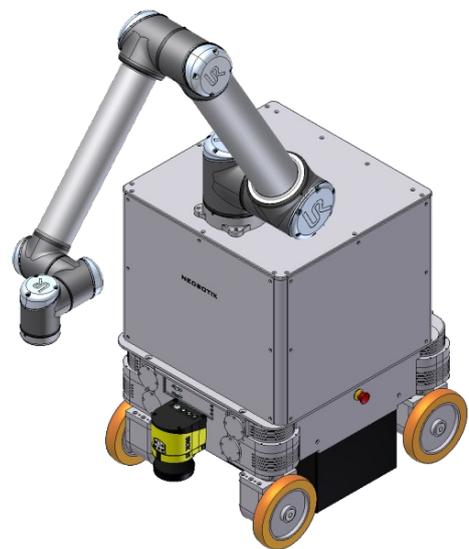


MMO – 700 UR10

Operating Manual



V2.4.5

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1 Introduction

1.1 General information

Mobile robot platforms are also known as automatic guided vehicles (AGV). This means the mobile system is capable of moving freely without the need of guide wires, optical guide strips or a magnetic sensor strip stuck to the floor marking the planned route.

Instead of hardware installations in the surrounding the destinations and the connecting pathways are defined by software. Using a simple 2D map of the area, there are just a few mouse clicks necessary to define routes for the robot. After this the control software is able to:

- move on predefined pathways,
- plan a path by itself between destinations,
- detect and evade obstacles on the path,
- execute programmed actions within the map.

The mobile robot navigates autonomously by acquiring sensor data of environment features such as walls and corners and comparing this data to the internal map.

1.2 Range of applications

The mobile robot may be used in a large variety of applications:

- Autonomous transportation tasks in industrial environments
- Automatic measurement of physical data in large areas (e.g. gas concentrations, temperatures, noise, etc.)
- Autonomous operations within large areas (e.g. surveillance, part handling, etc.)
- Telepresence while controlled via wireless LAN

1.3 About this document

This document is an addendum to the operating manual of the MPO-700 omnidirectional robot. It contains additional information about the extensions made to the original robot.

For further information please refer to the “MPO-700 Operating Manual” or contact Neobotix.



The warning triangle marks paragraphs that concern the danger of injuries, damages or both. Please read these paragraphs very carefully!



The prohibition sign marks actions or applications the robot is not intended for and which might result in damages, reduced life expectancy and loss of warranty.



The light bulb marks paragraphs that mention common problems, misunderstandings or errors and is meant to be a help in troubleshooting.

2 Product information

2.1 Product description

The mobile manipulator MMO-700 UR10 is an autonomous robot vehicle for a wide range of applications.

It is based on an MPO-700 omnidirectional robot which was equipped with an industrial robot arm UR10 from Universal Robots. An electrical cabinet on top of the mobile platform MPO-700 contains the controller box of the robot arm as well as the additional electrical hardware required to operate the arm.

2.2 Intended use

The MMO-700 UR10 has been designed for use in service robotics research. It can be used for a wide range of different experiments and tests in fields such as autonomous vehicles, mobile manipulation and factory automation.

The MMO-700 may only be used in laboratories, test halls or similar environments. It is not recommended to use the MMO-700 in any other surrounding, especially not outdoors, in offices or factories.

2.3 Improper use



The MMO-700 must not be used for transportation of passengers in any way. No person must ride on the robot itself, nor must the MMO-700 be used to move any other vehicle or hanger with passengers aboard.



The MMO-700 must not be operated in any publicly accessible area and is not approved for this kind of operation.



The MMO-700 must at no times be used without supervision of a qualified operator if there are guests, passers-by or other people unfamiliar with the robot within the working area.



The robot must never be operated in areas where there are staircases leading down, elevated platforms or other possibilities for falling or dropping down. This may cause serious injuries or death!

2.4 Working areas

The MMO-700 UR10 requires the same working area conditions as the MPO-700. Please refer to the MPO-700 Operating Manual for details.

2.5 Qualified personnel

The MMO-700 UR10 must only be modified, commissioned, operated and serviced by qualified personnel as stated in the MPO-700 Operating Manual.

3 Safety instructions

3.1 General

All safety instructions concerning the MPO-700 that are described in the according operating manual also apply to the MMO-700. Please read the corresponding chapter in the original operating manual very carefully and ensure that every person working on or with the MMO-700 reads those instructions as well.

3.2 Additional instructions

Robot arm

The UR10 robot arm was designed for direct interaction with humans. Its safety features limit its speed and power and significantly reduce its potential to cause injuries or damages.



Nevertheless the robot arm may hit people or obstacles before its safety features come into effect. When equipped with a dangerous tool, serious injuries may be caused.

