marker is between 70 and 100 mm, but the system is open to all other sizes. The limit is whether the camera can see the QR marker or not. It is required that at least 25 mm of empty white space surrounds the QR code.

QR markers can be created using any QR code generator. As long as the size is the same as stated in the QR code, there are no requirements for how to create the codes. An easy and free method is to search the internet for QR code generators and use one of the many results.

Be sure to print a QR marker in 1:1 scale. If it does not match the size, it will not work.

It is recommended to use less than 17 characters in the QR code. For example, "75mm-Cart_A" is 11 characters long. If more characters are added, the QR code will change format, and it will become more difficult to detect.

6. Usage

It takes several steps in the robot interface to set up the robot to pick up and place carts with a MiR Hook 100 mounted on top of MiR100.

This guide describes how to create a mission to pick up and place a cart. This mission example is titled *Cart mission.*

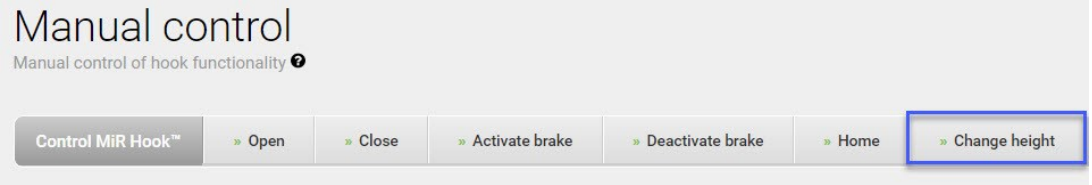
The steps for creating the mission example are described in this chapter and are outlined in the following points:

- Creating a cart on page 36. You must define the dimensions and docking parameters of the various types of carts your robot transports.
- Setting cart positions on the map on page 38. The positions of carts must be defined on the robot map so the robot knows where to go to pick up or place carts.
- Creating a cart mission on page 40. Creating a simple mission to pick up and place carts

After these steps are carried out, the robot is able to pick up and place carts autonomously.

6.1 Calibrate cart

It is important to calibrate the relation between MiR Hook 100 and the cart. In the **Manual control** menu under **Hook**, you must now enter values into the **Change height** field to define entry and lock heights for the hook to use when docking to and gripping a cart.



When a value is entered in **Change height** and confirmed, the hook will move up or down depending on the chosen value. The value represents the height from the bottom of the hook to the ground (mm).

1. Insert a height which enables the hook to go underneath the cart. This is known as the entry height. Remember the value as you will need it when defining the dimensions of the cart.
2. Place the cart over MiR Hook 100.

3. Now enter a height which enables the hook to grip the bottom frame (gripper bar) without lifting or pushing the cart. This step may require some trial and error until you have the correct height. This height value is known as the lock height, and is also used when defining the dimensions of the cart.
4. Change the height back to the entry height, and make sure the cart is still positioned over MiR Hook 100.
5. Now attach the QR-marker to the cart so that the camera on MiR Hook 100 can see it when MiR Hook 100 is ready to grip the cart.

NOTICE

The QR-marker must be oriented vertically when fixed on the cart grating. In other words, the QR code must be facing the Hook camera directly and may not be tilted in any direction. Otherwise, the camera may have problems reading the code.

If the camera can see the QR-marker, the position values are displayed. Otherwise, the fields will just display N/A.

The calibration is now completed. Do not move the robot, hook, or cart.

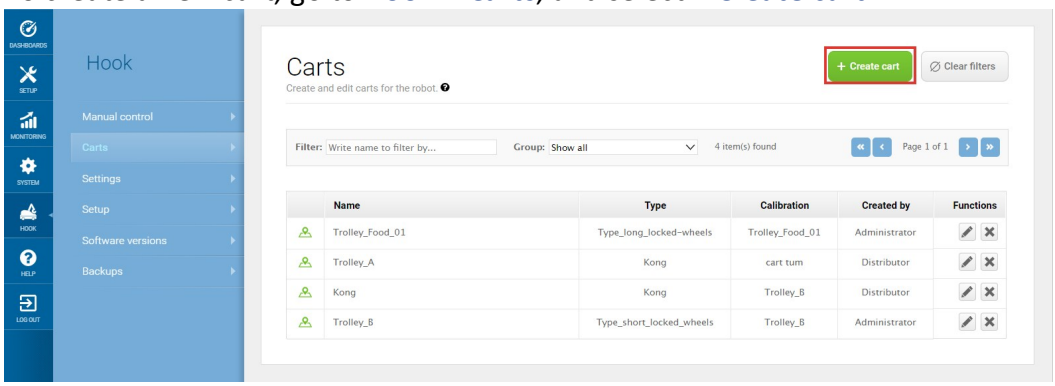
6.2 Creating a cart

Before creating missions with carts, you need to define the different carts that your robot will be docking to. This information is used when the robot is picking up, placing, and towing the cart to ensure that the cart is correctly transported.

