Operating guide (en)

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Copyright and disclaimer

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Table of contents

1. About this document

This guide describes how to set up and use MiR Precision Docking. It includes information regarding safe usage, mounting of the MiR Precision Docking station, how to operate MiR Precision Docking, and how to create missions that use the precision docking features.

1.1 Where to find more information

At www.mir-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 the robot quickly. This document is in the box with the robot in the printed format. Quick starts are available in multiple languages.
  - **User guides** provide all the information you need to operate and maintain the robot. User guides are available in multiple languages.
  - **Risk Analysis Guides** include guidelines for 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 MiRFleet and MiR AI Camera.
  - **Reference guides** contain descriptions of all the elements of the robot and MiRFleet interface. Reference guides are available in multiple languages.
  - **REST API references** for robots, hooks, and MiRFleet.
  - **MiR network requirements** specify the performance requirements of your network for MiR robots to operate successfully.

- **Distributor site > Download**
  http://www.mobile-industrial-robots.com/en/account/download/
  This page contains the following resources:
  - **CAD drawings** of MiR products are displayed by selecting **Show CAD-files**.
  - **Certificates** for the robots are displayed by selecting **Show Certificates**.
  - **Software** and **Product Release Notes** for your MiR product are displayed by selecting your product in the drop-down menu.
- **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 Precision Docking product page**
  http://www.mobile-industrial-robots.com/en/products/mir-add-ons/mir-precision-docking/
  This page contains specifications, pictures, and brochures for MiR Precision Docking.

1.2 Version history

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

Revision	Release Date	Description	SW	HW
1.0	2019-18-08	First edition	2.7.0	1.0
1.1	2019-27-09	Added chapter Maintenance on page 22.	2.7.0	1.0
1.2	2019-11-13	Small corrections	2.7.0	1.0

2. Safety

Read the information in this section before powering up and operating MiR Precision Docking.

Pay particular attention to the safety instructions and warnings.

NOTICE

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

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.

CAUTION

Risk of injury if a person is standing between MiR100/MiR200 and MiR Precision Docking station when the robot is docking.

- Ensure that all personnel are instructed not to stand close to a robot docking to a MiR Precision Docking station, and that the docking position is clearly marked as a operating hazard zone with visible tape or similar.

CAUTION

Risk of injury if you insert fingers inside the precision mounting holes of MiR Precision Docking.

- Do not insert your fingers in the precision mounting holes while the robot is on.

3. Product presentation

MiR Precision Docking is used in cases where high precision is required. It enables a MiR100/MiR200 to dock with a precision of ±1 mm left and right, and ±1 mm in depth. This is illustrated in *Figure 3.1*.

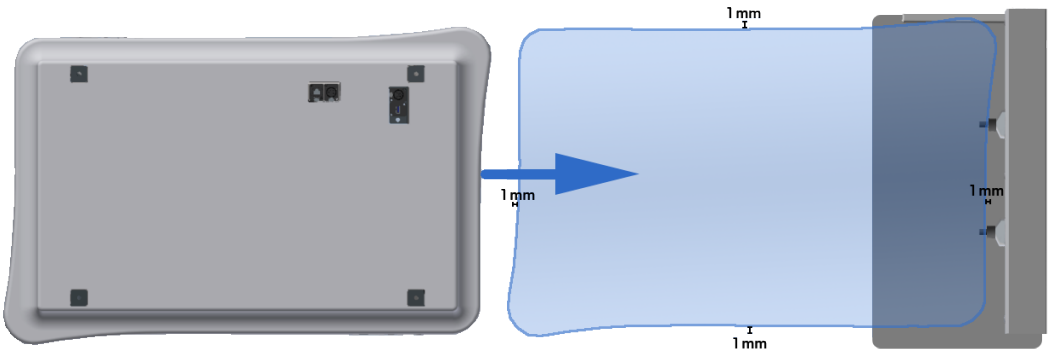


Figure 3.1. A MiR robot can dock with a precision of less than 1 mm in horizontal directions when using MiR Precision Docking.

The product consists of two parts: a set of precision holes mounted in the robot, known as the robot part; and a VL-marker station with a pair of precision pins. When the robot docks, it aligns the precision holes and pins to guarantee a precise docking. When the pins are inserted in the holes, the robot locks onto the docking station to ensure the robot is not displaced. When the robot needs to move to another position, the robot releases the pins, enabling the robot to undock. The pins are also released if you use Manual control to move the robot from the station.

You can also release the pins manually by pressing the Manual pin release button located on the side of the robot.

The robot part is already installed in MiR100/MiR200. The station can be placed anywhere that is accessible by the robot. It is important that free space is available around the station to ensure the robot is able to dock safely.

