Operating guide (en)

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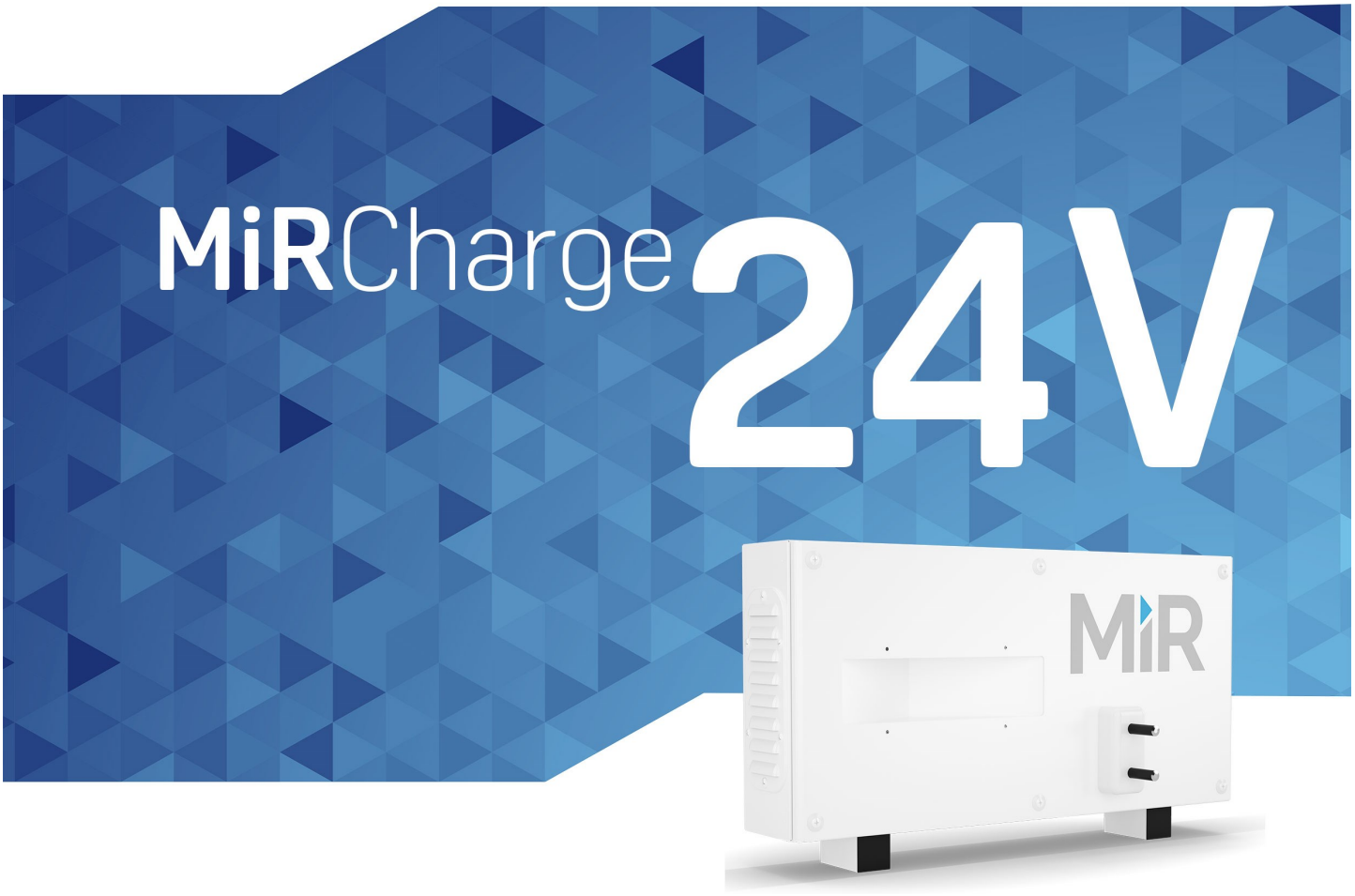

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Table of contents

1. About this document **4**

1.1 Where to find more information 4

1.2 Version history 5

2. Safety **6**

2.1 Safety message types 6

2.2 General safety precautions 7

3. Getting started **10**

3.1 In the box 10

3.2 Installing and powering up 11

3.3 Marking potentially hazardous floor area 13

4. Product presentation **17**

4.1 How charging works 17

4.2 Guide to light indicator 18

4.3 Identification label 19

5. Usage **20**

5.1 Creating a charging station marker on the map 20

5.2 Creating charging missions 23

5.3 Insert a charging action into a larger mission 27

5.4 Charging action parameters explained 33

1. About this document

This document contains the following information:

- How to install MiRCharge 24V and take precautions for safe use
- Product presentation
- How to set up MiR100 and MiR200 robots for automatic charging in MiRCharge 24V

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 relevant resources are available:

- **Distributor site > Manuals**
  http://www.mobile-industrial-robots.com/en/account/manuals/
  This page contains the following resources:
  - **Quick starts for robots**
    The short guide that lets you start operating the robot quickly. This document is in the box with the robot in the printed format. Available in multiple languages.
  - **User guides for robots**
    The user guide of the robot. Available in multiple languages.
  - **Operating guides for add-ons**
    The operating guide that describes how to set up and use add-ons such as charging stations, hooks and pallet lifts.
  - **MiR Robot Reference guide**
    The reference guide that describes the elements of the robot interface. Available in multiple languages.
  - **REST API references**
    The REST API reference for the robot and pallet lifts and hooks.

- **Distributor site > Download**
  http://www.mobile-industrial-robots.com/en/account/download/
  This page contains the following resources:
  - **CAD drawings**
    Select **Show CAD-files** to see the list of available CAD drawings.
  - **Certificates**
    Select **Show Certificates** to see the list of certificates for the robot.
  - **Software**
    Select your product to see the list of available software versions and Product release notes.
- **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 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.
- **MiRCharge 24V product page**
  https://www.mobile-industrial-robots.com/en/products/mir-add-ons/mircharge-24v/
  This page contains specifications, pictures, and brochures for MiRCharge 24V.

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	HW
1.0	2019-07-31	First edition	3.0
2.0	2019-10-07	Small updates to the document	3.0
3.0	2019-11-13	Corrections and layout changes	3.0

2. Safety

Read the information in this section before powering up and operating MiRCharge 24V.

Pay particular attention to the safety instructions and warnings.

NOTICE

Mobile Industrial Robots disclaims any and all liability if MiRCharge 24V or its accessories are damaged, changed or modified in any way. Mobile Industrial Robots cannot be held responsible for any damages caused to MiRCharge 24V, accessories or any other equipment due to programming errors or malfunctioning of MiRCharge 24V.

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.

- Take proper precautions to avoid damage or injury.

