MiRCharge

Technical Documentation

Version 1.4

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1   Introduction

MiRCharge ensures that MiR100 robots can automatically stay charged and operate undisrupted 24/7. Multiple MiR100's can share the same charging station; however, this requires integration in the MiR Fleet system to avoid bottleneck situations. For more information, see the MiR Fleet manuals.

This manual describes how to install the charging station and how to configure a mission in which the MiR100 automatically finds and docks to the charging station to recharge the battery. The MiR100 locates the MiRCharge by tracking an inbuilt V-marker. This is shown in Figure 1, where ① points to the V-marker ② to the charging pins of the charging station.
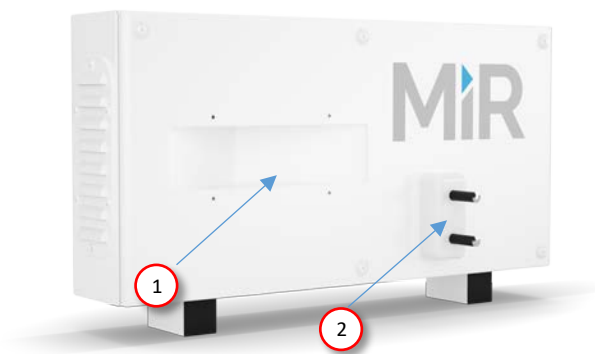

Figure 1. MiRCharge with built-in V-marker and charging pins

When the MiR100 is in position in front of the charging station, it will locate the V-marker, guide itself into position and start charging. The charging station will charge with up to 20 A only when both charging pins are pressed and the battery is connected. When the charging pins are not pressed, the charging station is not powered.

Note: 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.

2   Layout and dimensions

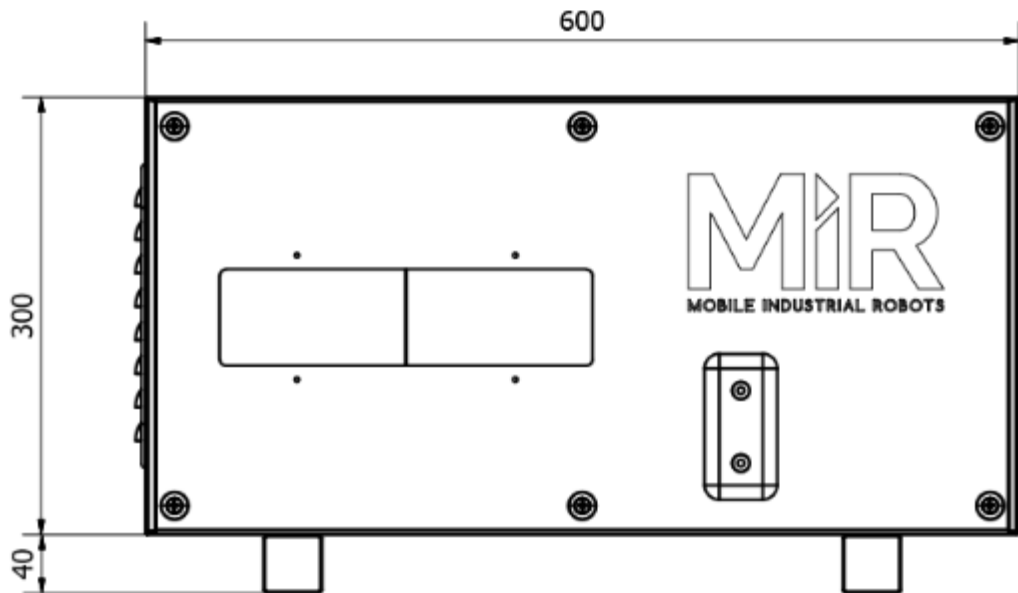The dimensions and layout of MiRCharge are shown in Figure 2, Figure 3 and Figure 4.
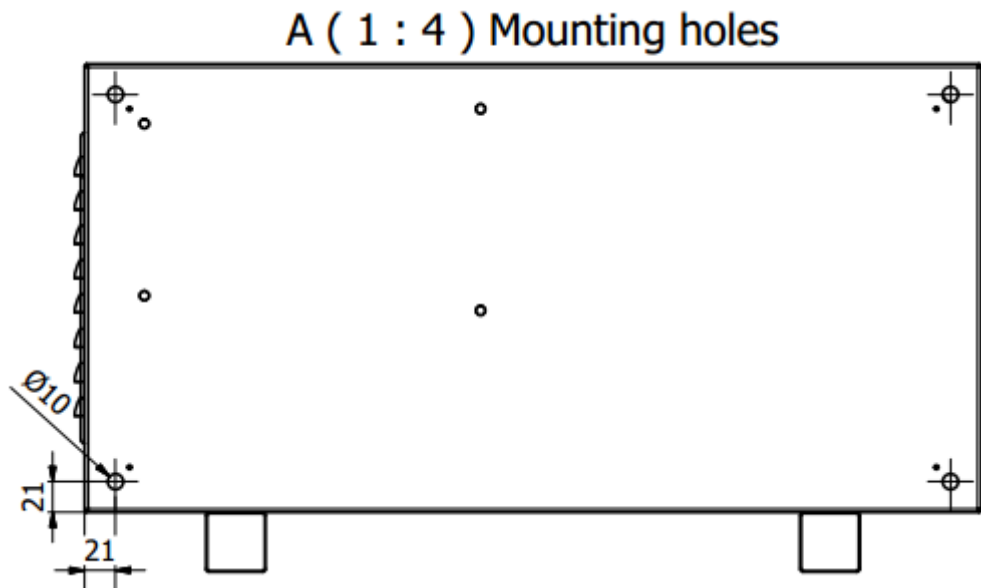