3.1 External parts

Figure 3.2 identifies the parts of the robot that are unique to a MiR100/MiR200 robot installed with MiR Precision Docking.

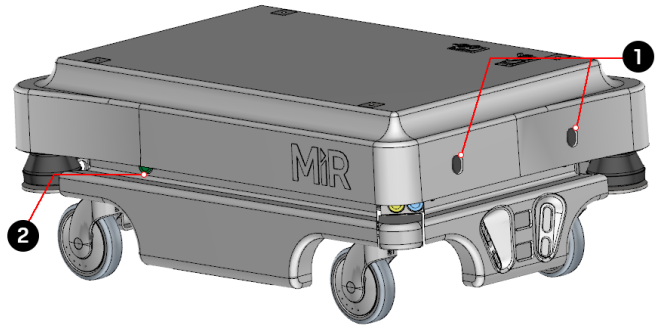


Figure 3.2. MiR100 installed with robot part.

Label	Description	Label	Description
1	Precision holes	2	Manual pin release button

3.2 Internal parts

The robot part is shown in *Figure 3.3*. The internal unit is located at the front of the robot beneath the robot's cover.

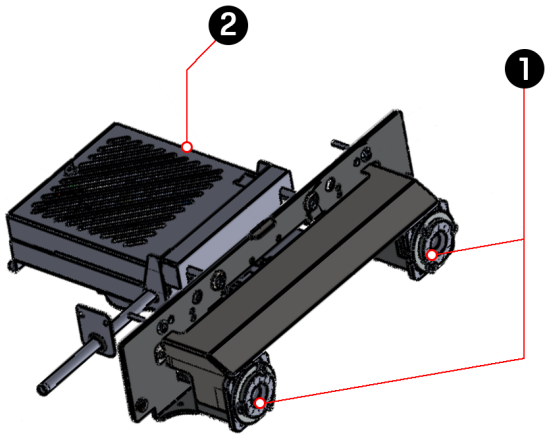


Figure 3.3. The robot part before it is installed in MiR100/MiR200.

Label	Description	Label	Description
1	Precision holes	2	Internal unit

4. Getting started

This section describes how to mount MiR Precision Docking, and prepare it for use.

4.1 In the box

This section describes the content of the MiR Precision Docking box.

The box contains:

1. MiR Precision Docking station
2. MiR100/MiR200 with MiR Precision Docking robot part

4.2 Mounting the MiR Precision Docking station

MiR Precision Docking consists of two parts: a robot part and a station.

NOTICE

The part mounted to the MiR robot is fitted in the MiR factory and should not be modified manually.

Figure 4.1 is an illustration of the mountable station with precision pins. There are three mounting holes that enable you to fix it to walls or other structures.