Laser scanner

The MMO-700's robot arm may reach beyond the laser scanner safety fields that were originally set up for transport and delivery. In order to ensure a safe operation of the robot, the safety fields must be adjusted to cover the robot arm's working space whenever possible and to prevent collisions between the arm and any person nearby.

Working required from the customer

The MMO-700 is a very complex robot. The applications in which it will later be used could not be foreseen in detail during the development of the robot.

Therefore, beside any modifications needed for certain research work or experiments, some very basic tasks must be completed before the robot can be used safely.



- An assessment of risks must be performed by the customer to identify the different measures needed to guarantee a safe operation.
- **All safety measures required for safe operation have to be implemented by the customer according to the assessment of risks and under the customer's responsibility.**
- The higher level control software for the robot has to be provided and installed by the customer. The safe operation of the robot greatly depends on the proper and reliable functioning of this software. Therefore it must be made sure that the robot's speed and workspace are limited to a safe level and that all axes are coordinated properly at all times.

In order to achieve a safe operation of the mobile robot, several measures might be required. The following list gives a short and incomplete overview of possible measures.

Additional actions might be required to guarantee the appropriate level of safety!

- Using the laser scanners area monitoring feature for collision avoidance
- Adding safety bumpers to the robot
- Limiting speed, power and work area of the robot
- Adding covers and shielding on the robot

4 Unpacking and assembly

4.1 Basic assembly



The mobile robot MMO-700 is packed in a rugged wooden box which can be reused for future transports.

The mobile platform can operate on its own without the controller cabinet or the robot arm attached. The robot arm on the other hand must be mounted on top of the mobile platform before it can be operated. Please note that the white bridge connector -X32 must be used to operate either sub-system separately.

Carefully lift the control cabinet onto the platform's top plate and position it as shown in figure 1. Make sure that the countersunk holes in the cabinet's base plate are aligned with the threaded holes in the platform's top plate.

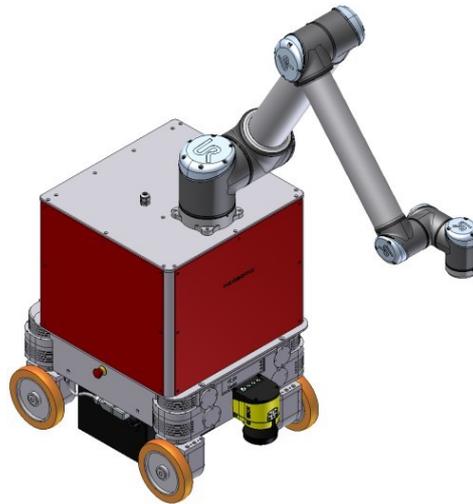


Figure 1: Controller cabinet and robot arm mounted onto the mobile platform

Now fasten the control cabinet to the mobile platform using the counter sunk screws that were included in delivery. The cover plates at the front and **right** side of the control cabinet (marked in red in figure 1) can be removed to provide easy access to the inside of the cabinet.

If the UR10 controller box was shipped separately, place it inside the cabinet and fix its base to the cabinet's base plate with the four M6 screws and washers. Then connect the black AC power cable and the cable with the grey Harting connector to the appropriate connectors at the bottom side of the controller box.

If the robot arm was shipped separately, position it on top of the control cabinet as shown above. Then fasten it securely using the M8 screws. Finally connect the robot cable to the plug at the back of the arm's base.

Connect the cables inside the control cabinet to the appropriate plugs (-X31, -X32 and Ethernet) of the mobile platform.

4.2 Installing the auxiliary batteries

In order to extend the robot's uptime, a second battery set can be installed into the controller cabinet. Before installing the auxiliary batteries, please turn off the robot and fully charge both the batteries that are currently used in the robot as well as the additional battery pack.



It is very important to fully charge both sets of batteries before connecting them. This will prevent internal currents between battery sets of different charge levels. Such currents may cause overheating and damage to the robot.

For charging the auxiliary batteries please use the adapter that was included in delivery to connect the battery charger directly to the black 3-way power connector -X31 inside the cabinet.

Remove the front plate of the controller cabinet and place the batteries inside the aluminium frame on the cabinet's base plate, with the battery cables facing into the cabinet.

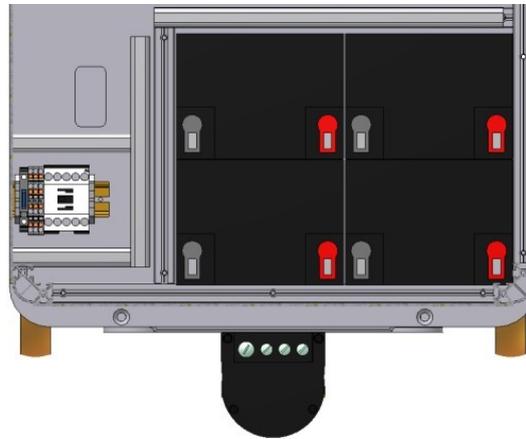


Figure 2: Position of the auxiliary batteries

Plug the battery cables into the four black connectors inside the cabinet. The connectors are protected against wrong polarity.