CAUTION

Indicates a potentially hazardous situation that could result in minor or moderate injury. Alerts against unsafe practices.

- Take proper precautions to avoid damage or 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

MiRCharge 24V is not approved for installation in areas with explosive gas atmosphere according to hazardous area classification zones 0, 1 and 2.

Sparks from static electricity may cause fire or explosions.

- Do not install MiRCharge 24V in any of the mentioned zones.

WARNING

Contact with live parts can cause electric shock.

- Do not remove the front cover of MiRCharge 24V while it is powered.

WARNING

Failure to ground MiRCharge 24V may cause electric shock.

- Ensure to ground MiRCharge 24V properly using one of the supplied three-prong plugs.
- If none of the supplied plugs fit the local wall outlet, please consult a licensed electrician.

WARNING

Risk of injury and electrical shock if used by children.

- Children should be supervised to ensure that they do not play with the appliance.

WARNING

Attempting to charge batteries outside the robot can lead to electrical shock or burns.

- Never charge the batteries outside the robot.

WARNING

Risk of injury and electrical shock if used by unqualified personnel.

- This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

WARNING

Using a charger different from the one supplied by the manufacturer can cause a fire.

- Use only the original charger.

CAUTION

Covered or blocked vents on the sides of MiRCharge 24V can cause overheating.

- Do not cover or block the vents.

CAUTION

The only intended use of MiRCharge 24V is to charge the internal battery of MiR100/MiR200 robots. Using it to charge other robot types or external batteries can damage MiRCharge 24V.

- Only use MiRCharge 24V to charge MiR100/MiR200 robots.

CAUTION

Metal parts placed or dropped on the charging connectors during charging may short circuit MiRCharge 24V or MiR100/MiR200.

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

- Do not place or drop metal parts on to the charging connectors during charging.

CAUTION

Connecting one of the supplied power cables to a wall outlet that does not fit the cable plug can damage MiRCharge 24V.

- Only connect the power cable to a wall outlet that fits one of the supplied cable plugs.

CAUTION

Charging a frozen battery can damage the battery.

- Never charge a frozen battery.

CAUTION

Operating the charger in a closed-in area with restricted ventilation can lead to overheating of the battery and/or the charger.

- Do not operate the charger in a closed-in area or restrict ventilation in any way.

3. Getting started

This section describes how to get started with MiRCharge 24V.

3.1 In the box

This section describes the content of the MiRCharge 24V box.

The box contains:

1. MiRCharge 24V
2. Power cables for different wall outlets:
   - 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 and powering up

This section describes how to install and power up MiRCharge 24V.

Before installing

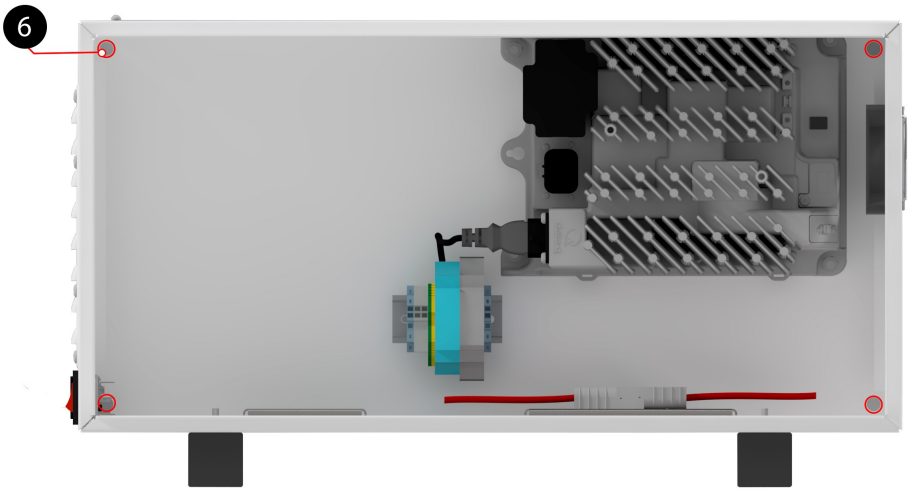
Before installing, please consider the following:

- Place MiRCharge 24V against a wall on a clean, even and dry floor.
- Keep the air vents on both sides of the charging station free to avoid overheating.
- Install MiRCharge 24V on an electric circuit that is protected by a circuit breaker with current rating 16 A (EU) / 15 A (US).
- Make sure there's a suitable wall outlet that supports the necessary power. For national electric codes, please consult a licensed electrician.

Wall fixing is not required, but if the charging station is moved even a few centimeters, the robot will be unable to dock precisely. We therefore recommend fixing it.

Figure 3.1 and Figure 3.2 show the parts of MiRCharge 24V relevant for the installation and powering up.

3.1. Front view of MiRCharge 24V



3.2. Inside view of MiRCharge 24V

Label	Description	Label	Description
1	Six front panel screws	2	Air vent
3	Power inlet	4	Power button
5	Fan	6	Four M10 mounting holes for fixation to wall (all four corners)

Mounting

Follow these steps to mount MiRCharge 24V to a wall:

1. Place MiRCharge 24V against the wall where it should be mounted.
2. Unscrew the six front panel screws. It is not necessary to remove the screws entirely.

WARNING

Do not connect the power supply before opening the front panel. Electric shock causing death or severe injury may result if you fail to observe this precaution.

3. Remove the front panel and mark the positions of the four mounting holes.
4. Remove the charging station and drill four holes in the wall of a suitable size for M10 bolts at the marked positions. Consider inserting wall plugs to ensure a secure mounting, in which case the drilled holes must accommodate the size of the chosen plugs.
5. Place the MiRCharge 24V against the wall again in the desired position. Ensure that the drilled holes align with the M10 mounting holes.
6. Fasten the charging station securely to the wall by screwing M10 bolts through the bolting holes and into the wall.
7. Once securely fixed, attach the front panel and tighten the six front panel screws.

Powering up

NOTICE

Read Safety on page 6 before powering up the charging station.

Follow these steps to power up the MiRCharge 24V

1. Insert the power cord into the power inlet, then into the wall power outlet.
2. Press the power button to turn it on.

3.3 Marking potentially hazardous floor area

This section describes how to mark the floor around MiRCharge 24V to secure safety to personnel and ensure the robot is not blocked when docking to and undocking from the charging station. The area inside the marking is considered a potentially hazardous zone that should be kept clear of people and objects.