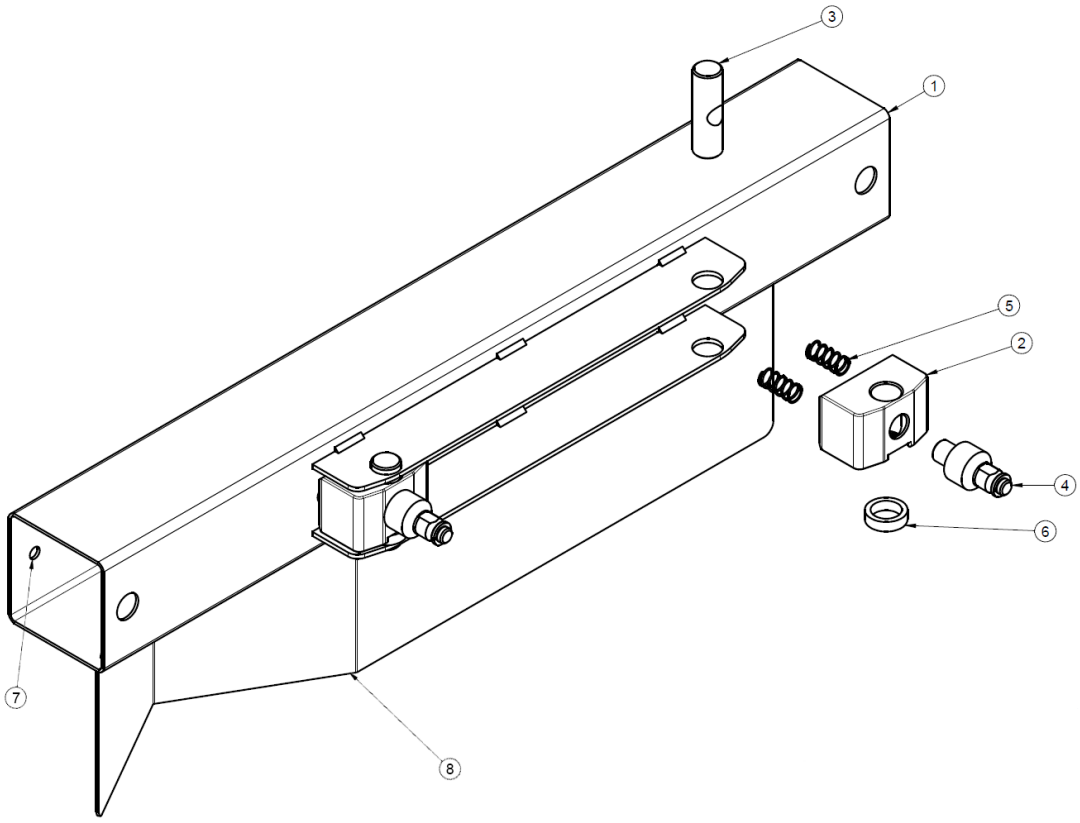


Figure 4.1. Mountable docking station with precision pins.

Label	Description	Label	Description
1	Mounting bar	2	Precision pin block
3	Block axle	4	Precision pin
5	Coil springs	6	Wave springs
7	Mounting hole	8	VL-marker

When mounting the MiR Precision Docking station, it is important that the station is mounted at the correct height from the floor, so the precision pins align correctly with the robot part. *Figure 4.2* describes the distances between the three mounting holes.

For the MiR robot to dock correctly, the surface the station is mounted to must be plane and perpendicular to the floor surface the robot drives on.

The following steps describe how to mount the station correctly.

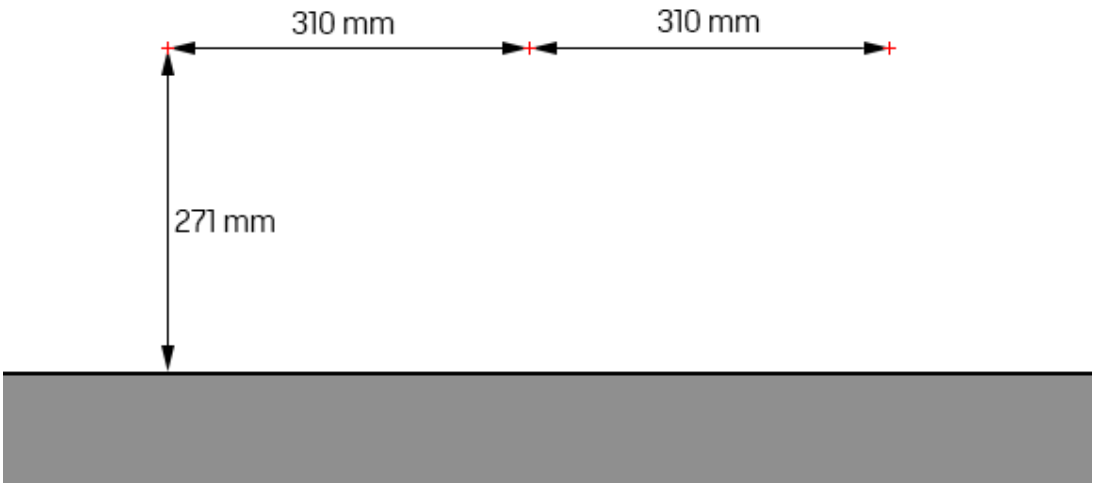


Figure 4.2. The red crosses mark the positions of the three mounting holes. The vertical measurement is from the floor, and the horizontal measurements are the horizontal distances between the holes.

1. Mark the three points shown in *Figure 4.2* on the wall, or other vertical surface, that the station is to be mounted to.
2. Place the station over the marked points, so they are visible through the mounting holes. Verify that this is the position where you want the station to be mounted.

It is a good idea to check that the height of the precision pins at this position aligns with the precision holes of the robot.

3. When satisfied, remove the station and drill three holes to fit the mounting holes. Consider inserting wall plugs to ensure a secure mounting, in which case the drilled holes must accommodate the size of the chosen plugs.
4. Place the station back in the desired mounting position, and screw in three bolts through the mounting holes to fix the station to the wall.

