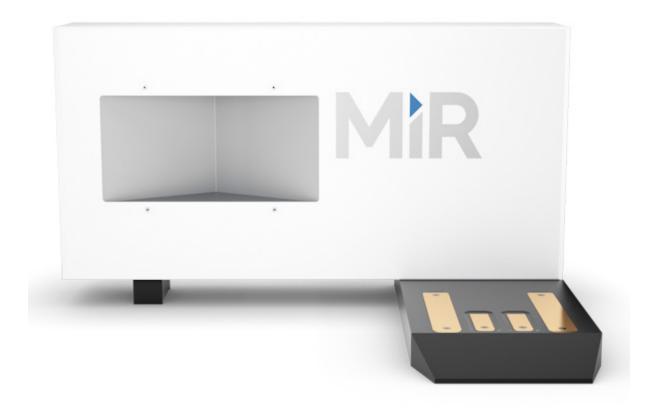
MìRCharge 500



Operating Guide

en



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Table of contents

1	About this manual	1
	1.1 Overview	1
	1.2 Document history	1
	1.3 Where to find more information	
2	Safety	
	2.1 Introduction	
	2.2 Safety concept	2
	2.3 General safety instructions	
	2.3 1 Warning notes	3
	2.3 2 Caution notes	
3	Getting started	4
	3.1 In the box	
	3.2 Installing MiRCharge 500	5
	3.2 1 Marking potentially hazardous floor area	. 6
4	Product presentation	8
	4.1 About MiRCharge 500	8
	4.11 How charging works	
	4.2 Identification label	9
5	Usage	10
	5.1 Introduction	10
	5.2 Creating a charging station marker on the map	10
	5.3 Creating charging missions	13
	5.3 1 Create a simple charging mission	13
	5.3 2 Insert a charging action into a larger mission	16
	5.3 3 Charging action parameters explained	20

1 About this manual

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1.1 Overview

This Operating Guide contains all essential information about how to start up and operate a MiRCharge 500 charging station. It also includes necessary information about safe handling of the charging station and examples of how to wet up robots for automatic charging in a MiRCharge 500. The Operating Guide is intended for Mobile Industrial Robots' distributors as well as end users responsible for the daily operation of MiRCharge 500.

1.2 Document history

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

Doc version	Release date	Description	HW rel
1.0	2019-01-24	First edition	1.0

1.3 Where to find more information

At mobile-industrial-robots.com, the following extra resources on MiRCharge 500 are available.

 MiRCharge 500 product page https://www.mobile-industrial-robots.com/en/products/mir-add-ons/mircharge/ This page contains specifications, pictures, brochures and manuals for MiRCharge 500.

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 > Manuals

http://www.mobile-industrial-robots.com/en/account/manuals/

The section contains the following resources:

- This MiRCharge 500 Operating guide
- Distributor site > Download

http://www.mobile-industrial-robots.com/en/account/download/

- CAD drawings
 Click Show CAD-files to see the list of available CAD drawings.
- EC Declarations of Conformity Click Show Certificates to see the list of EC Declarations of Conformity.
- Certificates. Click Show Certificates to see the list of certificates for the robot.
- 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 with the robot.

2 Safety

2.1 Introduction

The information in this chapter must be read and understood **before** MiRCharge 500 is powered up for the first time. It is important to read the following safety information in order to operate MiRCharge 500 safely.

This manual contains notices you have to observe to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol. The notices shown below are graded by signal words to indicate degree of danger.



Mobile Industrial Robots ApS disclaims any and all liability if MiRCharge 500 or its accessories are damaged, changed or modified in any way. Mobile Industrial Robots ApS cannot be held responsible for any damages caused to MiRCharge 500, accessories or any other equipment due to malfunctioning of MiRCharge 500.

2.2 Safety concept



Indicates an immanently hazardous situation that **will** result in death or severe personal injury if proper precautions are not taken.



Indicates a potentially hazardous situation that **could** result in death or severe personal injury if proper precautions are not taken.



Indicates a situation that **could** result in minor personal injury or damage to the equipment if proper precautions are not taken.