Figure 2 Front of MirCharge

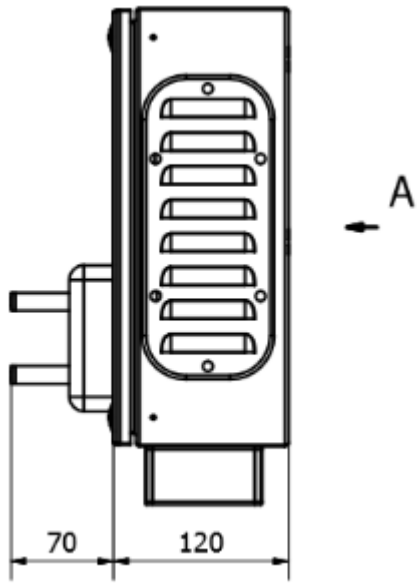*Figure 3 Rear side of MiRCharge*

Figure 4 Side view of MirCharge

3 Mounting MiRCharge

This chapter describes how to mount MiRCharge on a wall. Wall mounting is required to guarantee a successful charging procedure. Wall mounting requires that the front panel of MiRCharge is removed.

⚠️ **WARNING – Risk of electric shock**

Be sure to disconnect the power supply from the charging station before opening the front panel. Electric shock causing death or severe injury may result if you fail to observe this precaution.

Step	Instruction	Illustration
1	NOTE: It is important that the charging station has at least 50 cm of space on both sides.	
2	The MiRCharge must be placed on a clean, smooth and dry surface and mounted up against a solid wall to ensure stability when the robot connects to the charging pins.	

3	To mount the MiRCharge to the wall, untighten the six screws on the front panel of the charging station. **Note**: It is not necessary to remove the screws entirely.	
4	Open the front panel and fix the MiRCharge to the wall through the four screw holes in the back panel.	

5	After mounting, place back the front cover and tighten all six screws.	
6	Connect MiRCharge to a 230 VAC, 50 Hz outlet with ground. Use an adapter if needed to convert from EU power connectors. In case 230 VAC@50 Hz is not possible in your region, please send an email to support@mir-robots.com.	