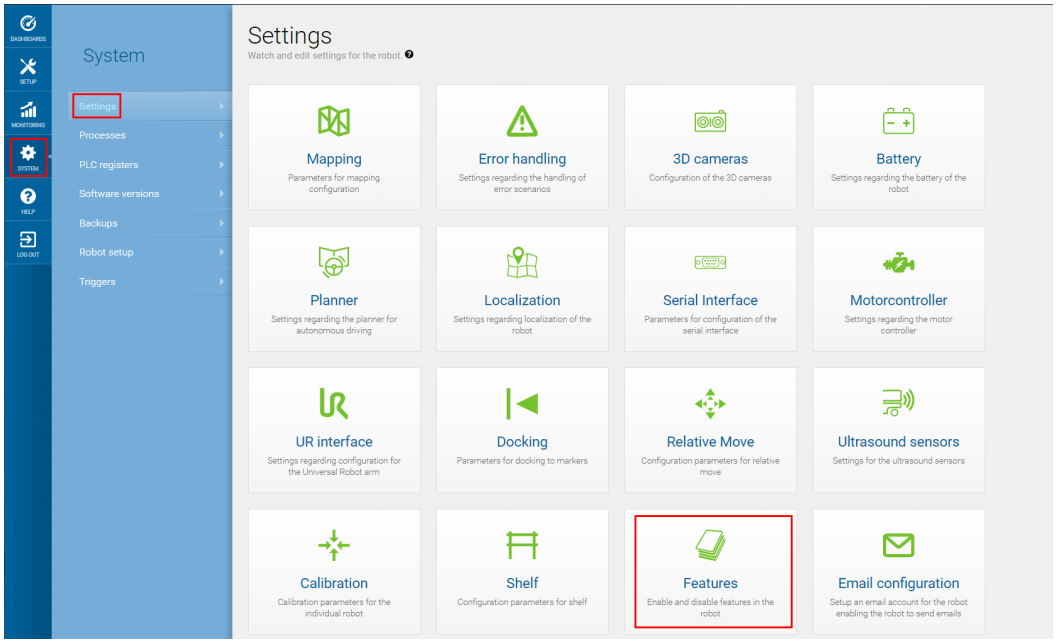
5. Usage

Before being able to use MiR Precision Docking, you must enable the feature on the robot with the mounted precision holes. In the map editor, it is then possible to create precision docking markers that can be used in missions. This section describes how to enable MiR Precision Docking and then use it in missions.

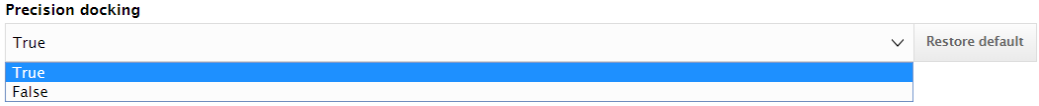
5.1 Enable MiR Precision Docking

The following steps describe how to enable the use of MiR Precision Docking in the Robot interface.

1. Go to **System > Settings > Features**.



2. Under **Precision docking** select **True** in the drop down menu.



You have now enabled MiR Precision Docking and can create precision docking markers.

5.2 Creating a precision docking marker on the map

This section explains how to create a precision docking marker on a map.

Before creating the marker, you must ensure that the robot is localized correctly in an active map. If in doubt, you can check if the red lines representing the laser scanner line match the black lines on the map as shown in *Figure 5.1*.

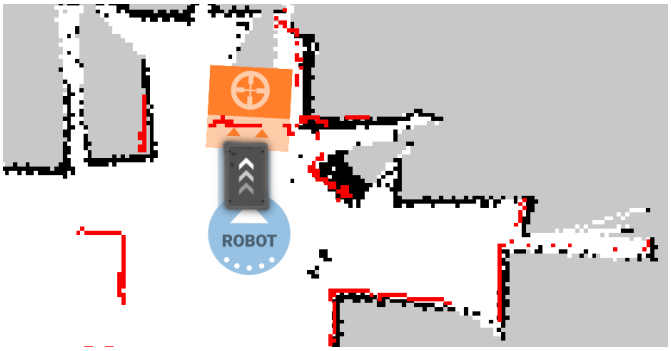
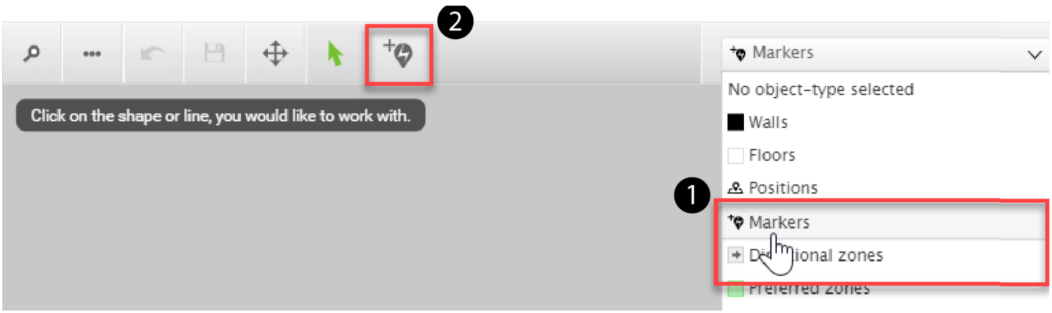