To make the robot interface display hook options, you must enable the feature as described in Enable MiR Hook 100 feature on page 20.

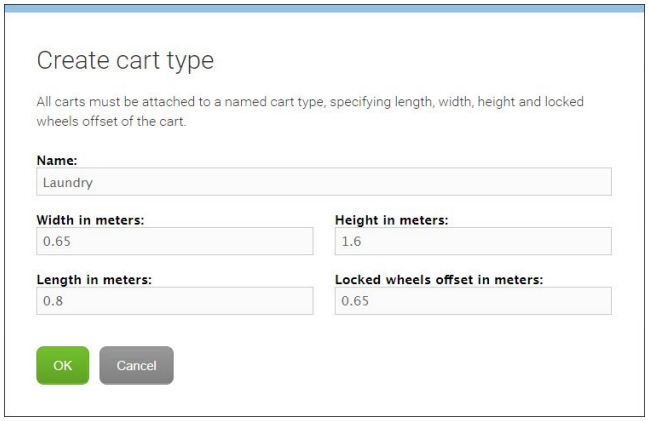
Follow these steps to create a new cart:

1. To create a new cart, go to **Hook > Carts**, and select **+ Create cart**



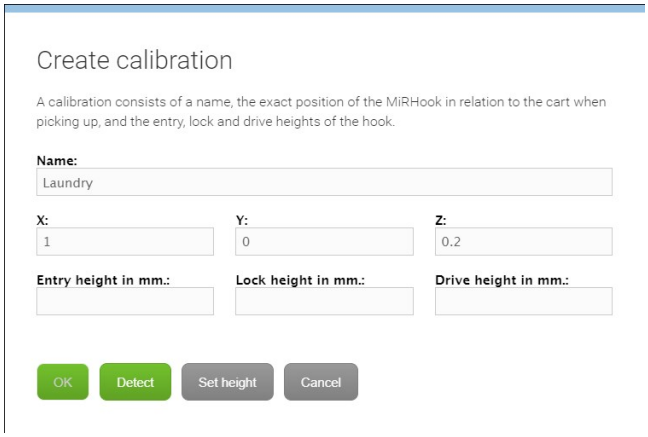
2. Under **Name (QR ID)**, insert the name corresponding the QR ID of the cart. You can either insert the name manually, or you can place the QR code in front of the Hook camera and select **Detect** to automatically fill out the name.

3. Under **Type**, select **Create / Edit**. Here you can either select an existing cart type, or create a new cart type by selecting **Create type**. When creating a new cart type you must defined the following parameters:



- **Name**: Is used to identify the cart type.
- **Width**, **Height** and **Length**: These are the dimensions of the cart. They are also identified in the image below.
- **Locked wheels offset**: The locked wheels offset is the distance from the front of the cart to the locked wheels axis.

4. Under **Calibration**, select **Create / Edit**. Here you can either select an existing cart calibration, or create a new calibration by selecting **Create calibration**. When creating a new calibration you must defined the following parameters:



- **Name**: Is used to identify the calibration settings. This will automatically be filled when you select **Detect** and MiR Hook 100 is correctly positioned to read the QR code of the cart.
- **Entry height**: Defines the height of the hook when the robot can move the gripper beneath the gripper bar. This is the height the robot should currently be set to. Select **Detect**, and if MiR Hook 100 is correctly positioned to read the QR code of the cart, the Entry height will be entered.
- **X, Y and Z**: These are used to define the exact position of MiR Hook 100 relative to the cart. If MiR Hook 100 is positioned at the Entry height determined in Calibrate cart on page 34 and the camera is in front of the UR code, you can select **Detect** to automatically fill in these parameters.
- **Lock height**: Defines the height of the hook when the gripper is securely attached to the gripper bar. This is the value determined in Calibrate cart on page 34 step 3.
- **Drive height**: Defines the height of the hook that should be used while the robot is towing the cart. This is often the same as the Lock height.