4 Programming the robot for a MiRCharge

It takes two preparational steps before the robot will automatically go to a MiRCharge for battery recharge:

1. Creating a charging position in the map covering the location where the MiRCharge is placed, see 4.1 Creating a charging station position, p. 9.
2. Creating a mission which includes driving to the charging station, recharging and moving away again, 4.2 Creating a simple charging mission, p. 12.

It is assumed that the MiR100 is localized in a correct map. If in doubt, check the Command View to make sure that the red dots representing the laser scanner line match the black pixels in the correct map.

4.1 Creating a charging station position

Follow these easy steps to create a position that will take the robot to the charging station and start the charging.

1. Manually drive the robot to a position approximately 1 m in front of and facing the charging station.
2. In the web interface, go to "Command View" (Service > Command View).
3. Click "Create new Position". Name the position, and select Position type "Charging station".
4. Click "Detect marker". The "Detect marker" function automatically tracks the position of the charging station and sets the X and Y parameters in the robot enabling it to connect to the charging station.
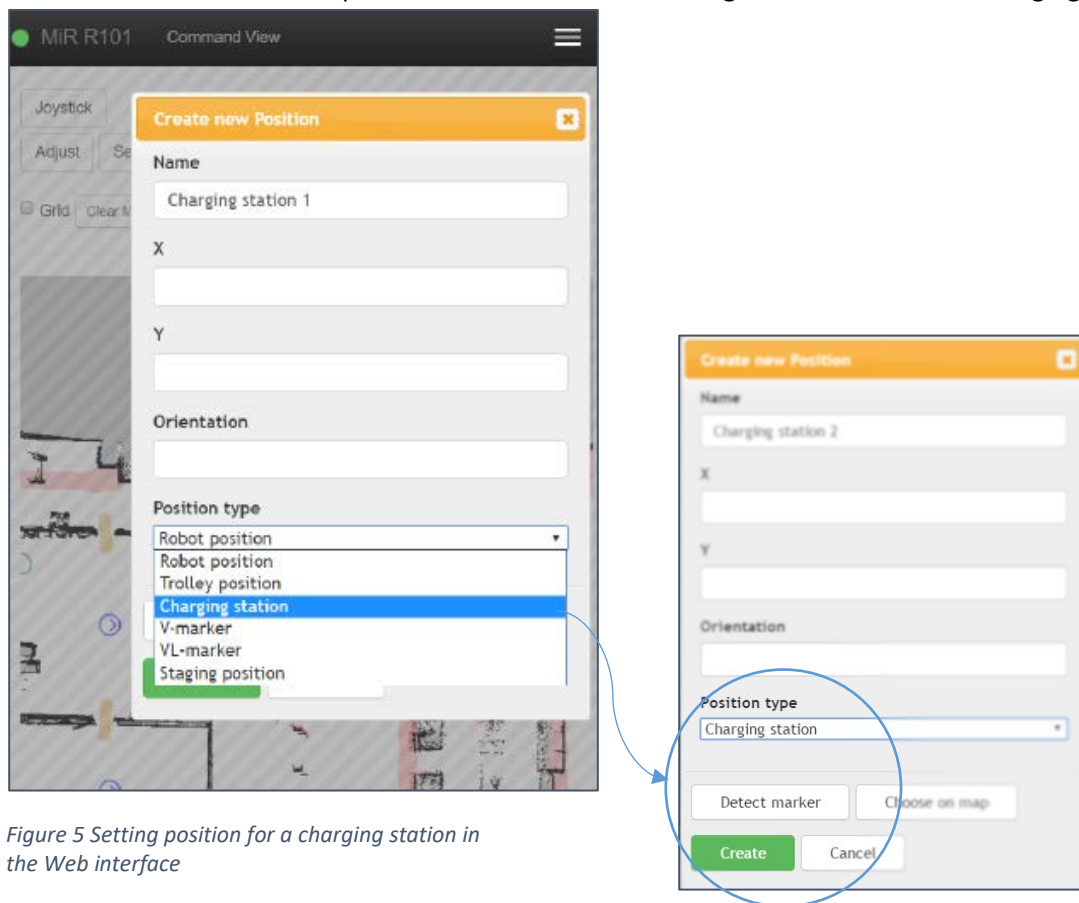