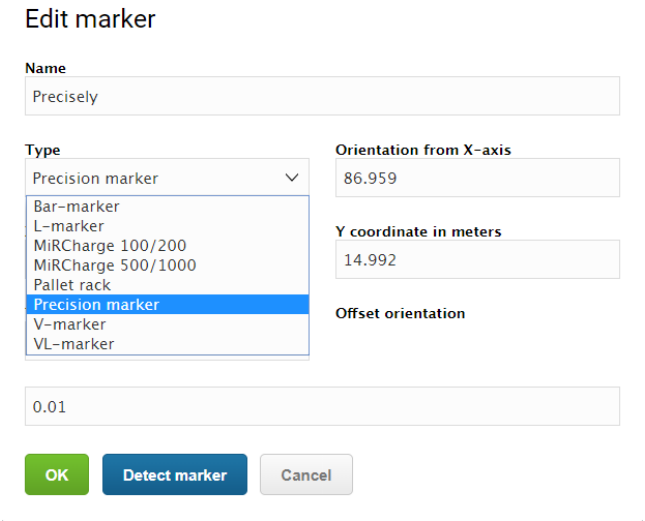
Figure 5.1. The red lines represent what the laser scanners detect. The robot is correctly localized when they align with the black lines that represent walls.

Once the robot is localized, it is possible to insert a precision docking marker correctly on the map using the following steps:

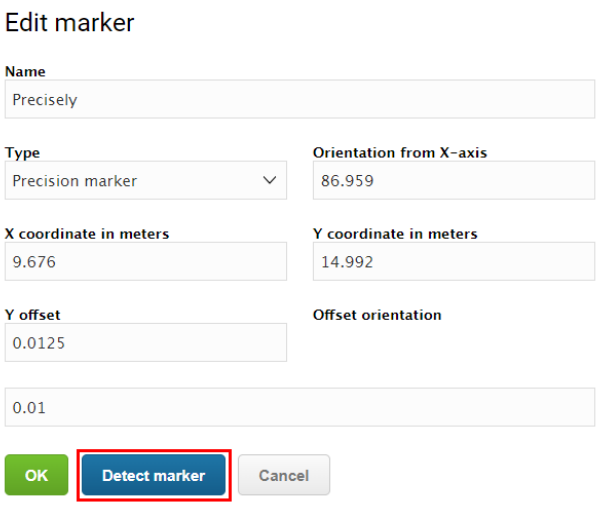
1. Manually drive the robot so its front is facing the MiR Precision Docking station and is within one meter from it.
2. In the robot interface, go to the map editor for the active map where you want to create a marker. This is done by going to **Setup > Maps** and selecting the edit icon next to the map you want to work on.
3. In the Object-type drop-down menu, select **Markers** (1), and then select the icon to **Draw a new marker** (2).



4. In the **Edit marker** dialog box, enter a name for the marker and select **Type > Precision marker**.

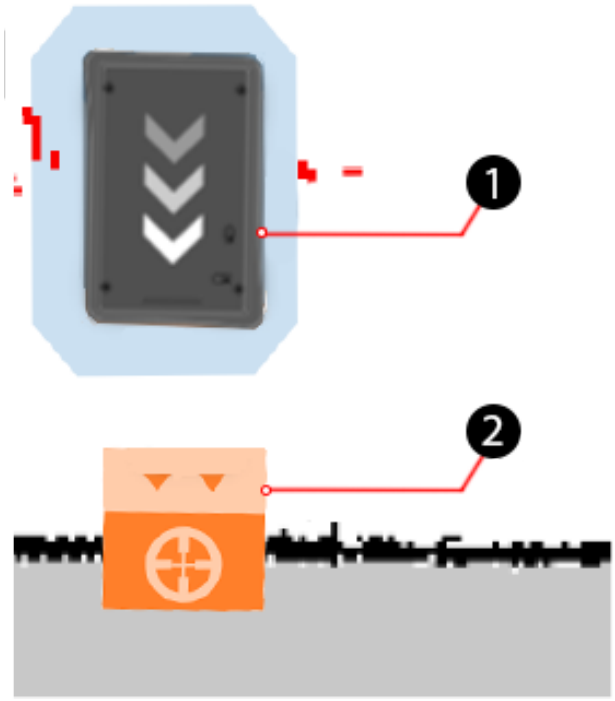


5. Select **Detect marker**. The Detect marker function tracks the position of the station using the VL-marker and automatically sets the X, Y and orientation values in the **Edit marker** dialog box, enabling it to dock to the station.