Indicates a situation that **could** result in property damage if proper precautions are not taken.



2.3 General safety instructions

This section contains general safety notes. Some safety notes are further specified in other sections of the manual and further safety notes are present throughout the manual.



All service and repair work must be carried out by qualified service personnel.

2.3.1 Warning notes



- Do not remove the front cover of MiRCharge 500
 Danger of electric shock from contact with live parts.
- Do not use MiRCharge 500 in an environment with explosive gases.
 Danger of fire or explosions caused by sparks from static electricity.

2.3.2 Caution notes



• Immediately, disconnect power from MiRCharge 500 if the charger does not work correctly or has been damaged

Leaving the power on may cause damage to the device.

- Do not place MiRCharge 500 near heat sources, and follow the installation instructions given in this manual Failure to follow the instructions may cause damage to or malfunction of the device.
- Do not cover or block the vents on the sides of MiRCharge 500 Blocking may cause overheating of the device.
- Only use MiRCharge 500 for its intended purpose Wrong use can damage the device.

MiRCharge 500 is a charging station with the specific purpose to charge the internal battery of MiR500 robots. Do not connect MiRCharge 500 to other equipment than MiR500 robots and do not attempt to charge external batteries.

• Do not place or drop metal parts on the charging connectors during charging Risk of short circuiting and damage to charging station and/or robot.

The charging connectors carry voltage only when in contact with the connectors underneath the robot. Both robot (including its battery) and charging station are protected by fuses to avoid dangerous situations in case the terminals underneath the robot are short circuited during charging.

- Only connect MiRCharge 500 to a wall outlet that fits one of the supplied cable plugs
 Use of a different plug or alterations to one of the supplied plugs may damage the device.
- Ensure that MiRCharge 500 is properly grounded by using one of the supplied three-prong plugs Failure to ground the device may cause electric shock.

If the supplied cables do not fit the local wall outlet, please consult a local electrician.

3 Getting started

3.1 In the box

This section describes the content of the MiRCharge 500 box.







Figure 3.1. The MiRCharge 500 box and content

- 1. MiRCharge 500
- 2. Power cables for different wall outlets:
 - NEMA L6-15 plug for use in 230/240 V installations.



- NEMA 5-15P plug for use in 110/120 V installations, (only delivers 50% of the max rated charging power).
- CEE 7/7 plug for use in 230/240 V installations



3. MiR document folder containing EC Declaration of Conformity.



3.2 Installing MiRCharge 500

MiRCharge 500 is easy to install and commision in any facility where MiR500 robots operate.



Make sure to read and follow the safety notes applying to the installation of MiRCharge 500. See Safety on page 2.

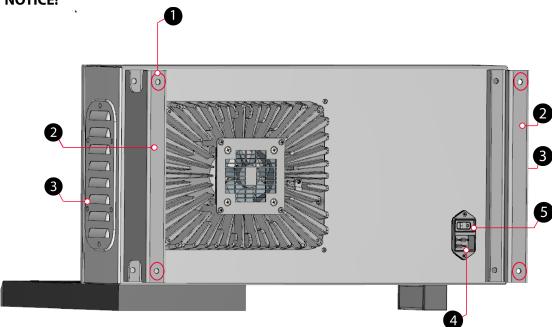


Figure 3.2. MiRCharge 500 components

- 1. M8 mounting holes for fixation to wall.
- 2. Mounting bracket (one on each side)
- 3. Air vent (one on each side)
- 4. Power inlet
- 5. Power button



For a safe installation, ensure that the following preparations are made before mounting and powering up MiRCharge 500:

CAUTION! • To avoid overheating, place MiRCharge 500 in location where non of the air vents are blocked.

- Make sure to connect the power cable to a suitable wall outlet that supports the necessary power. For national electrical codes, please consult a local, licensed electrician.
- Ensure that MiRCharge 500 is installed on an electric circuit which is protected by a circuit breaker with current rating 16 A (EU) / 15 A (US).

Mounting The charging station is to be placed against a wall with access to a power outlet.