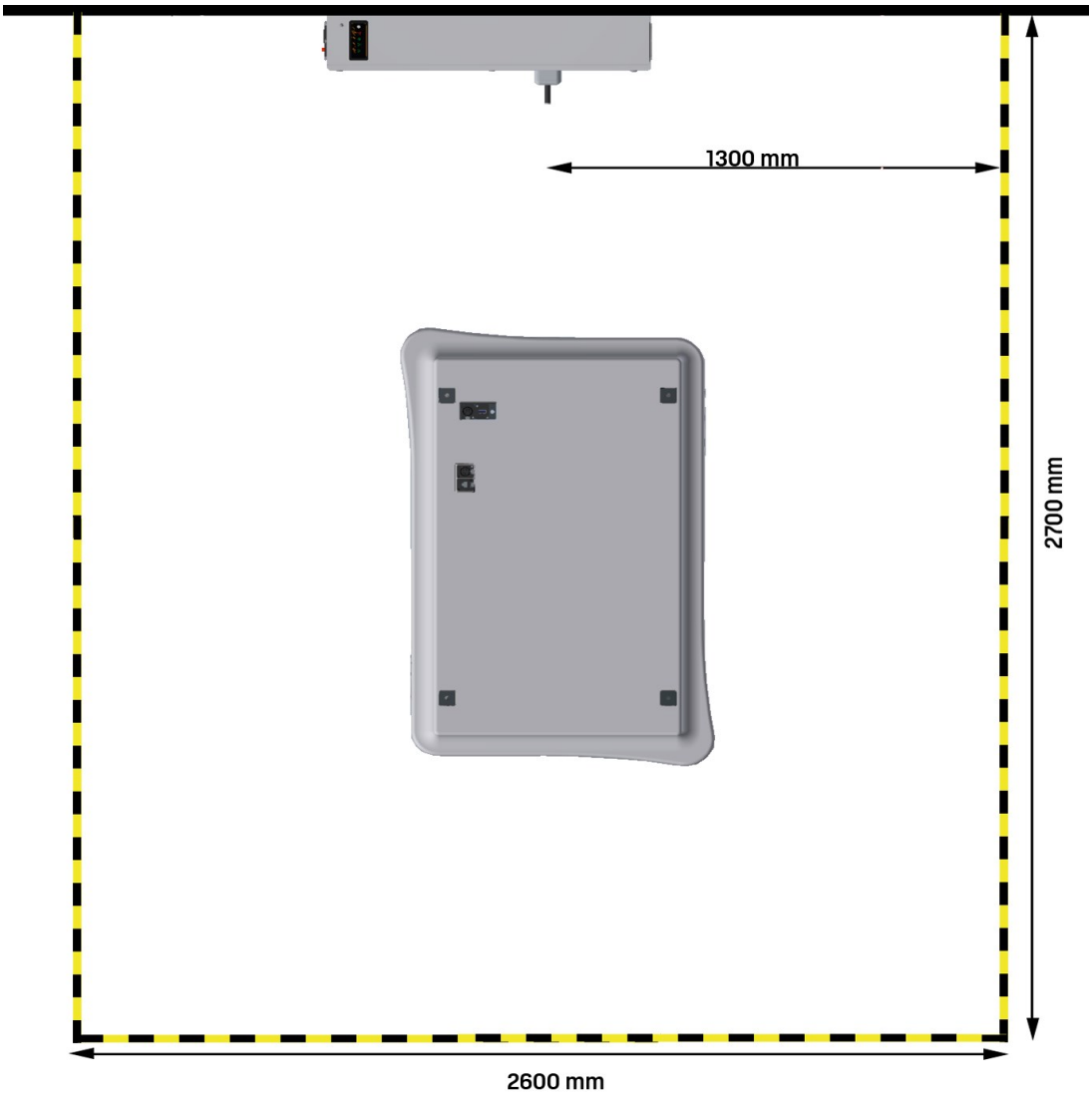
Why marking is required

When a robot approaches a charging station it slows down, reducing the size of its protective field sets. The status light band emits a wavering white light to indicate that it is docking. This starts when the robot reaches the entry position approximately one meter from the charging station marker.

There is a risk of being trapped between the robot and the charging station when the robot docks to it. To avoid potentially hazardous situations and ensure that the robot is not prevented from docking due to obstacles, you should mark the physical area around MiRCharge 24V with signal tape.

Marking the safety area

Figure 3.3 illustrates where the floor marking should be for a single charging station



3.3. The floor around MiRCharge 24V must be marked to indicate the space that should be clear of obstacles and people when the robot is docking. This can for example be done with signal tape.

The yellow/black striped line indicates the area that should be marked with signal tape. The space within the marked area must be clear of objects to secure the robot a smooth entry to the charging station.

The area is based on the robot's path docking 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.

The illustration indicates the maximum free space required to guarantee that the robot is not prevented from docking due to blocking obstacles. In some cases, less free space may be sufficient. If you choose to mark a smaller area, the minimum dimensions should be determined during commissioning.

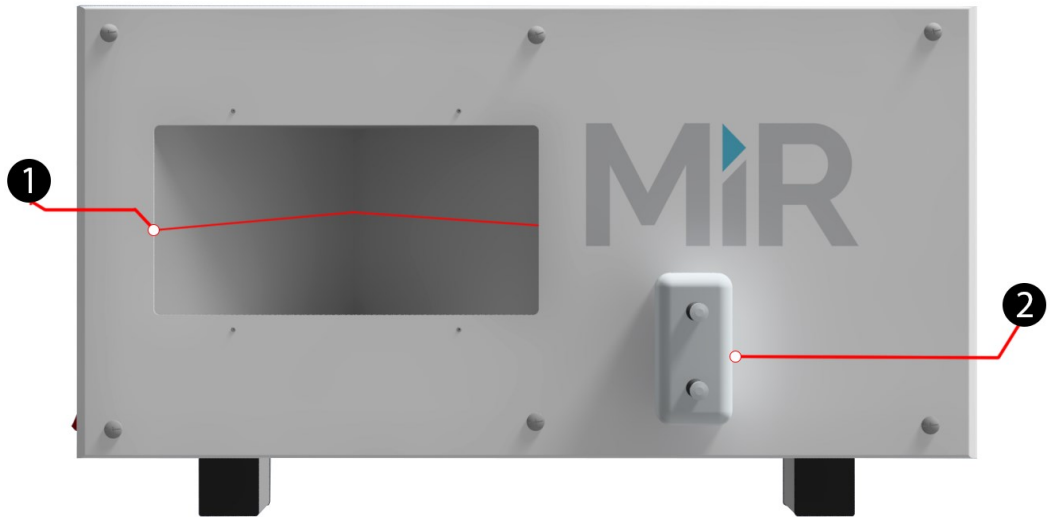
4. Product presentation

MiRCharge 24V is a charging station that autonomously recharges docked robots, enabling autonomous operation 24/7. Multiple robots can share the same charging station; however, for this we recommend integrating the robots in MiRFleet to avoid bottleneck situations. For more information see the MiRFleet Getting started guide.