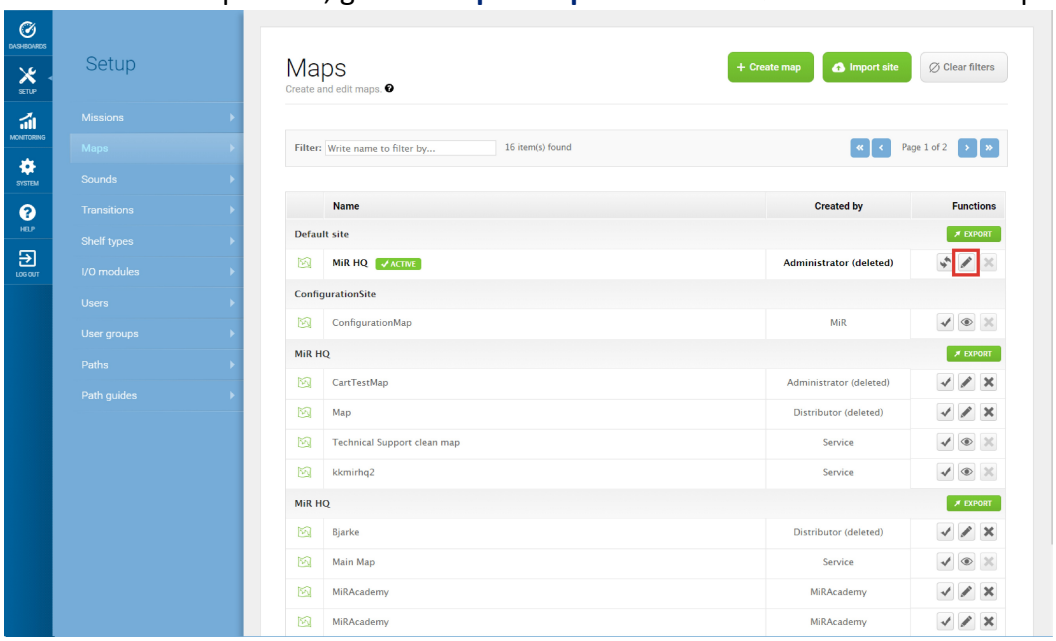
5. Select **Save changes** when you are done. The cart is now displayed in the list of carts.

6.3 Setting cart positions on the map

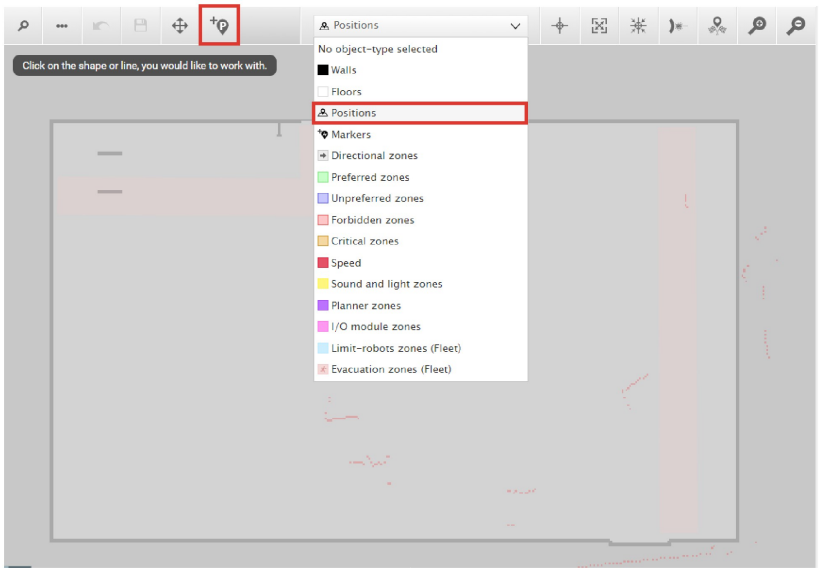
To create the mission *Cart mission*, cart positions must be defined in the map. It is only at cart positions that the robot is able to pick up carts.