Now put the front and side plates back in place, fasten them securely and start the robot.



When the auxiliary batteries have been used, the robot must only be recharged by connecting the battery charger to the robot manually or by using the automatic charging station. Do not recharge either set of batteries individually by connecting them to the battery charger directly.

Three ATO fuses (80 V) inside the cabinet protect the electrical system from excessive currents. Please see the electrical circuit diagram for details.

5 Technical data

5.1 Mechanical properties

Dimensions

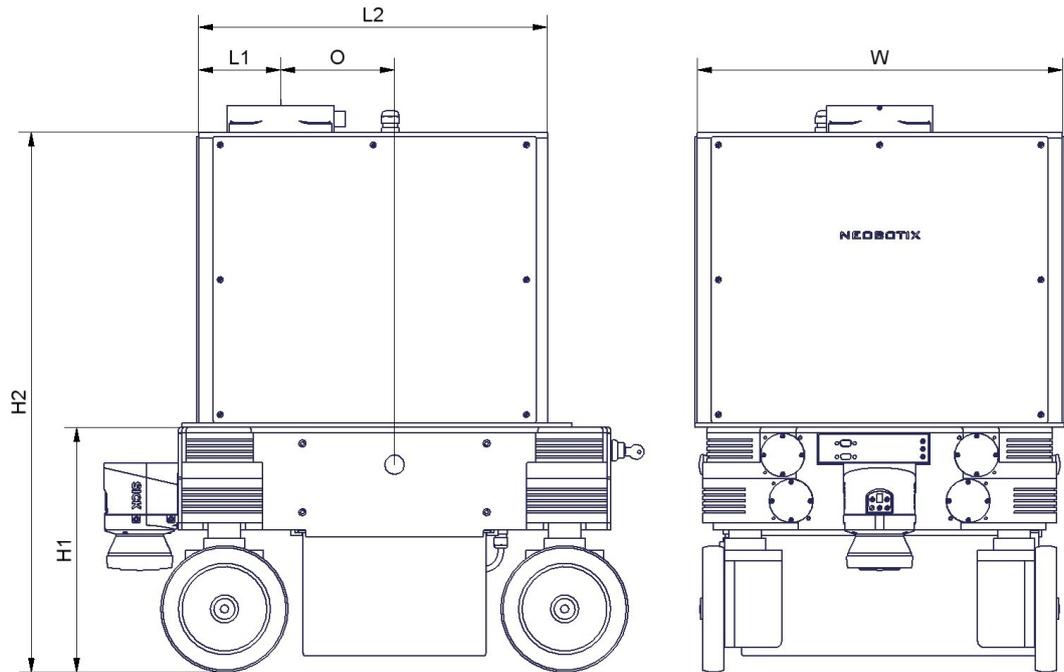


Figure 3: Dimensions of the MMO-700 UR10

All dimensions are in millimetres.

Description	Symbol	Value
Height of the mounting plane	H1	348
Height of the control cabinet's top plate	H2	767
Offset between arm base and platform centre	O	160,5
Distance to the front of the cabinet	L1	115,5
Length of the cabinet's top plate	L2	492
Width of the cabinet's top plate	W	515

5.2 Properties of the UR10

The hardware of the UR10 robot arm has not been modified. All features and properties of the arm remain unchanged as stated in the manufacturer's documentation. Please refer to this documentation for further information.

The platform's emergency stop system was integrated into the arm's safety system as external machine. Technical details on this connection can be found in the electrical circuit diagram of the MMO-700 UR10 and in the operating manual of the UR10. In case the arm is to be operated separately this connection has to be bridged with the white connector -X32 that was included in delivery.

The configurable inputs CI0 and CI1 have been changed to "Unassigned".

The configurable outputs CO0 and CO1 have been set to "Emergency stop".

The safety configuration password was set to **neobotix**.

Please contact Neobotix if you have any questions concerning the safety system.



6 Legal notes

Version information

This document has been translated and is not the original. Please refer to the German version in case of uncertainties or questions.

Liability

Every care has been taken in the preparation of this manual which represents the state of technology at the time of its composing. However, inaccuracies or omissions might occur. Please inform Neobotix in case you notice any.

The Neobotix GmbH cannot be held responsible for any technical or typographical errors and reserves the right to make changes to the product and manual without prior notice.

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Declaration of conformity

This product fulfils all relevant directives of the European Union. For further information please contact Neobotix.



Declaration of RoHS conformity

This product complies to the RoHS directives of the European Union. For further information please contact Neobotix.

Downloads and further information

Additional information, data sheets and documentations, also for the other products of Neobotix, can be found on our homepage www.neobotix-roboter.de.

Imprint

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