Figure 5 Setting position for a charging station in the Web interface

Note: If the robot is too far from the charging station, a message is shown:

"Make sure the marker is located in front of the robot and try again…"

Move the robot closer to the charging station. The charging connectors on the robot front should point directly towards the charging pins and the front laser scanner to the middle of the V-marker.
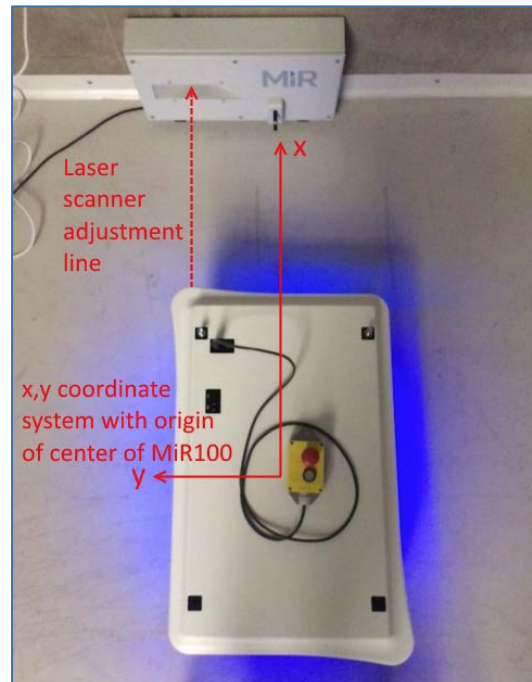

Figure 6 The ideal robot position when creating a charging station position.

5. Click "Create" to save the position. A new green colored position icon has now been added to the map and may be used in missions etc.
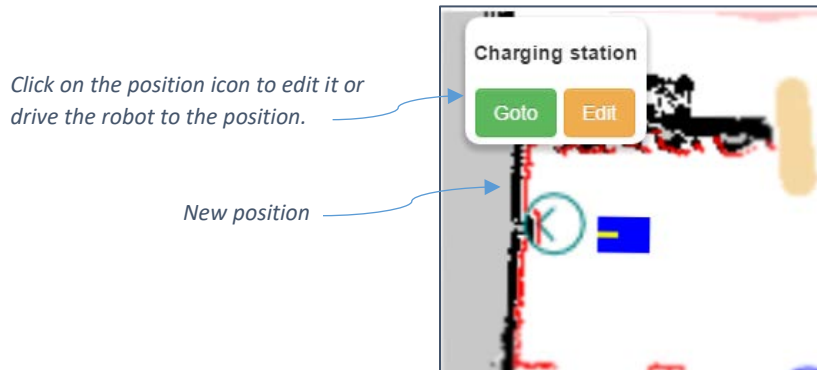
Click on the position icon to edit it or drive the robot to the position.