Follow these steps to create a cart position:

1. To create a new position, go to **Setup > Maps**. Select **Edit** for the active map.

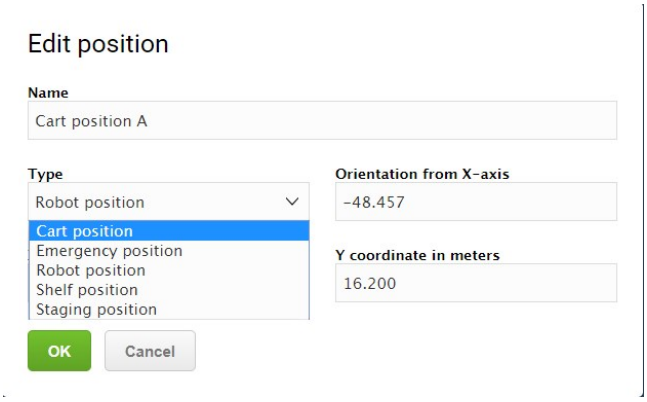


2. Within the editor, select **Positions** in the **Object-type** drop down menu, and select **Draw new position** in the editor tools.



3. Select the point on the map where you want the cart position to be placed.

4. In the **Create position** dialog box, name the position, and under **Type**, select **Cart position**.



5. Select **OK** to create the cart position. The position is now visible on the map.

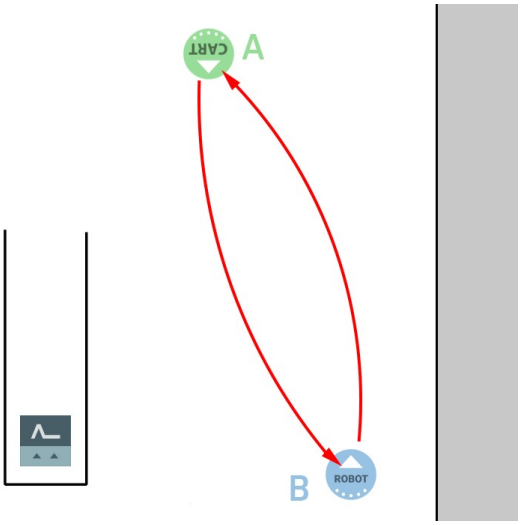
If you want to make more than one position on the map, repeat the previous steps.

6.4 Creating a cart mission

This section describes how you create the example mission *Cart mission*. The mission demonstrates how you use cart actions in your mission. After creating this example mission, you can modify the mission to include more complex actions. To make the example yourself, it is assumed that you completed the following:

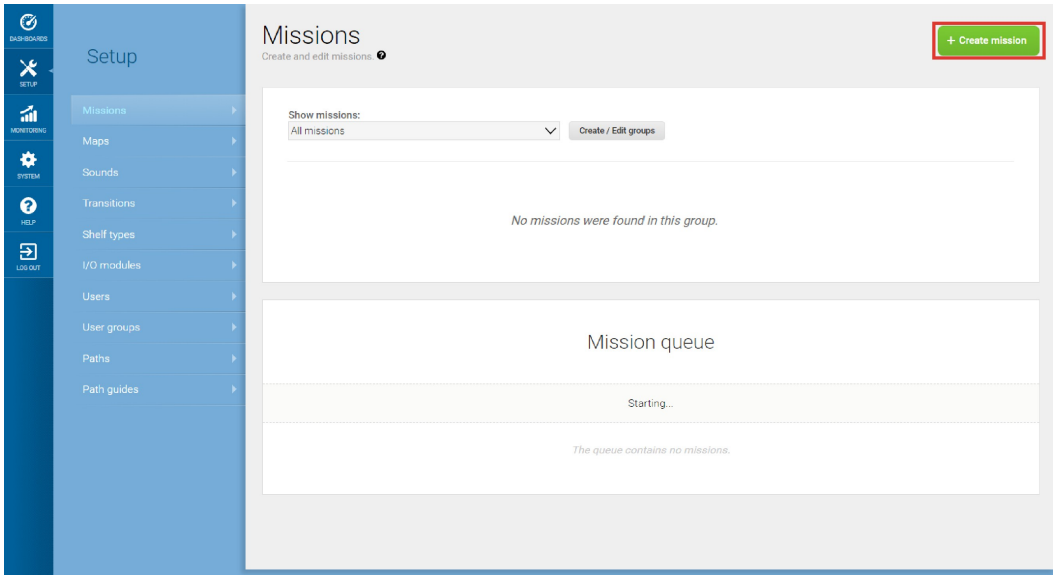
- Enabled the **Hook** feature, as described in Enable MiR Hook 100 feature on page 20.
- Created two cart positions titled **Position A** and **Position B**, as described in Setting cart positions on the map on page 38.
- Placed a cart at the physical location of **Position A** and defined the cart, as described in Creating a cart on page 36. In this example, the name of the cart is **Basic cart**.