The two distance brackets (2) are prepared with M8 holes (1) that are used to fix MiRCharge 500 to a wall.





Wall fixing is not required; the robot will not push the charging station when docking.

But if there is a slight risk that the charging station could be pushed, for example to one side or the other, it is recommended to fix it to the wall to ensure that the physical position of the charging station corresponds to the marker position on the map.

Powering up

Insert the power cord into the charging station first (4), then into the wall power outlet. Press the Power button (5) to turn MiRCharge 500 on.

3.2.1 Marking potentially hazardous floor area

When docking to MiRCharge 500, the robot mutes its personnel detection means temporarily. This includes turning off the protective fields around the scanners.

The muting starts when the robot reaches the entry position approximately 1 meter from Charging station marker. To indicate this to people nearby, MiR500 slows down and starts blinking yellow using the eight indicator lights on the corners of the robot.

To avoid potentially hazardous situations as a consequence of the muted personnel detection means, the physical area around MiRCharge 500 should be marked with signal tape or similar.



For more information on personnel detection means and protective fields, see *MiR500* User Guide.

The size of the marked area is calculated based on the robot's path going to the charging station and takes into account that the robot may have to make a turn of up to 90° when docking to the charging station.

Figure 3.3 illustrates how to calculate where the floor marking should be:

- The red dotted line shows the area where the robot mutes the personnel detection means. This is the potentially hazardous zone.
- The yellow/black striped line indicates the area that should be marked with signal tape. The space between the red dotted zone line and the tape marking should be held free of objects to ensure a smooth entry to the charging station.



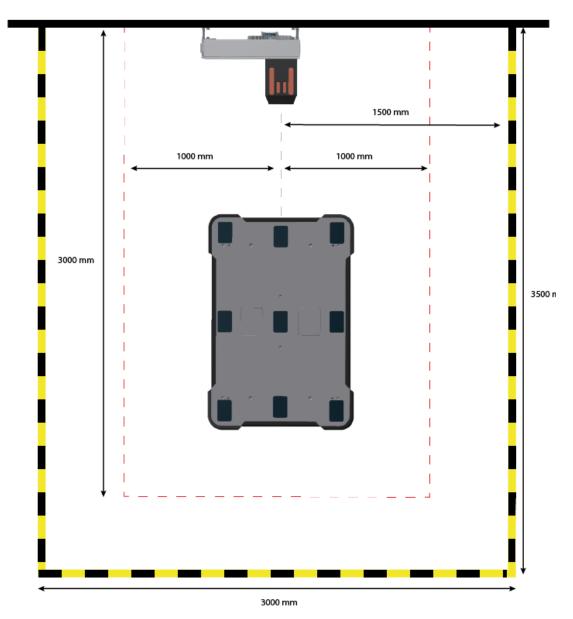


Figure 3.3. The floor around the docking station must be marked with signal tape to indicate where the personnel protection means are muted.

4 Product presentation

4.1 About MiRCharge 500

MiRCharge 500 is a charging station that enables MiR500 robots to stay charged for undisrupted operation 24/7. Multiple MiR500 robots can share the same charging station; however this requires integration in MiRFleet to avoid bottleneck situations. For more information, see *MiRFleet Reference quide* on the website.

4.1.1 How charging works

Automatic recharging happens when MiR500 moves to a marker (on the map) in front of MiRCharge 500, and locates the integrated VL-marker. The robot then guides itself into position on the charging plate (pos 2 in Figure 4.1.).



The connectors on both charging plate and underneath the robot are voltage-free until connection between those is made and proper CAN bus connection is established.