New position

Figure 7 New position created in map

Note: If, after you have set the position, the robot is not able to activate the charging pins, for example if it goes a bit too far to the left or right (Y offset) or does not get close enough to the charging pins (X offset), then go to the "ROS parameters" page (Service > Configuration > System settings > ROS parameters) and adjust the Calibration values.
Notice! These settings apply globally, i.e. if changed, they will apply to all positions set in the robot.
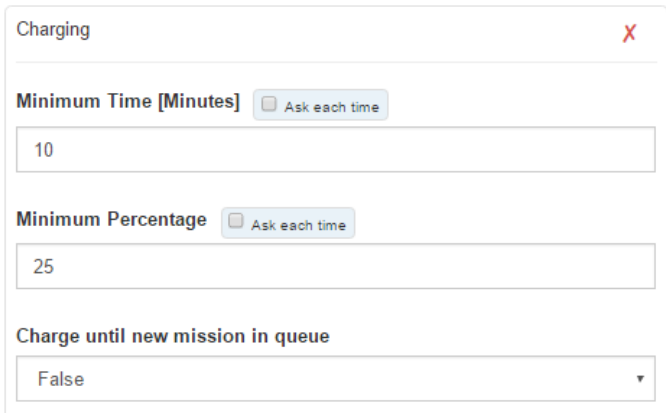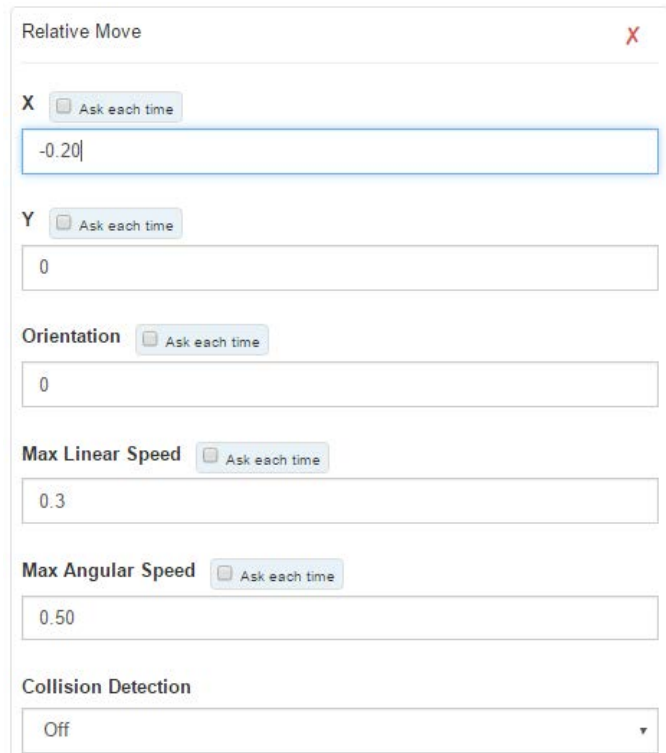
4.2   Creating a simple charging mission

When a charging position has been created in the map, charging missions can be created using this position and enabling the robot to go to the charging station for recharging.

Follow the steps below to set up a simple charging mission.

Step	Instruction	Illustration
1	From the main menu, click "Mission"	Overview Map » Taxi » Route » Mission » New Map » Service »
2	Press "Create mission"	Mission configuration — Current area: Company HQ Select mission... Queue Mission · Create mission · Edit mission · Delete mission Missions in queue — Show log Status: The robot is paused Name · State
3	This opens the Missions menu where missions are created from the Actions building blocks and already created missions. For more information on creating missions, see MiR100 Missions Interface manual.	Actions — Mission Actions · Missions Name: Wait Description: If Loop Area: While — Company HQ Return Break — Drag action or mission here... Continue Move To Known Position — Save · Cancel

Step	Instruction	Illustration
4	Create a mission that contains the following actions: • Docking • Charging • Relative Move	**Mission** **Name:** Charging mission **Description:** **Area:** Company HQ Docking ✗ Charging ✗ Relative Move ✗ Save Cancel
	Now set the parameters for these four actions:	
5	Click to expand the "Docking" action. From the dropdown list, select previously created charging position, Charging station.	Docking ✗ **Marker** Charging station 1

Step	Instruction	Illustration
6	Click to expand the "Charging" action and insert the parameters for how many minutes the MiR100 should charge *or* the minimum percentage to which it should charge before continuing to next action. See further explanation and examples in 4.1.1.1. OR actions explained.	 "Charge until new mission in queue" can be either True or False. Default is False, meaning that the mission will move to next action when either the minimum time or percentage is reached. If set to True, the mission will move to next action only when a new mission is appended to the queue. This option will let the MiR100 continue charging when it has nothing to do even if it has completed the charging criteria.
8	In the "Relative Move" action, define how the MiR100 should move away from the charging station. **X**: Forward/backward motion. For example, "-0.20" will force the MiR to drive backwards 0.2 meters. **Y**: Sideways. The MiR100 will make a 90 degree turn before rotating. **Orientation**: Degree of orientation: Position values are counterclockwise. Note: Orientation must be defined in a separate "Relative move" action. **Collision Detection**: Default is OFF which keeps the MiR100 turning until it goes into emergency stop. If set to ON, the MiR100 takes nearby objects into account.	