The goal of the mission is to pick up a cart at **Position A**, drive to **Position B** with the cart, and drive back to position A to place the cart.



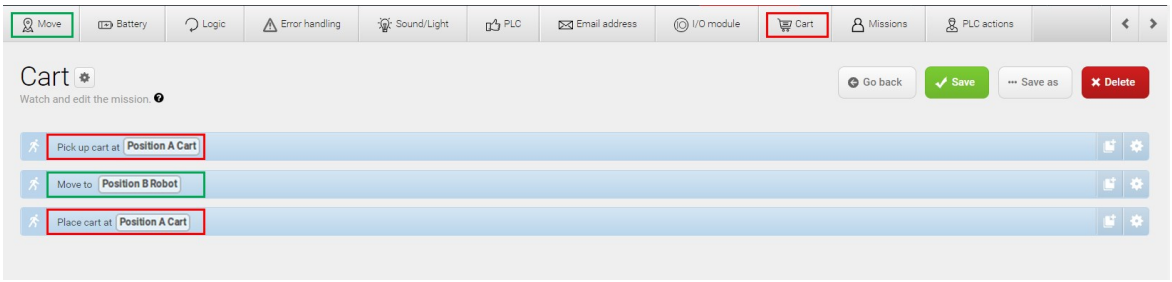
Follow these steps to create the example mission *Cart mission*:

1. To create a new mission, go to **Setup > Missions** and select **Create mission**.



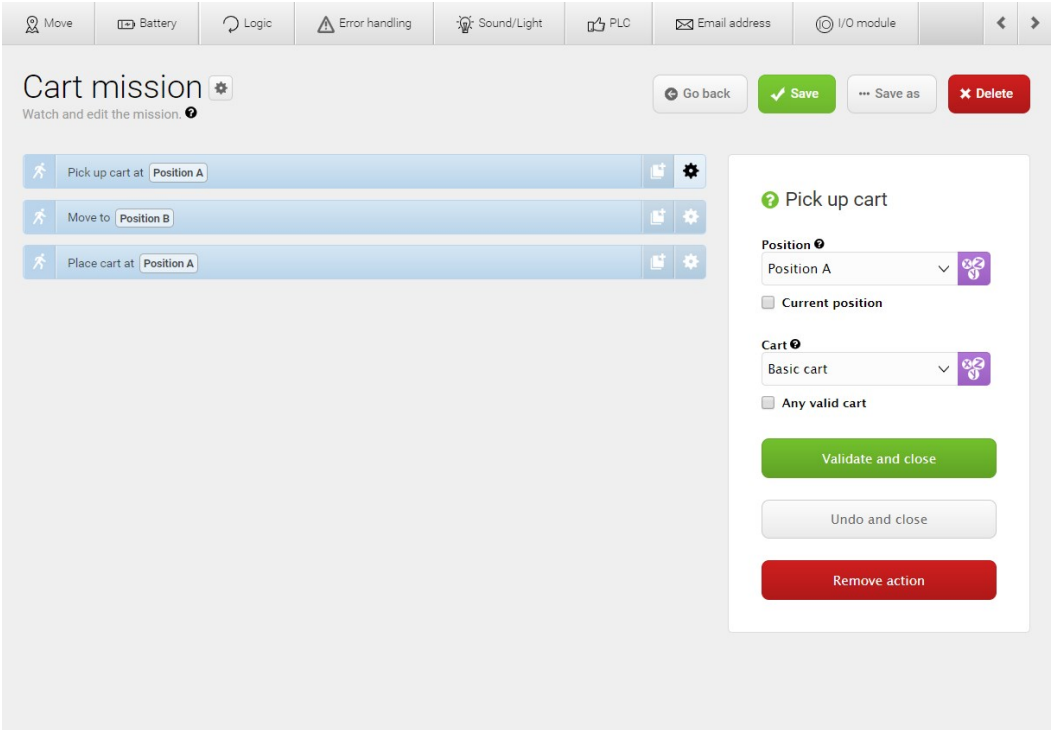
2. Name the mission *Cart mission*, and select a mission group and site. Select **Create mission** when you are done.

