motion plastics®

ReBeLMove Pro

Operating instructions

Mobile platform for material handling

igus®.eu

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1 GENERAL DESCRIPTION

In this section you will find information on these operating instructions as well as general safety instructions for handling the *ReBeLMove Pro*. In the following, the *ReBeLMove Pro* is also referred to as the robot.

1.1 Notes on the assembly and operating instructions

These operating instructions are an integral part of the user documentation for the robot. Observe all instructions, data and regulations contained in the operating instructions. The operating instructions will help you to operate the robot safely and with a high level of productivity. We reserve the right to make technical changes to the illustrations and information in the operating instructions in order to improve the robot.

1.2 Using the operating instructions

The purpose of these operating instructions is to familiarise you with the robot and to use it for its intended purpose. The operating instructions contain important information on how to operate the robot safely, properly and economically. Observing them helps to avoid hazards, reduce repair costs and downtimes and increase the reliability and service life of the robot. The operating instructions must be supplemented with instructions based on existing national regulations for accident prevention and environmental protection. The operating instructions must always be available at the robot's place of use and must be in a legible condition. The operating instructions must be read and observed by every person who is to work with the robot, e.g.: operation including set-up, troubleshooting, care, disposal of operating and auxiliary materials, maintenance (servicing, inspection) and/or transport. In addition to the operating instructions and the binding accident prevention regulations applicable in the user's country and at the place of use, the recognised technical rules for safe and professional work must also be observed.

1.3 Design of the operating instructions

Safety-relevant information is labelled with appropriate symbols and bold type.

Enumerations
Lists of specifications in any order, which do not necessarily have to be followed, are marked with a dot.

Example:
- Specification A
- Specification B
  - Part specification for specification B

Sequences
Work steps that must be carried out in the specified order are numbered and the result of the work steps is shown in italics.

Example:
1. Step 1 to be carried out
   Result of step 1
2. Step 2 to be carried out
   2.1. Sub-step of step 2 to be carried out

1.4 Obligations of the operator

The operator undertakes to only permit persons to work on the robot who:
- are familiar with the basic regulations on occupational safety and accident prevention and have been instructed in the handling of the robot.
- have read and understood the safety instructions and warnings in these assembly and operating instructions and have confirmed this with their signature.
- have been trained or instructed and their responsibilities for operation have been clearly defined.
- are regularly instructed about difficulties, hazards and other special rules of behaviour.

The operator undertakes:
- to observe and instruct, in addition to these assembly and operating instructions, the generally applicable statutory and other binding regulations on accident prevention, environmental protection and the handling of hazardous substances.
- to provide personal protective equipment.
- to define the responsibility of the robot operator in order to enable the robot operator to refuse instructions from third parties that are contrary to safety requirements.
- to check the safety-conscious work of the personnel at regular intervals.
- to observe the legal provisions and regulations applicable at the place of use of the robots.

1.5 Requirements for personnel

All persons who are authorised to work on and with the robot are obliged to do the following before starting work:

- to observe the basic regulations on occupational safety and accident prevention.
- to read the safety and warning information in these assembly and operating instructions and to confirm by their signature that they have understood them.
- to put on personal/workplace-related protective clothing and use aids that serve occupational safety during work, insofar as this is necessary for safety reasons.
- to comply with the competency requirements.

1.6 Dangers when handling the robot

The robot is built according to the state of the art and recognised safety regulations. Nevertheless, improper use may result in danger to the life and limb of the user or third parties, or damage to the robot or other property. The robot must only be operated in a safe and proper condition.

DANGER

Observe the safety instructions!

- Only operate the robot if all protective devices and safety-related equipment, e.g. emergency stop devices are present and functional.
- Immediately eliminate or arrange for the elimination of any malfunctions that could compromise safety.
- Observe the residual risks and dangers in section 2 "Safety instructions".