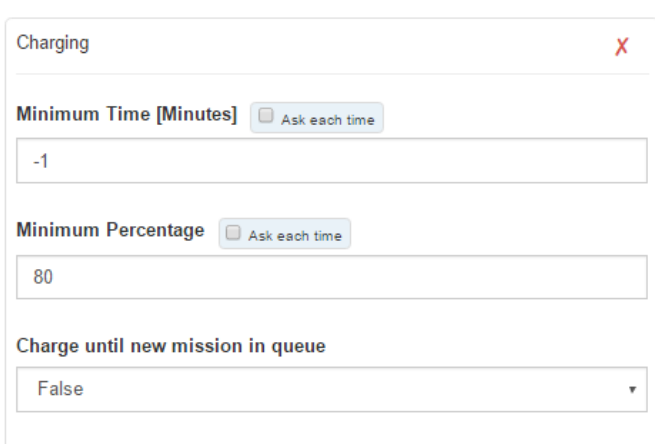| Step	Instruction	Illustration
		Note: Setting the collision detection to OFF is used in environments where there is either tight space or in spaces that are dedicated to the MiR100. In case an obstacle is present while the MiR100 turns with collision detection set to OFF, the MiR100 will continue turning until the emergency system kicks and stops the robot. Therefore this does not compromise the overall safety guaranty of the MiR100.

When finished, the mission could look like this:

- **Docking**: Select the already created charging position "Charging station"
- **Charging**: Minimum charging time: 10 minutes *or* Minimum battery percentage: 25% - whichever comes first.
- **Relative move**: For the first relative move action, let the MiR100 reverse 20 cm by setting the relative move parameter "X" to " -0.20"

4.2.1 OR actions explained

The OR action used in the Charge action requires that one *or* the other entry is true; in our example the robot must have charged for 10 minutes OR the battery percentage have reached 25%. When either of those requirements are fulfilled, the mission continues. If, for example, the battery is at 24% when the charging starts, and it takes only 2 minutes to reach 25%, then the charging action is completed and the mission continues without waiting for the set 10 minutes.

If you want to make sure that the battery percentage reaches a certain limit, for example 80%, independently of a minimum time setting, you can set the Minimum Time value to "-1". This will make the system ignore the minimum time because "-1" is always treated as FALSE. In the example below the robot will charge until it reaches 80% no matter how much time it needs.

Charging   X

Minimum Time [Minutes]   ☐ Ask each time

-1

Minimum Percentage   ☐ Ask each time

80

Charge until new mission in queue

False   ▾

Figure 8 Suppressing one parameter in an OR action

5   Frequently Asked Questions

Question: The MiR100 can't find the charging station. Why is that?

Answer: Try one or more of the following solutions:

1. Adjust the map in command view.
2. Make sure there is at least 50 cm of space on both sides of the charging station?
3. If none of the above works, depending on distance from dock, change the Dock search tolerance in the relevant docking mission.

Question: MiR100 is trying to dock but it does not drive close enough to touch the charging pins.

Answer: In the Calibration menu (Service > Configuration > System settings > ROS parameters), adjust the X offset to a value lower than 0.6.

Question: MiR100 is trying to dock but it continues to move towards the charging station until it goes into emergency stop.

Answer: In the Calibration menu (Service > Configuration > System settings > ROS parameters > Calibration), adjust the X offset to value higher than 0.51.

6   Change log

Version	Date	Changes
0.1	27.08.2015	Document created
1.0	01.09.2015	Revision for mission change
1.1	29.09.2015	Text changed in "Relay" and Optocoupler.
1.2	08.07.2016	Updating document to software release 1.6.3.
1.3	27.10.2016	Updating document to software release 1.7: Setting of charging positions and creation of missions made simpler.
1.4	19.01.2017	Updating document to software release 1.8: Updated with parameterized missions. Sections containing Try/Catch actions example replaced with reference to same information in MiR100 Missions interface manual.