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

6. Select **OK** to create the marker. A new marker icon (2) is now visible on the map in front of the robot (1).



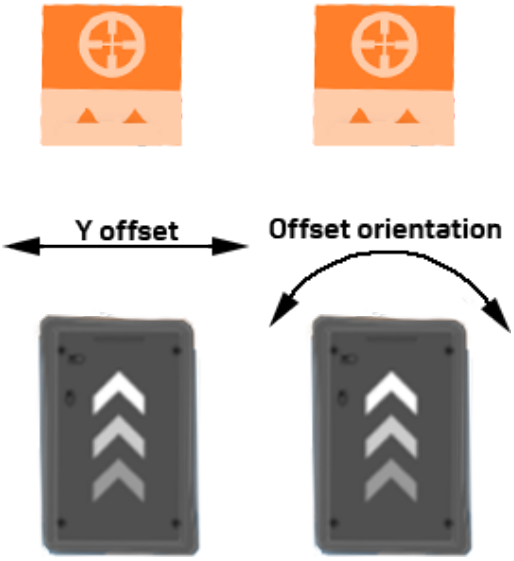
It is unlikely that the marker aligns precisely with the precision pins. It is important to test how your robot docks to the precision docking station and change the offsets accordingly. The offsets can be changed by selecting the marker on the map, and then selecting **Edit**.

CAUTION

The robot will not register if the pins are not aligned with the holes and will continue to dock to the station, regardless of the pins colliding with the front of the robot.

- When docking the first time, closely supervise the robot, and stop it immediately if it becomes clear that the pins and holes will not align in the docking.

7. There are two offsets within the editor you can modify. Positive values modify the offset to the left of the robot, and negative values modify to the right.
   - **Y offset**
     How far to either side the robot should dock.
   - **Offset orientation**
     How much the docking angle should change



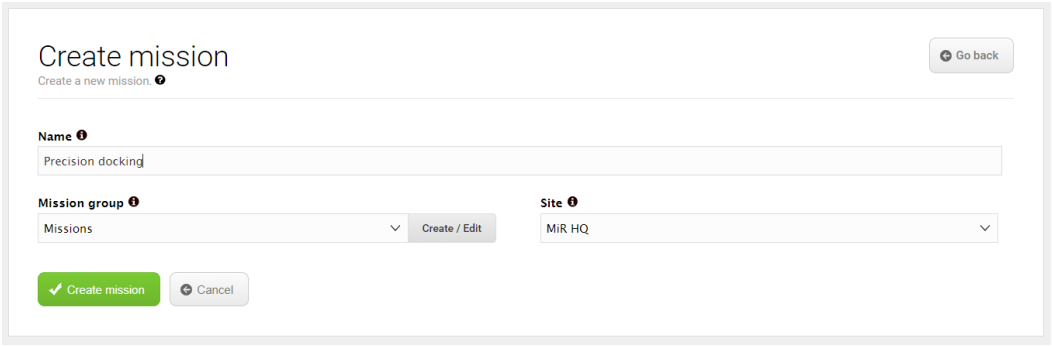
   Continue to modify these until the precision pins and holes align correctly when the robot docks to the marker.

8. To test that the docking is correct, check that the robot locks to the pins once docked. Then send the robot to another position. It must automatically release the pins when undocking from the station.
9. If the robot does not release itself from the pins, the offsets may require further adjustment.

5.3 Creating a precision docking mission

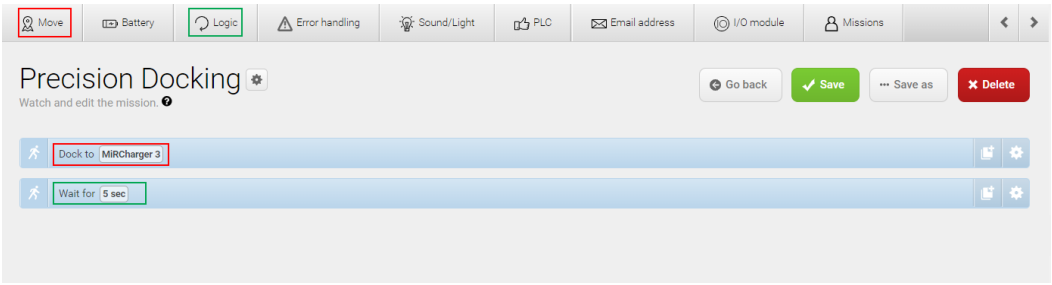
This section describes how to create a mission that makes a MiR robot autonomously dock to a MiR Precision Docking station. The procedure is identical to any other case where the robot must dock to a marker, the only difference is that a precision docking station is chosen. This example demonstrates a mission where the robot docks to the MiR Precision Docking station and waits there for five minutes. Another mission can be listed after this example mission to send the robot to another position.