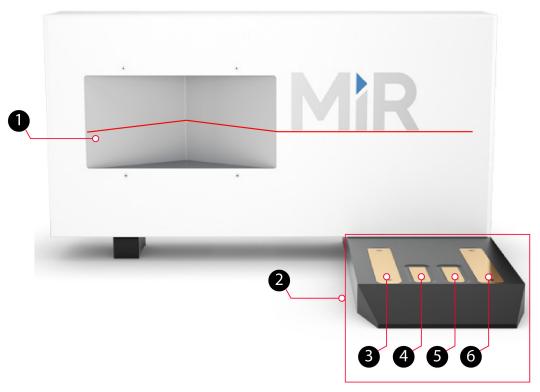


Figure 4.1. MiRCharge 500 uses the VL-marker to orient itself correctly on the charging plate

- 1. VL-marker: the V-shaped recess combined with the front plate to the right form a so-called VL-marker that the robot's front safety scanner uses to detect the charging station
- 2. Charging plate
- 3. Charging connector, positive terminal
- 4. CAN high CAN bus communication between robot and charging station processor
- 5. CAN low CAN bus communication between robot and charging station processor
- 6. Charging connector, negative terminal



When MiR500 is in position on top of the charging connectors (pos. 3 and 6 in Figure 4.1.), the robot must first deliver a small current to the charging station before the charging station starts the charging.



If the robot's battery is completely discharged, it is necessary to connect an external cable charger. See *MiR500 User Guide* on the website.

Charging time

MiRCharge 500 charges a battery from 10% to 90% in an hour.

4.2 Identification label

The identification label of MiRCharge 500 is placed on the right-hand side of the of the charging station.



Figure 4.2. Example of MiRCharge 500 CE marking and identification label

• CE Mobile Industrial Robots ApS declares that MiRCharge 500 meets

the requirements of the applicable EC directives. See also the EU

Declaration of Conformity.

• Serial number The 15-digit serial number is a unique identifier of the charging

station.

• MiRCharge 500 1.0 Product name and hardware version.

5 Usage

5.1 Introduction

It takes two steps in the robot interface to set up robots for automatic recharging in MiRCharge 500. This chapter describes how to create a marker in front of the charging station that will enable the robot to move and connect to the charging station:

- 1. Creating a charging station marker on the map on the location where MiRCharge 500 is located, see Creating a charging station marker on the map on page 10.
- 2. Creating a mission that includes driving to MiRCharge 500, recharging to a defined battery level and moving away again, see Creating charging missions on page 13.

After these steps are carried out, the robot is able to move to the charging station autonomously and keep the battery charged while carrying out missions.



If the robot is operating as part of a fleet, automatic charging is handled by MiRFleet. This means that you should not create missions that include charging actions.

5.2 Creating a charging station marker on the map

This section explains how to create a charging station 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.

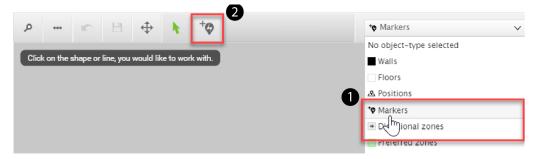


Figure 5.1. The red laser scanner line along a wall indicates that the robot is localized correctly in an active map.

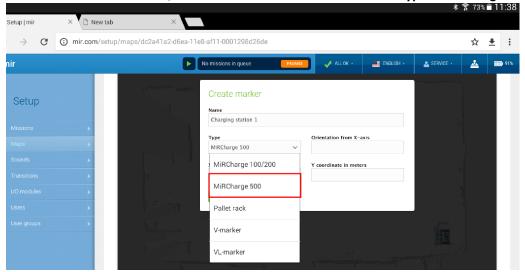
- 1. Manually drive the robot to a position approximately 1 meter in front of MiRCharge 500.
- 2. In the robot interface, select the map where you want to create the marker; go to Setup > Maps > Edit map.
- 3. On the Object-type menu, select Markers (1), and then select the icon Draw a new marker (2)

Tip! Alternatively, if the active map is visible on the dashboard, the marker may be created directly from the dashboard. Select the icon **Draw a new marker**.

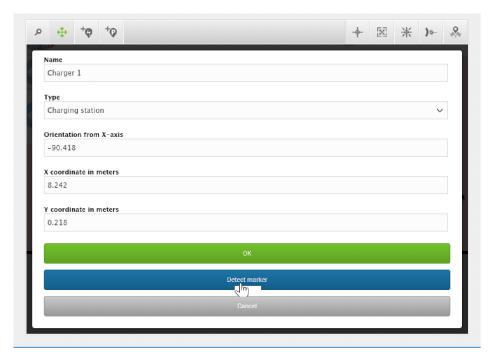




4. In the Create marker window, enter a name for the marker and select Type > MiRCharge 500.



5. Select **Detect marker**. The Detect-marker function tracks the position of the charging station and automatically sets the X, Y and Orientation values in the robot, enabling it to connect to the charging station.