Intended use

The *ReBeLMove Pro* is intended for commissioning and use in operational indoor areas where public access is restricted. Details of the environmental conditions under which the robot should be operated can be found in the specifications. The *ReBeLMove Pro* is equipped with safety-relevant functions that have been specially developed for the following purposes: collaborative operation, in which the robot works without a protective housing or together with people. The robot may only be used within the performance limits specified in section 3 "Technical data" of the operating instructions. Any other use or use beyond this is considered misuse and is not in accordance with the intended use. igus® SE & Co. KG is not liable for any resulting damage.

As partly completed machinery in accordance with the EU Machinery Directive, the *ReBeLMove Pro* can be equipped with superstructures that do not comply with the above limitations. The persons who design, manufacture or commission a system that does not comply with the limits of use of the *ReBeLMove Pro* have the obligations of a manufacturer and must ensure a safe design in accordance with EN ISO 12100. The guidelines given in this manual are not sufficient.

Examples of superstructures that do not fall within the intended use of the *ReBeLMove Pro* are in particular:

- Shelves on stands (with or without wheels)
- Superstructures (including payload) that increase the base of the *ReBeLMove Pro*
- Conveyor belts (electrically powered or not)
- Robot arms
- Customised handling stations

Intended use also includes:

- observing all instructions and regulations in the operating instructions and all accompanying documents.
- adherence to the prescribed inspection and maintenance intervals or those specified in the operating instructions and accompanying documents.
- Travel path: Minimum width of the travel path: at least 1.2m. Bottlenecks must be sufficiently dimensioned. It is forbidden to drive into dead ends without escape routes.

1.7 Reasonably foreseeable misuse

Reasonably foreseeable misuse includes, in particular:

- the transport of people.
- transport of materials that do not comply with the product specification.
- the use of cleaning agents that do not comply with the product specification.
- using the robot for other purposes.
- operating the robot with bypassed safety devices.
- operating the robot with an incomplete safety guard.
- the operation, maintenance and repair of the robot by unauthorised and/or untrained persons.
- the use of non-original spare parts.
- operation outside of indoor areas.
- change the SICK configuration.
- operation in hygiene zones.
- the operation of the robot on inclined surface gradients (max. inclination: 3%).
- exceeding the total payload and uneven distribution of the load, which could lead to instability.
- use of the robot in medical and life-critical applications.
- operating the robot outside the permissible operating parameters and ambient conditions.
- use of the robot in potentially explosive environments.
- placement of objects or the presence of persons in the robot's path of travel.
- manipulation of the sensor system.
- attempting to charge the robot at a charging station not intended for this purpose or using an incompatible charger.
- operating the robot outside of defined travel paths in the production hall.
- using the robot where charging stations and transfer stations are not clearly marked and accessible.
- operating the robot in areas that are simultaneously used by other vehicles (e.g. forklifts).
- communicating with other machines or systems via unauthorised interfaces.

1.8 Reference to training courses

To ensure sufficient familiarity with the robot, the operating personnel are instructed by employees of igus® SE & Co. KG. Only use trained or instructed personnel. Clearly define the responsibilities of personnel for operation, set-up, maintenance and repair. Personnel who are to be trained, instructed or are undergoing general training may only work on the robot under the constant supervision of an experienced person.

1.9 Claims for defects and liability

In principle, our "General Terms and Conditions of Sale and Delivery" apply. These have been available to the operator of the robot since the contract was concluded at the latest. Claims for defects and liability for personal injury and damage to property are excluded if they are attributable to one or more of the following causes:

- improper use.
- improper installation, commissioning, operation and maintenance.
- operating the robot with defective safety devices or improperly installed or non-functional safety and protective devices.
- failure to observe the instructions in the assembly and operating instructions regarding transport, storage, assembly, commissioning, operation, loading, maintenance and set-up.
- unauthorised structural changes.
- inadequate monitoring of robot parts that are subject to wear.
- improperly carried out repair work.
- disasters caused by foreign bodies and force majeure.
- vandalism.