4.1 How charging works

To connect to MiRCharge 24V, the robot moves to a position in front of the charging station to locate the VL-marker (1). It then moves forward to push the charging pins (2) and the charging begins.

Figure 4.1 identifies the features of MiRCharge 24V.



4.1. Front view of MiRCharge 24V.

Label	Description	Label	Description
1	V marker: the V-shaped recess forms a so-called V marker that the robot's front safety scanner uses to detect the charging station	2	Charging pins

Before the charger may deliver power to the robot's battery, the robot must press in both charging pins and thereafter send a small electrical current to the charger. This ensures that the robot is correctly docked before the charger begins charging with up to 25 A.

The standard MiR100 comes with embedded charging hardware in the front charging plate and is ready to use with the charging station. In previous models of the MiR100, the front charging plate is not included and needs to be retrofitted if the automatic charging funtionality is required. In this case, please consult support@mir-robots.com where we will assist you with the relevant documentation.

If the robot's battery is completely discharged, you must connect an external cable charger. For information on how to do this, see the User guide or Quick start of the robot.

4.2 Guide to light indicator

An LED light indicator is fixed on the top of MiRCharge 24V. The light indicator provides information regarding the charging status of the docked robot. Around the light indicator a sticker is placed to describe the main light operations.

Status	LED light operation
No robot docked	OFF
Charging - battery at low power state	Slow green flashing (1 s on, 0.2 s off)
Charging - battery at high power state	Fast green flashing (0.4 s on, 0.1 s off)
Charge complete	Constant green
Error	Rapid amber flashing (0.5 s on, 0.5 s off)
Fault	Constant red

4.3 Identification label

The identification label of MiRCharge 24V is placed on the right-hand side of the charging station.

4.2. Example of MiRCharge 24V CE marking and identification label.

CE	Mobile Industrial Robots ApS declares that MiRCharge 24V meets the requirements of the applicable EC directives.
Serial number	The 15-digit serial number is a unique identifier of the charging station.
MiRCharge 24V 3.0	Product name and hardware version.

5. Usage

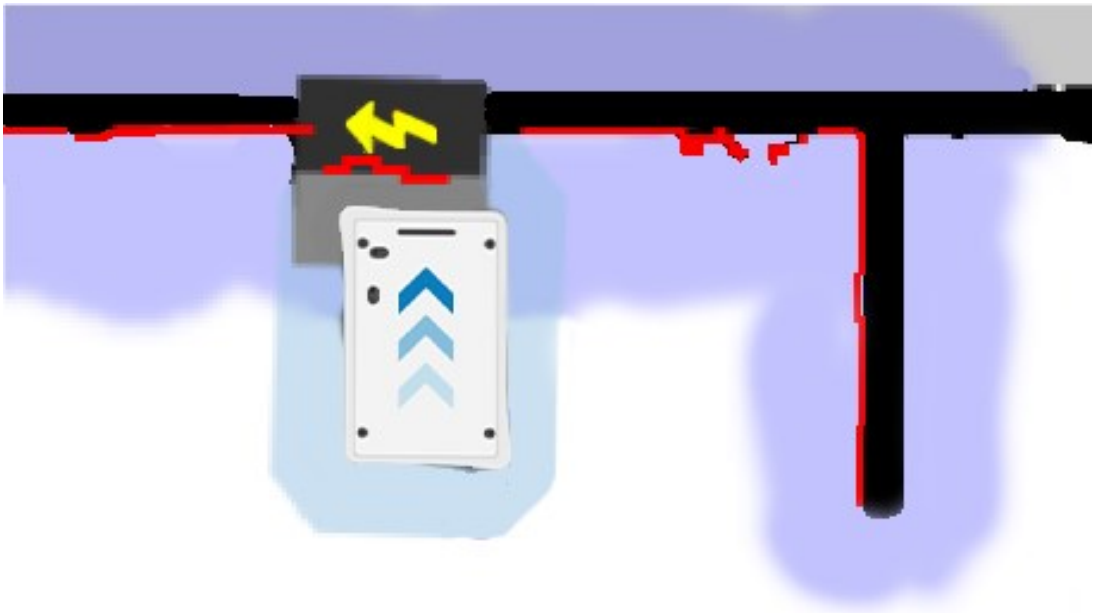
This chapter describes how to set up a robot for automatic charging in MiRCharge 24V. To do so, you must set up a marker on the map and create a mission that enables the robot to move to the charging station to start charging.

If you are using MiRFleet, charging is handled automatically, and you should not create a mission that includes charging actions.

5.1 Creating a charging station marker on the map

This section explains how to create a charging station marker on a map.

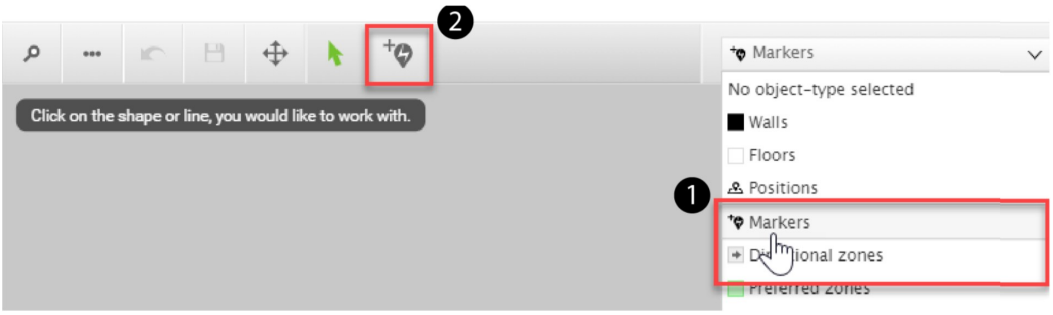
Before creating the marker, you must ensure that the robot is localized correctly on an active map. If in doubt, you can check if the red lines representing the laser scanner line match the black lines on the map as shown in Figure 5.1.



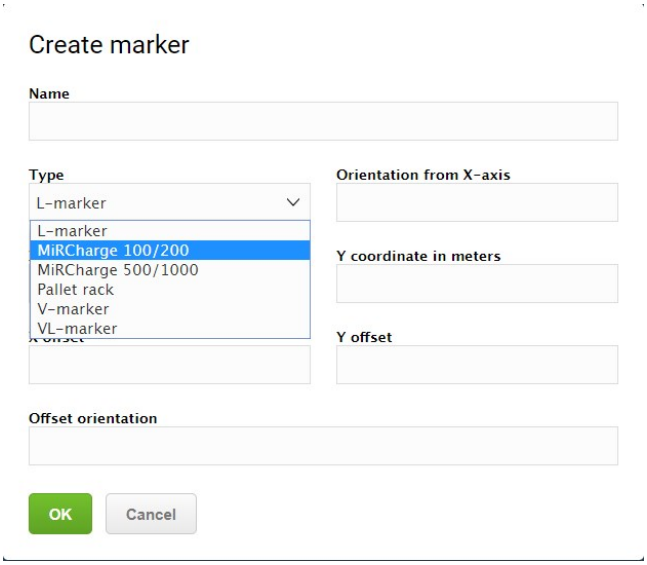
5.1. The red lines represent what the laser scanners see. The robot is correctly localized when they align with the black lines that represent walls.