3. Select the following actions:
   - In the **Cart** menu, select **Pick up cart**.
   - In the **Cart** menu, select **Place cart**.

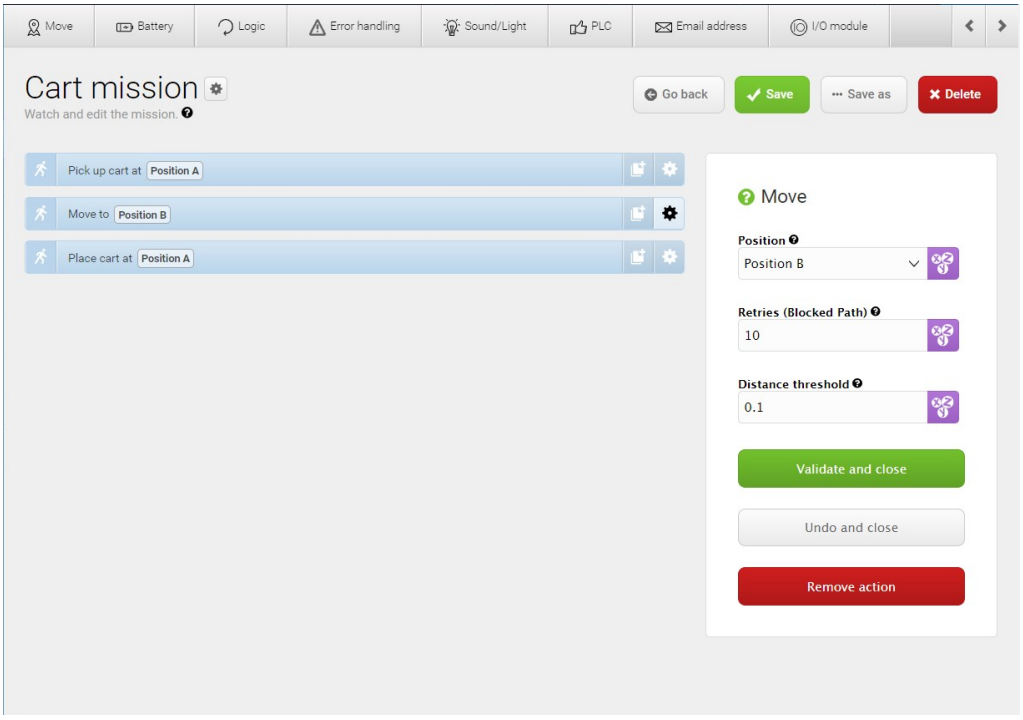


The following steps describe which parameters each action should be set to. To modify the parameters, select the gearwheel ⚙ at the right end of the action line to open the action dialog box. When you have set the parameters, select **Validate and close**.