1. In the robot interface, create a new mission. This is done by going to **Setup > Missions** and selecting **Create mission**. Name the mission, select the correct site, and select **Create mission**.



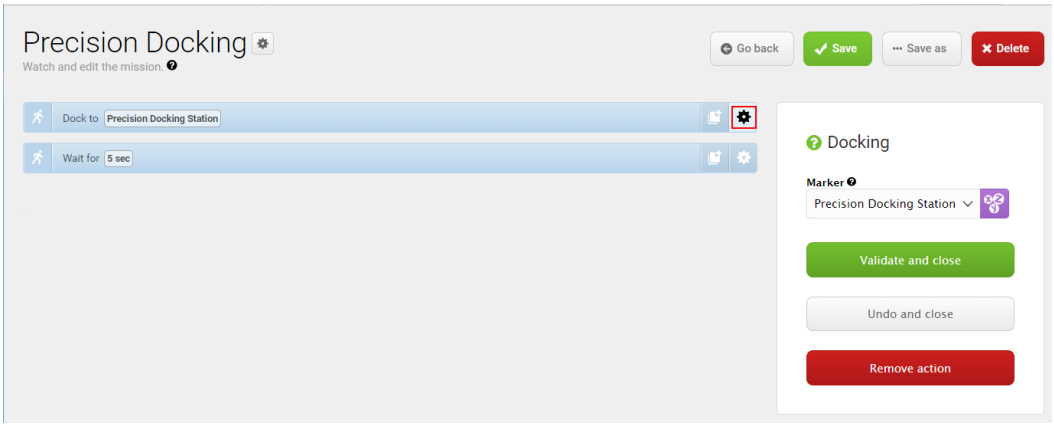
2. Within the **Create mission** window, insert the following actions:
   a. In the **Move** menu, select **Docking**
   b. In the **Logic** menu, select **Wait**

   The mission should look like this:



   The next steps describe how to set the parameters of the chosen mission actions. To set the parameters of each action, open the action dialog box by selecting the gearwheel icon of the action in question.

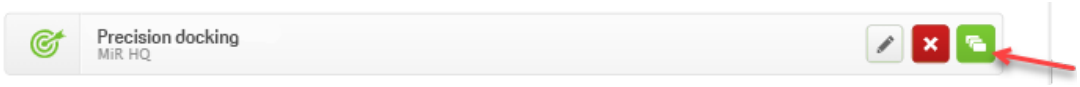
3. In the **Dock to** action dialog box, select the precision docking marker in front of the docking station that you created on the map. Select **Validate and close**.



4. In the **Wait** action dialog box, set the length of time you want the robot to be docked at the station. In this example, the wait time is set to five minutes.

5. The mission is complete. Select **Save** to save the mission.

The mission is now visible in the missions list and ready to add to the missions queue.



In this mission example, the robot is set to wait a specified time at the docking station. It is also possible to use other actions, such as user prompts or output from I/O modules to determine when the robot must undock.

WARNING

When a MiR robot docks to a MiR Precision Docking station, the robot slows down and the status light emits a white wavering light. Do not step in front of the robot, and keep a safe distance from the docking station.

6. Maintenance

The following maintenance schedules give an overview of regular cleaning.

NOTICE

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

Check regularly for damage on both the precision docking station and the robot part. If any damage is visible, do not operate MiR Precision Docking until the damaged part is replaced.

6.1 Regular monthly checks and maintenance tasks

MiR Precision Docking requires regular lubrication of certain parts to function optimally. Use a multi-purpose lubrication with PFTE for moving parts, such as TRI-17 spray.

Refer to Product presentation on page 8 to identify the robot components referred to in the maintenance section.

Once a month, carry out the following maintenance tasks:

NOTICE

If you use the MiR Precision Docking in a dusty environment, you should perform maintenance more frequently.