Once the robot is localized it is possible to insert a charging station marker correctly on the map using the following steps.

1. Manually drive the robot so its front is facing the MiRCharge 24V and is within one meter from it.
2. In the robot interface, enter the map editor of the map where you want to create a marker. This is done by navigating to **Setup** > **Maps** and selecting the **Edit** icon next to the map you would like to work on.
3. In the Object-type drop-down menu, select **Markers** (1), and then select the icon **Draw a new marker** (2).

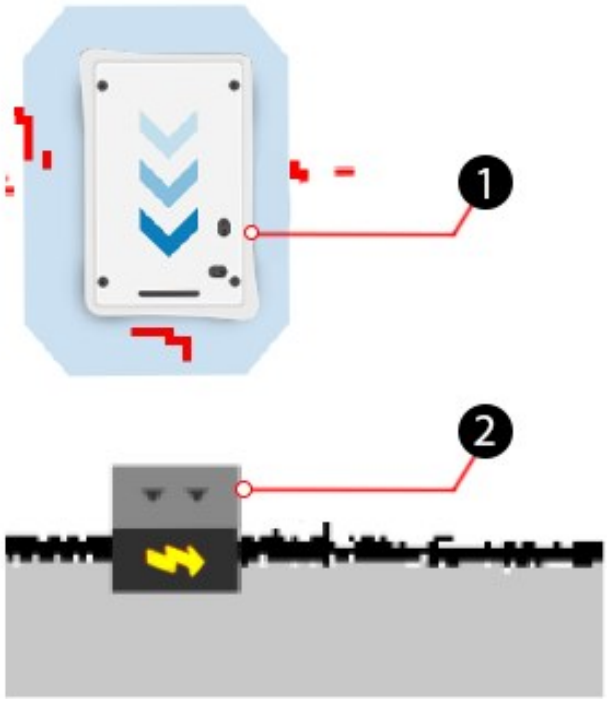


4. In the **Create marker** window, enter a name for the marker and select **Type** > **MiRCharge100/200**.



5. Select **Detect marker**. The Detect-marker function tracks the position of the charging station using the V-marker 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 (2) represented by a lightning symbol is now visible on the map in front of the robot (1) and is ready to be used in missions.



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 V-marker of the charging station.

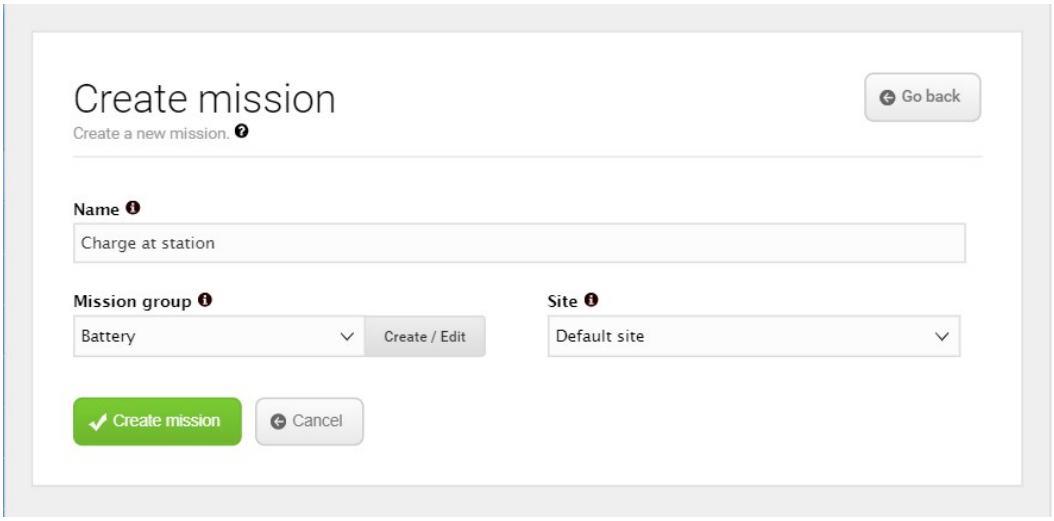
5.2 Creating charging missions

This section describes how to create missions that enable the robot to automatically dock at a charging station and recharge its battery. Two examples are given to explain how the actions **Docking** and **Charging** can be used. The first example presents the simplest method of recharging including a relative move to leave the charger, and the second exmple

presents how an **If** action may be used to control when the robot should recharge relative to its remaining power level.