6. select **OK** to create the marker. A new marker icon represented by a lightning symbol is now visible on the map and ready to use in missions.

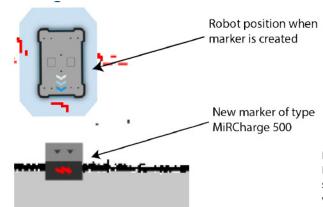


Figure 5.2. The charging station marker of the MiR500 can be recognized by the red lightning symbol. For the MiR100 / MiR200 robots it's yellow.

Note

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

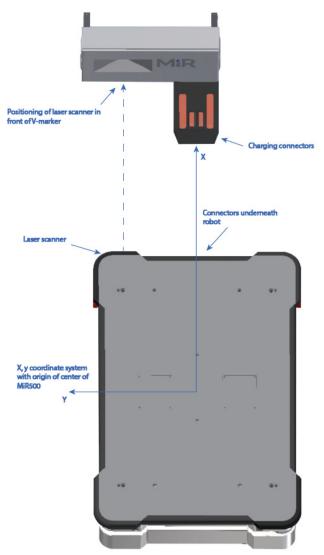


Figure 5.3. The ideal position of the robot when you create a marker for the charging station.



5.3 Creating charging missions

This section describes how to create missions that include moving to a charging station for automatic recharging of the battery.

The first example shows how to set up a simple mission that only includes that charging action itself, see Create a simple charging mission on page 13

The second example shows how to include a charging action in a larger mission where you set the robot to check the battery by inserting an **If** action that regularly checks if the battery is below or above a defined level. See Insert a charging action into a larger mission on page 16

A charging mission must contain minimum two actions:

- Docking
- Charging

5.3.1 Create a simple charging mission

This simple example shows how charging is handled via a mission including the minimum required actions:

- Docking
- Charging

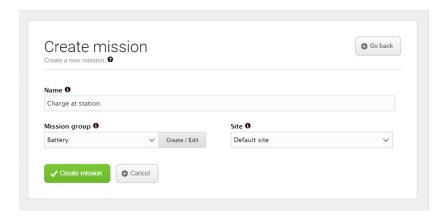
To move the robot away after ended charging, this example also contains a

Relative move

The Relative move action is not necessary if charging is part of a larger mission where the robot moves to another position after finished charging.

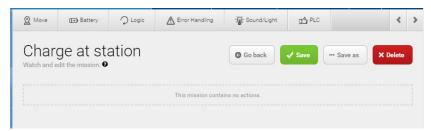
Follow these steps to create a simple charging mission:

1. In the robot interface, go to **Setup > Missions** and select **Create Mission**. Name the mission, select the correct site and select **Create mission**.



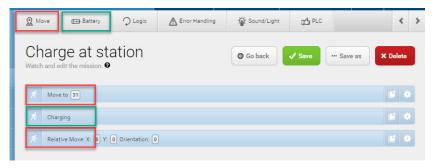


The **Create mission** window opens.



- 2. Insert the following actions:
 - On the Move menu, select Docking.
 - On the Battery menu, select Charging.
 - On the Move menu, select Relative move.

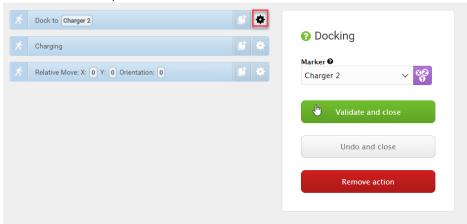
The mission now looks like this:



Next steps include definition of which charging station to go to, setting of charging parameters and, finally, how to move away from the charging station.

To set the parameters for each action, select the gearwheel of the action in question.