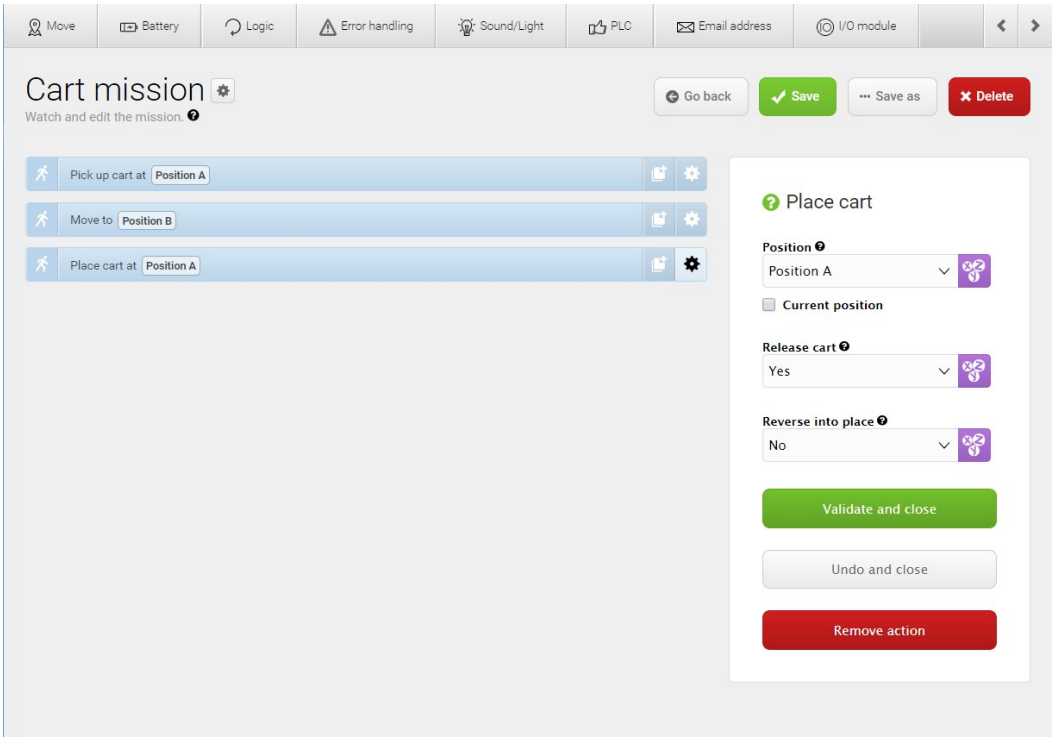
4. For the **Pick up cart** action, set the parameters as follows:
   - **Position**: Select **Position A**.
   - **Cart**: Select the cart that is placed at **Position A**. In this example, the type is **Basic cart**.



5. For the **Move to** action, set the parameters as follows:
   - **Position**: Select **Position B**.
   - **Position type:** Select **Main**.
   - **Retries**: Leave the number of retries at the default value of 10.
   - **Distance threshold**: Leave the threshold at the default value of 0.1.



6. For the **Place cart** action, set the parameters as follows:
   - **Position**: Select **Position A**.
   - **Release cart**: Select **Yes** to make MiR Hook 100 release the cart and leave it at the position.
   - **Reverse into place**: This parameter describes how you want your robot to move to the cart position. There are the following options:
     - **No**: The robot will drive to the position in any way it can. This can be used if the position is in an open area, and the robot can leave the position after releasing the cart.
     - **Yes, with collision check**: The robot will reverse into the position and activate collision check so it scans for obstacles while reversing.
     - **Yes, without collision check**: The robot will reverse into the position without activating collision check so it does not scan for obstacles.



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

7. Maintenance

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

The stated intervals are indicative and depend on the operating environment and frequency of usage of the robot.

NOTICE

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

7.1 Regular weekly checks and maintenance tasks

Once a week, carry out the following maintenance tasks:

Parts	Maintenance tasks
3D cameras	Check for dust and clean. We recommend using anti-static lens spray and a lens cloth.

7.2 Regular checks and replacements

Before starting replacement tasks:

- Press the **On/Off** button to turn off the robot.
- Push the battery switch button to remove power from the battery.
- Turn off relays and unplug the battery.

The following table contains the parts that you should check and the intervals when you should do that:

Part	Maintenance	Interval
Pins	Check that all pins are mounted correctly and the set screws are tightened. If the set screws are not tightened enough; remove them, apply screw locking adhesive, and re-apply the screws.	Check monthly and replace as needed.
Visual inspection of the mechanical parts (gripper and vertical console)	Check for cracks or bending, and check the springs.	Check monthly and replace as needed.
Visual inspection of cables	Check if the cables are jammed or damaged and if the insulation is intact.	Check monthly and replace as needed.
Angle encoder	Loosen the brake in the interface (**Hook > Manual Control > Deactivate brake**), grab the hook arm and swing it slowly from one side to the other. Check if the LED light is green all the way.	Check monthly.

Part	Maintenance	Interval
Brake	Check the resistance and function of the brake. If the brake is activated, there should be resistance. If the brake is deactivated, the movement should be smooth. If the brake is not working properly, make sure that the hook service kit has been implemented. Read more in our How to guides on the Distributor site.	Check monthly, and clean the brake pad with brake cleaner when needed.
Hook	Check the gripper function and perform a homing in the interface, see Homing on page 22.	Check monthly.
Bolts in top interface	Remove the hook cover and check if the four bolts in the top interface are tightened.	Check monthly.
Safety marking on the floor	Check if the safety markings made with for example, tape around cart pick-up and drop-off points are intact and visible.	Check every six months, and replace as needed.