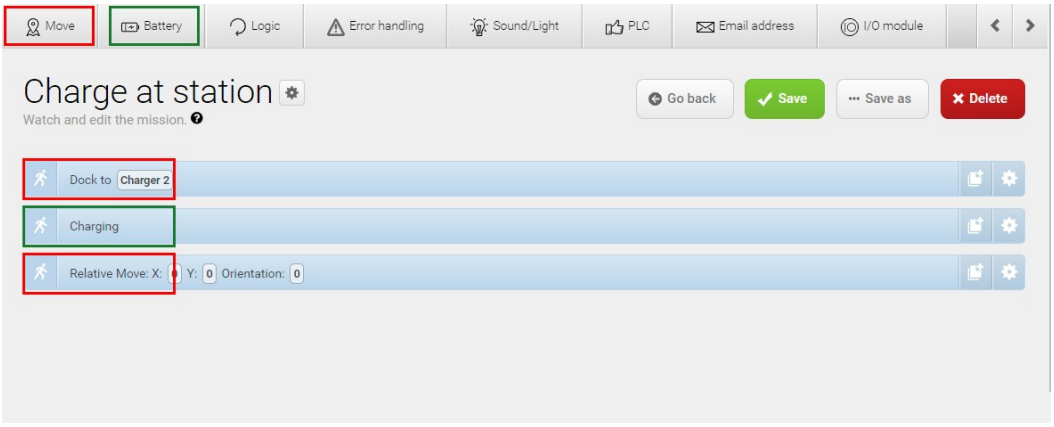
Create a simple charging mission

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



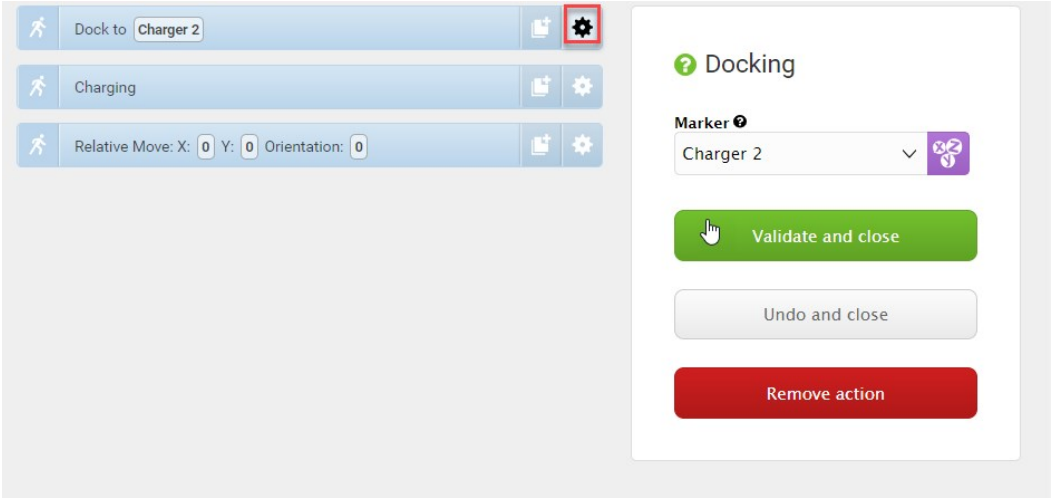
2. In the create mission window insert the following actions:
    1. In the **Move** menu, select **Docking**.
    2. In the **Battery** menu, select **Charging**.
    3. In the **Move** menu, select **Relative move**.

    The mission should look like this:

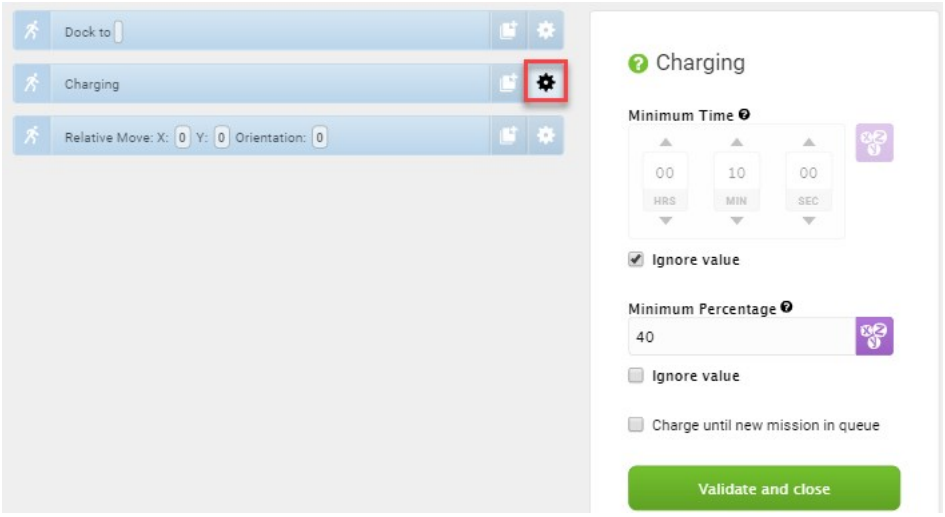


    The next steps describe how to set the parameters of the chosen mission actions. To set the parameters of each action, open the action dialog by selecting the gearwheel icon of the action in question.

3. 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**.

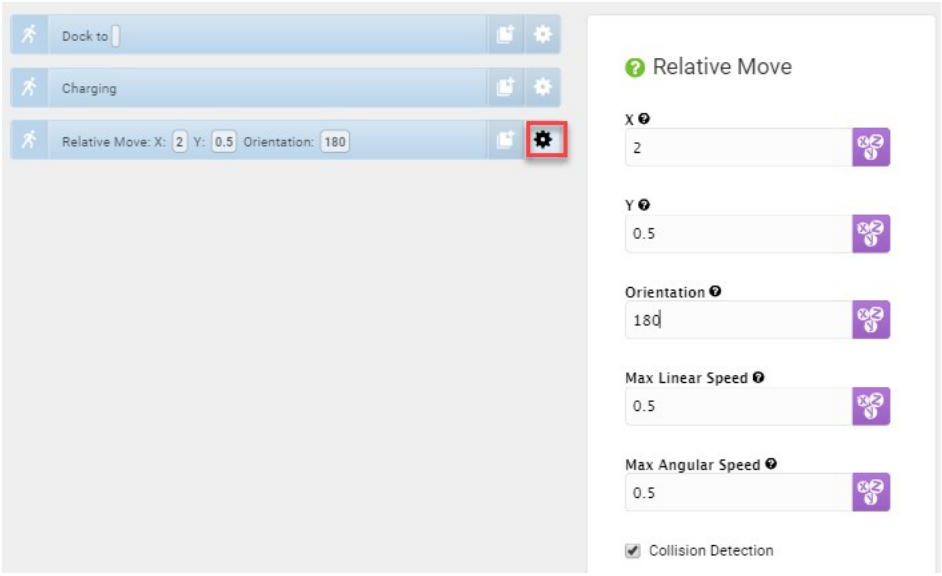


4. In the **Charging** action dialog, define how the charging should be completed. In our example, there is no minimum time. When the battery reaches 40%, the charging is completed. Select **Validate and close**.



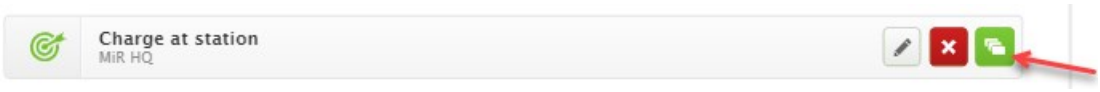
To read more about the different Charging action combinations, see Charging action parameters explained on page 33.

5. 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 will move the robot backwards and to the side. Select **Validate and close**.



6. 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.