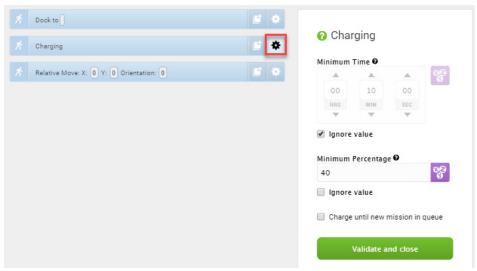
1. In the **Dock to** action dialog, select the marker position in front of the charging station that you created on the map. Select **Validate and close**.



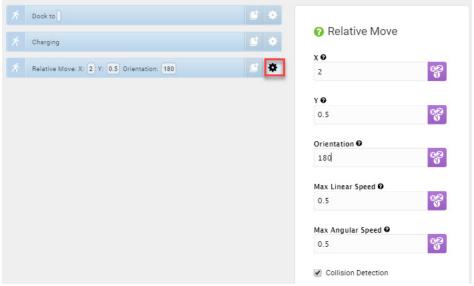
2. In the **Charging** action dialog, define how the charging should be completed. In our example, there is no minimum time. When the battery reaches 40%, the charging is completed. Select **Validate and close**.



• To read more about the different **Charging** action combinations, see Charging action parameters explained on page 20.

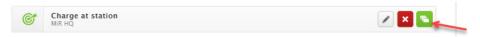


3. In the **Relative move** action dialog, define how far the robot should move away from the charging station after charging is completed. This is done by defining an X-value and a Y-value that moves the robot backwards and to the side. Select **Validate and close**.



4. 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.





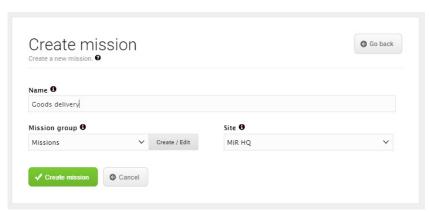
5.3.2 Insert a charging action into a larger mission

Usually, charging actions are part of larger missions where the battery level is regularly checked throughout the mission. The missions can be created in a number of ways, but must include an **If** action that regularly checks the battery level and sends the robot to a charging station when the battery level falls below a defined percentage.

In the following example, the whole mission is embedded in a Loop action that ensures that the mission starts over every time the last action is carried out. Inside the Loop action, there is an **If** action which checks the battery level every time the actions under True or False are completed.

Follow these steps to insert a charging action into a larger mission:

1. In the robot interface, go to **Setup > Missions** and select **Create Mission**. Name the mission, select the correct site and select **Create mission**.



The Create mission window opens.



- 2. Insert the following actions:
 - On the **Logic** menu, select **Loop**.

Click on the gray bar that reads **Content** to embed the next action into the Logic action.

• On the **Logic** menu, select **If**.

Click on the gray bar that reads **True** to embed the next actions into the **If** action.

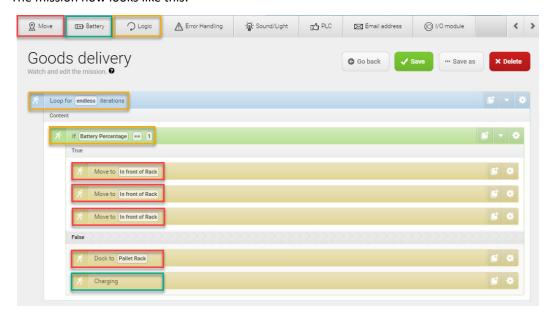
• On the **Move** menu, select **Move** three times.

Click on the gray bar that reads **False** to embed the next actions into the **If** action.

- On the **Move** menu, select **Move**.
- On the Battery menu, select Charging.



The mission now looks like this:



The next steps include definition of which positions the robot should move to when the **If** action is **True**, and, when the **If** action is **False** which charging station the robot should go to and setting of charging parameters.

To set the parameters for each action, select the gearwheel of the action in question.