Robot part - precision holes

Follow the steps below to lubricate the precision holes properly:

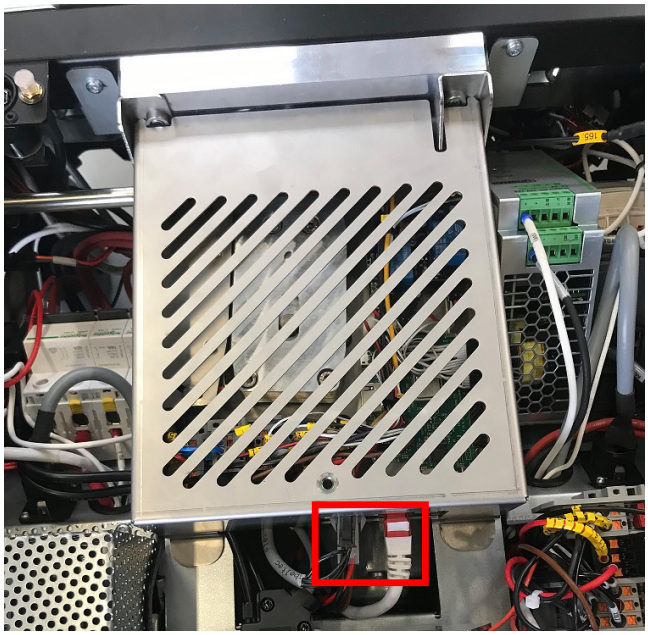
1. Push in each precision hole, using a hex key until it clicks.
2. Wipe the inside of the precision holes using a soft microfiber cloth.
3. Spray deep inside the precision holes with lubricant.

4. Press the manual pin release button.
5. Spray the precision holes with lubricant again.

Robot part - internal unit

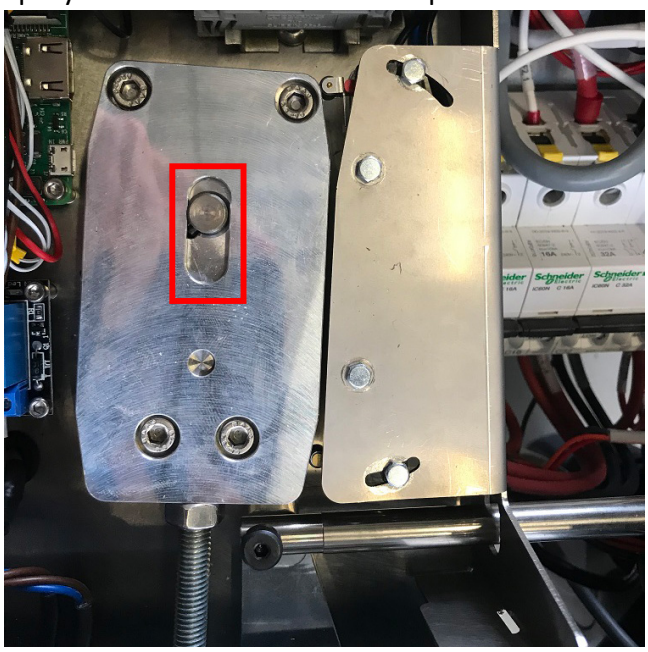
Follow the steps below to lubricate the internal unit properly:

1. Push in each precision hole, using a hex key until it clicks.
2. Remove the top cover of the robot.
3. Disconnect the three cables that connect to the internal precision docking robot part unit.



4. Unscrew the single screw in the cover, and gently lift the cover off.

5. Spray lubricant in the unit cover plate hole.



6. Press the manual pin release button.
7. Spray lubricant in the unit cover plate hole again.
8. Wipe away any overspray.
9. Place the top cover back on the internal unit.
10. Plug the cables back in, and place the cover back on the robot.

7. Troubleshooting

This section describes how to handle some of the more common issues with MiR Precision Docking.

7.1 The robot does not dock or undock correctly

If you are experiencing troubles with the robot docking to a MiR Precision Docking station, it is most likely due to the precision holes and pins not aligning correctly. It is important to keep in mind that with a precision of ±1 mm, it may take some time to configure the docking correctly.

NOTICE

Even if your robot appears to dock correctly to the precision docking station, the offsets still require configuration if the robot is not able to undock from the station.

The following points describe possible solutions to issues regarding docking and undocking:

- Ensure that the surface around the docking station is level so the robot is not tilted when it docks.
- As described in Creating a precision docking marker on the map on page 13, configure the offsets until the robot successfully docks and undocks from the station.
- Check that the height of the pins and holes also align. If not, you will need to remount the precision docking bar. If the precision docking bar is placed too high, you may consider placing a platform beneath the station to raise the robot to the correct height. The platform must be large enough to fit all the robot's wheels when it docks, ensuring that the robot is not tilted.

7.2 The precision docking marker is not available

If the precision docking marker is not available when you are creating markers in the map editor, you must enable **Precision docking** under **Features**, as described in Enable MiR Precision Docking on page 13. If the option is not displayed under **Features**, update your robot software to the latest version.

7.3 Other issues

If you are experiencing any other issues, we recommend rebooting your robot. If the issue persists, create an error log as described in the how-to guide *How to generate an error log for Technical Support* and contact Technical support. The how-to guide is found on our Distributor site.