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

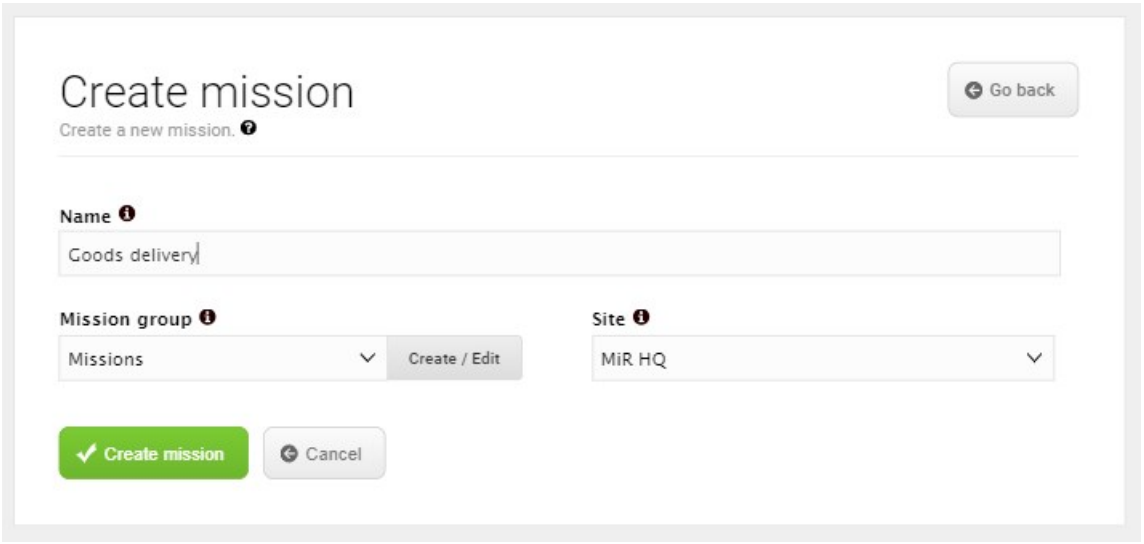
5.3 Insert a charging action into a larger mission

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.

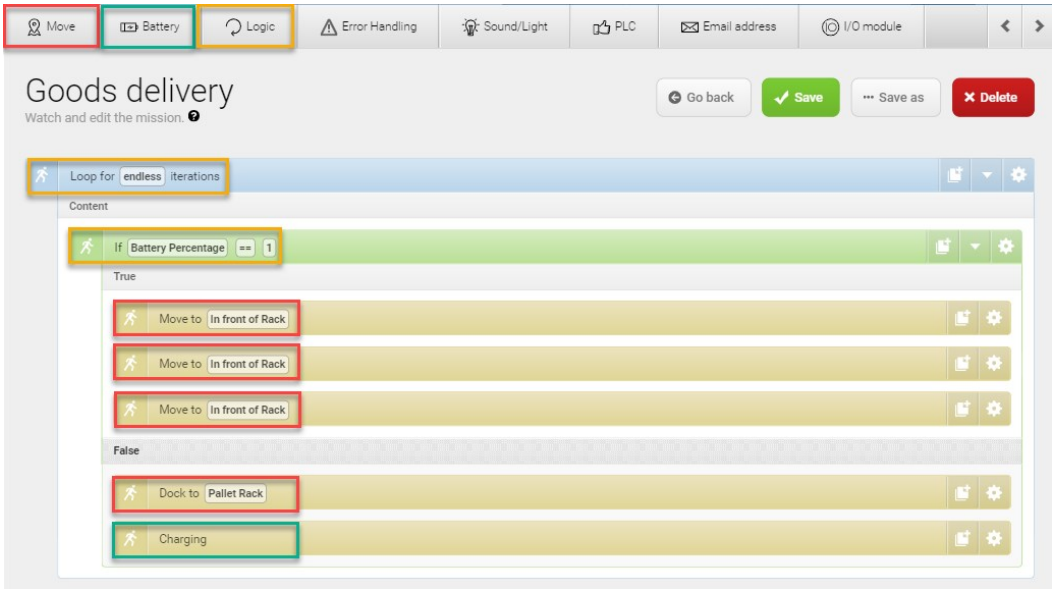
Follow these steps to insert a charging action into a larger mission:

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



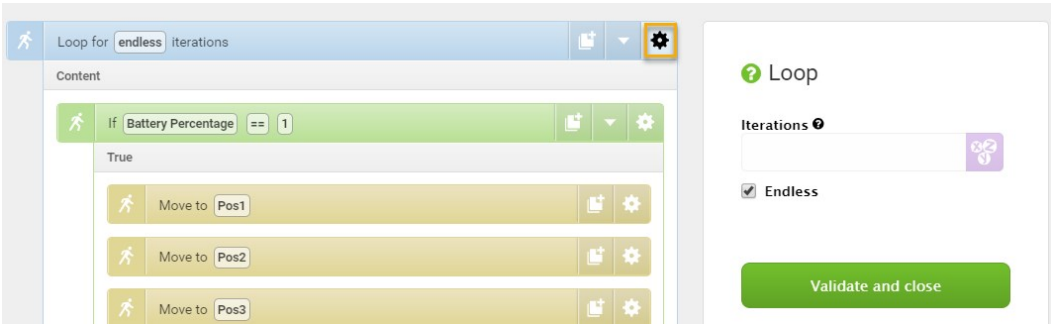
2. Within the **Create mission** window complete the following steps to add the necessary actions:
    1. In the **Logic** menu, select **Loop**.
    2. Select the gray bar that reads **Content** to embed the next action into the **Logic** action.
    3. In the **Logic** menu, select **If**.
    4. Select the gray bar that reads **True** to embed the next actions into the **If** action.
    5. In the **Move** menu, select **Move** three times.
    6. Select the gray bar that reads **False** to embed the next actions into the **If** action.
    7. In the **Move** menu, select **Move**.
    8. In the **Battery** menu, select **Charging**.

    The mission should look like this:



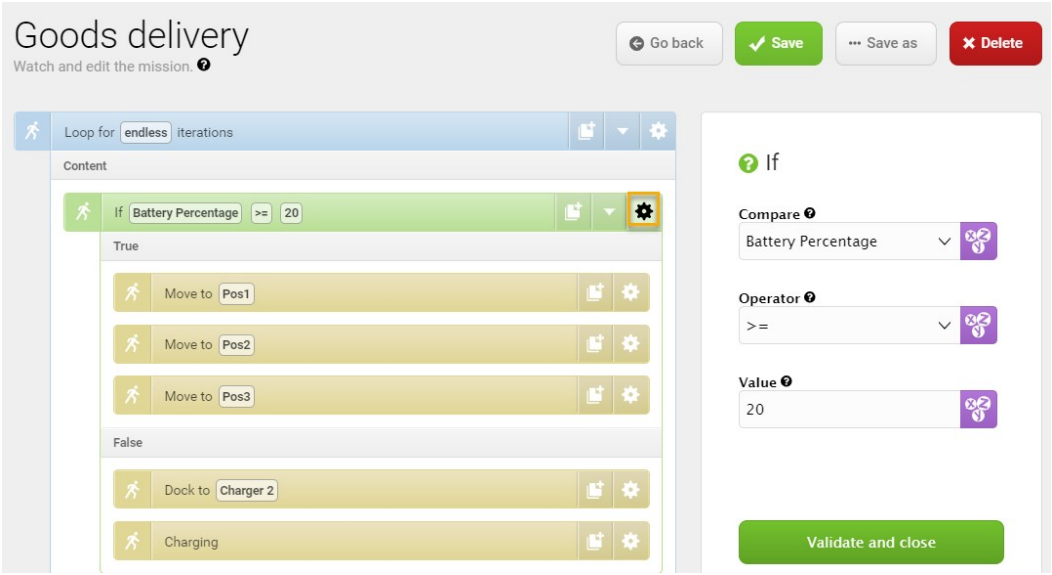
The next steps describe how to define the parameters of the **If** action, and where the robot should move when the **If** action is **True** or **False**. To set the parameters of each action, open the action dialog by selecting the gearwheel icon of the action in question.