2 SAFETY INSTRUCTIONS

2.1 Safety symbols in these operating instructions

DANGER

"DANGER" indicates an imminent danger that will lead to serious physical injury or death.

WARNING

"WARNING" indicates a potentially dangerous situation that could lead to serious injury or death.

CAUTION

"CAUTION" indicates a potentially dangerous situation that could lead to minor personal injury.

NOTE

"NOTICE" indicates a potentially dangerous situation that can lead to damage to property and the environment. This signal word is also used for application notes and other useful information.

2.2 Warning signs on the robot

In places with an increased risk, it may be necessary to attach warning signs. These warning signs must not be removed and must always be clearly visible.

Warning sign	Type of danger
	Warning of hand injuries
	Warning of dangerous electrical voltage
	Warning of crushing hazard
	Warning of rotating rollers

2.3 General safety instructions

DANGER

Danger due to missing or unsuitable protective equipment!

- Wear the protective equipment prescribed by the company for all work on the robot.
- Wear safety shoes.
- Do not wear protective gloves when working with pull-in hazards.
- Wear tight-fitting safety goggles and solvent-resistant protective gloves when handling flammable liquids.
- Observe the wearing times of protective gloves. When wearing protective gloves for long periods of time, use special skin protection products before starting work.
- Wear personal protective clothing.
- Observe the information in the safety data sheets for the conveyed media.

CAUTION

Danger of slipping!

- Keep the base of the robot clean of lubricants.
- Remove leaked liquids immediately.

NOTE

Every employee has the right to refuse instructions from third parties that are contrary to safety regulations.

2.4 Safety instructions for transport, assembly and initial commissioning

DANGER

Risk of injury during transport to the operating site! Danger to life due to moving load!

- Comply with legal regulations on load securing.
- All moving parts must be secured with cable ties or similar before transport.
- Only use lifting gear and load-bearing equipment with sufficient load-bearing capacity for loading work.
- Do not stand under or in the immediate vicinity of moving loads.
- Never exceed the max. capacity of the load handling equipment.
- Only use load handling equipment that are in perfect condition, suitable and sufficiently dimensioned.
- The lifting equipment (chains) must be designed for the robot weight. The chain lengths must be set in such a way that the robot is lifted horizontally.
- The load is properly attached.
- Before lifting the load, make sure that it is properly fastened and secured.
- Standing under suspended loads is prohibited.
- The operator must always have the load and the danger zone in view.
- Secure the danger zone over a wide area and put up warning signs.
- Only transport loads vertically.
- Always pick up the load symmetrically.

DANGER

Hazards due to damaged components or assemblies!

- After unpacking the robot, all parts and components must be checked for damage.
- After setting up the robot, all parts and components must be checked for damage.
- Any damage detected must be documented.
- Check the robot for damage before initial commissioning.
- Report any transport damage to the transport company and the manufacturer immediately upon receipt of the delivery.
- Do not put a damaged robot into operation.

2.5 Safety instructions for operation

DANGER

Danger to persons!
- Ensure that there are no persons in the danger zone before switching on the robot.
- Be careful and attentive in the entire working area of the robot.
- First allow faults to be completely eliminated, then unlock the emergency stop button and restart the robot.

WARNING

Improper operation of the robots!
- Only qualified personnel with operating authorisation may operate the robot.
- Memorise the position and function of the individual operating and control elements.
- Get familiar with the robot.
- Clearly define responsibilities and areas of work.
- Be aware of possible dangers on the robot.

WARNING

Improper operation of the robot!
- Use the robot as intended.
- Check the robot for damage before starting work.
- Use the robot in a technically perfect, operational and functionally safe condition.
- First, have any damage to the robot professionally repaired, then put the robot into operation.

WARNING

Unforeseen operating behaviour of the robots!
- Do not modify control, switching and safety devices.
- Do not change the software of the programmable control system without prior consultation.