Loop action

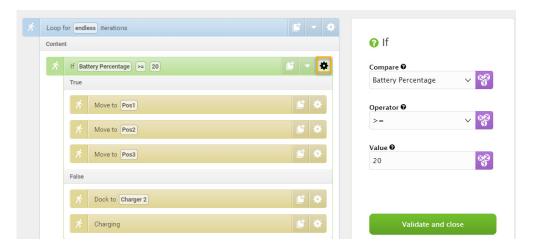
1. In the **Loop** action dialog, select the check box **Endless** under Iterations. Select **Validate and close**.



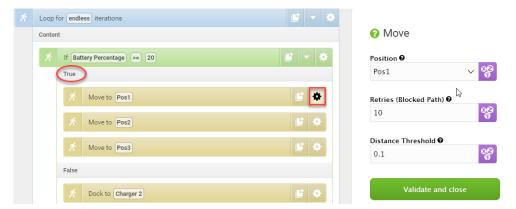
If action

- 2. In the **If** action dialog, do the following:
 - Select Battery Percentage under Compare.
 - Select >= (greater than or equal to) under **Operator**.
 - Type '20' under Value.
 - Select Validate and close.

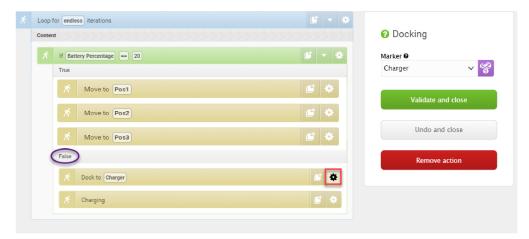




3. Under **True** in the **If** action, select a position for each of the three Move actions. Then select **Validate and close**.



- 4. Under **False** in the **If** action, set the parameters for the **Dock to** and **Charging** actions:
 - In the **Docking** action dialog, select the marker position in front of the charging station that you created on the map. Then select **Validate and close**.



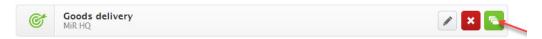


• In the **Charging** action dialog, define how the charging should be completed. In our example, there is no minimum time. When the battery reaches 50%, the charging is completed. Select **Validate and close**.



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.



Tip! The mission can also be inserted in other missions. In that case the Relative-move action is unnecessary.

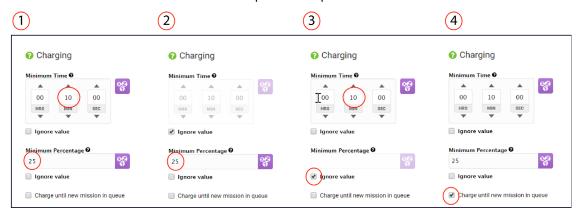


To read more about the different **Charging** action combinations, see Charging action parameters explained on page 20.



5.3.3 Charging action parameters explained

A charging action can be defined as a minimum time or a minimum percentage level or a combination of those two. This section explains the options.



1. Either/Or: combination of minimum time and minimum percentage

When you combine minimum time, e.g. 10 minutes and minimum percentage, e.g. 25%, the robot stays in the charging station until it reaches the first of the two parameters before moving on with the mission.

2. Minimum Percentage

If you want to ensure that the battery is charged to a certain level, you can select the **Ignore value** check box under **Minimum Time**. The robot will then charge the battery up to the set minimum percentage before moving on with the mission.

3. Minimum Time

If you want to ensure that the battery stays in the charging station for a minimum amount of time, you can select the **Ignore value** check box under **Minimum Percentage**. The robot will then charge for the set minimum amount of time before moving on with the mission.

4. Charge until new mission in queue

You can choose to let the robot stay in the charging station until it receives a new mission by selecting **Charge until new mission in queue**. This is useful, for example when the charging action is not followed by other actions, or the charging action is not included in a looped mission in which case the robot will continue after the set charging time or percentage is fulfilled.

Topping up cycle

If the battery reaches 100% while the robot is waiting for a new mission, the charger disconnects and lets the battery discharge until it has dropped to 90%. It then connects again and tops up until the battery is back to 100%.

This may mean that even if the robot has been in the charging station overnight, you might find it with a battery level just above 90% the next morning depending on where it is in the topping up cycle.