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



4. In the **If** action dialog, do the following:

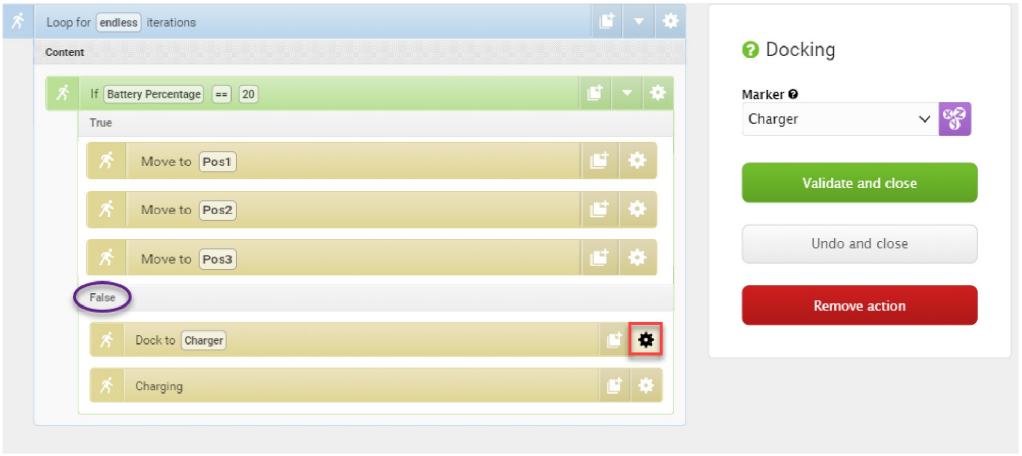
   - Select **Battery Percentage** under **Compare**.
   - Select **>=** (greater than or equal to) under **Operator**.
   - Type '20' under **Value**.
   - Select **Validate and close**.



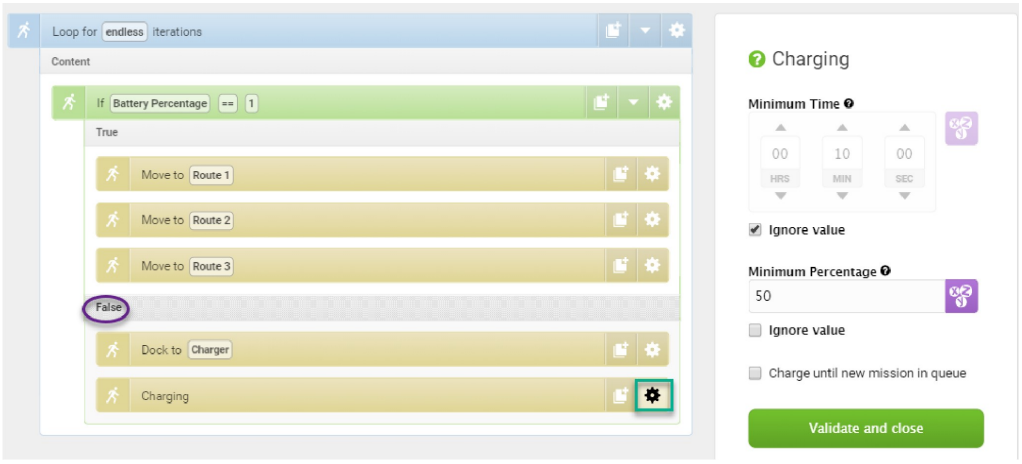
5. Under **True** in the **If** action, select a position for each of the three **Move** actions. Then select **Validate and close**.

6. 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**.



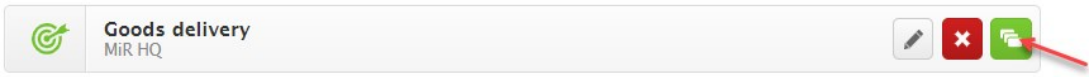
   - In the **Charging** action dialog, define how the charging should be completed. In our example, there is no minimum time. When the battery reaches 50%, the charging is completed. Select **Validate and close**.



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

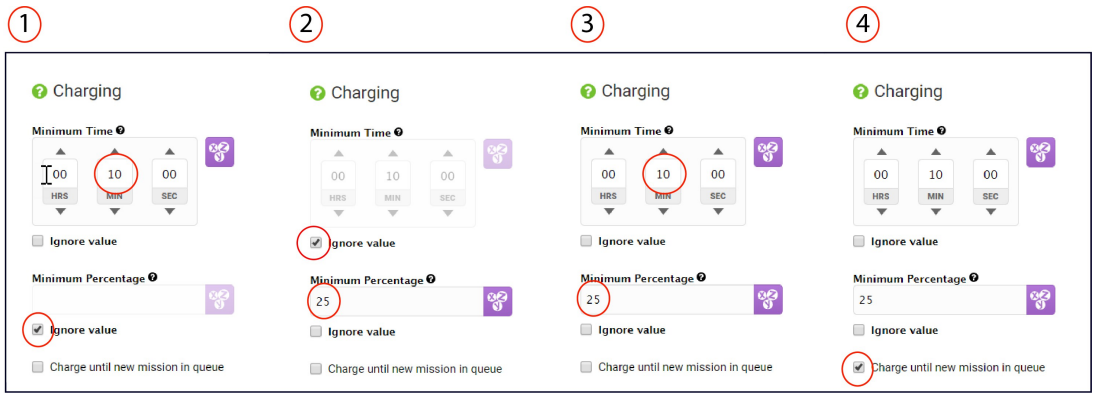
7. The mission is complete. Select **Save** to save the mission.

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



5.4 Charging action parameters explained

A charging action can be defined with a minimum time, a minimum percentage, or a combination of those two. This section explains the four options for setting the charging duration.



1. **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.
2. **Minimum Percentage**
   If you want to ensure that the battery is charged to a certain percentage, 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. **Combination of minimum time and/or minimum percentage**
   When you select neither of the **Ignore value** check boxes, you combine minimum time and minimum percentage, so the robot stays in the charging station until it fulfills one of the two parameters before initiating the next 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.