8. Updating MiR Hook 100 software

This section describes how to update the robot software.

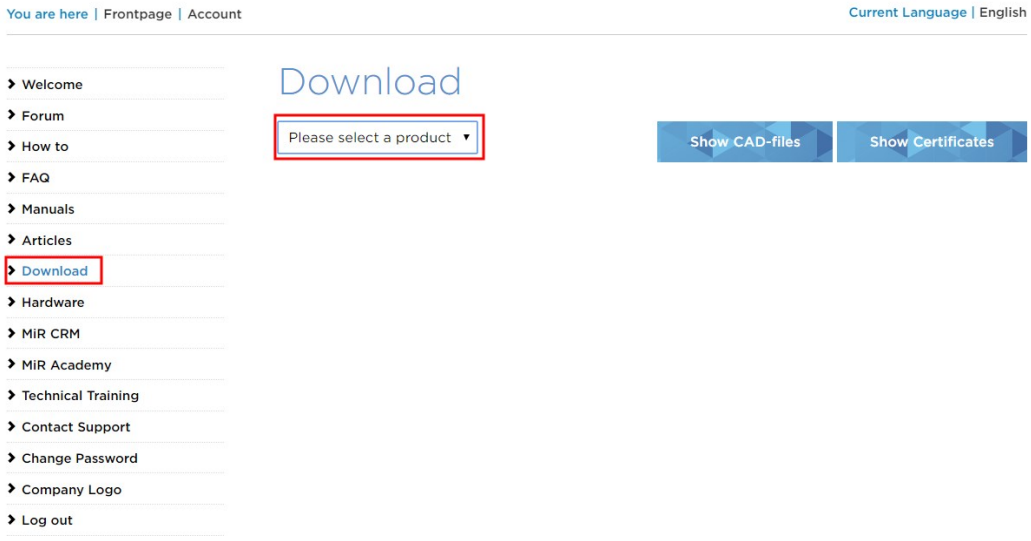
MiR continuously updates the software the robots use, either to fix issues, to improve existing features, or to introduce new features. Each software release is issued with a release note explaining the content of the update and its target audience.

NOTICE

When updating MiR100 with an attached MiR Hook 100, the hook software must be updated first to ensure that the robot is compatible with the hook when uploading the software.

Follow the steps below to update MiR Hook 100 software:

1. Go to the MiR Distributor site and sign in with your credentials.
2. Select **Download** and select MiR Hook 100 in the product drop down menu.

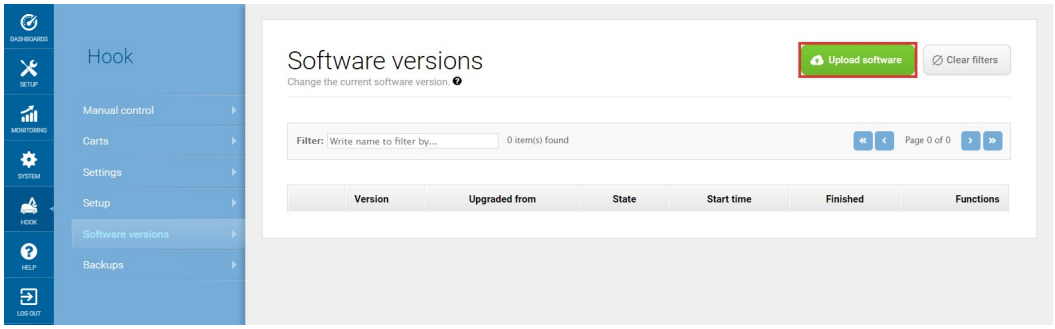


3. Download the desired version of **MiR Software Robot / Hook / Fleet 2 version x.x.x**.

Software

File	Last update	
MiR Software Robot / Hook / Fleet 2 version 2.8.0.3	19 Dec 2019	Download
MiRFleet 1 version 2.8.0	19 Dec 2019	Download
Known Product Issues Note 2.8.0	19 Dec 2019	Download
Product release note 2.8.0.pdf	19 Dec 2019	Download
MiR Fleet Server Solution 2.8.0	20 Dec 2019	Download

4. Connect your computer to the WiFi of the robot you want to update, and sign in to the robot interface.
5. Navigate to **Hook > Software versions** and select **Upload software**.



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