WARNING

Risk of crushing on rotating/moving robot parts!
- Do not start the robot until the existing protective devices have been closed/ assembled.
- Ensure that there are no persons in the danger zone, especially in the direction of travel and opposite direction, then operate the robot.
- Do not open the safety devices during operation.
- Do not reach into rotating/moving robot elements or devices.

2.6 Safety instructions for installation, maintenance, servicing and troubleshooting

DANGER

Risk of injury due to unexpected switch-on!
- Switch off the robot during set-up and maintenance work, servicing and troubleshooting and secure it against unexpected restarting.
- Switch off power to the robot before starting work; disconnect the battery using the battery isolator switch.

DANGER

Risk of injury due to falling!
- Do not use the robot as a climbing aid. Always use appropriate access aids to reach external parts of the system (e.g. ladders and platforms).
- Do not climb on railings or balustrades.

DANGER

Risk of injury from falling objects!
- Make sure that no objects fall off the robot.
- The danger zone below must be secured against trespassing if necessary.

DANGER

Danger to persons and the robot!
- Only authorised specialist personnel are permitted to set up the robot and rectify faults.
- Secure the area for set-up and maintenance work, maintenance and troubleshooting as far as necessary.
- Carry out installation work and troubleshooting work that requires safety devices and/or covers to be disabled with the utmost caution. Clearly define responsibilities and areas of work.
- Refit all safety devices and/or covers immediately after completing the work.
- After work, switch on the robot only after ensuring that there are no persons in the danger zone.
- Be careful and attentive in the entire working area of the robot.

WARNING

Danger due to improper maintenance and repair work on the robot!

- Only persons authorised by the manufacturer are permitted to service and repair the robot.
- Repair work must only be carried out by qualified specialist personnel.
- Observe the safety instructions in these assembly and operating instructions and in the operating instructions and manuals of third-party manufacturers before carrying out maintenance and repair work.
- Familiarise yourself with the individual maintenance and repair instructions before carrying out any work.
- Remove all tools and objects on and from the robot after set-up, maintenance and repair work, servicing and troubleshooting.
- Check screws regularly for tightness.

2.7 Lithium battery

This section contains safety precautions for handling lithium batteries in the robot.

WARNING

Lithium batteries can become hot, explode or ignite in the event of electrical or mechanical misuse, causing serious injury.

Observe the following precautions when handling and using lithium batteries:

- Do not short-circuit the battery. Pay attention to the correct polarity when inserting and recharging.
- Do not expose the battery to temperatures outside the specified temperature range. Do not set fire to the battery.
- The battery must not be crushed, pierced or dismantled. The battery contains safety and protective devices which, if damaged, can cause the battery to generate heat, explode or ignite.
- Do not allow the battery to get wet.
- If leaking battery fluid comes into contact with the eye, do not rub the eye. Rinse the eye with water and consult a doctor immediately. If treatment is not carried out, the battery fluid can damage the eye.
- Only use the original charger (charging cable or charging station) and always follow the battery manufacturer's instructions.

2.8 Residual risks

Despite the safety devices, the use of the robot may pose a risk to the life and limb of the user or third parties, or to the health and safety of others or result in damage to the robot and other property. Special care is required:

- During set-up work when safety devices are open (danger of being pulled in; danger of being crushed).
- There is always a risk of jamming in the vicinity of moving robot elements.
- When handling the robot, there is always a risk of impact.

3 TECHNICAL DATA

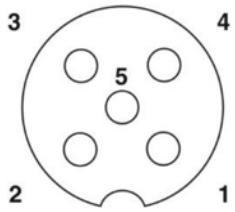
3.1 Complete system without add-on

General data	
Naming the robots:	ReBeLMove Pro
Robot type:	Mobile robot
Overall dimensions (L x W x H):	795mm x 550mm x 195mm
Total weight (with battery):	71kg
Emission sound pressure level:	40dB(A)
Payload:	250kg
Speed and performance factors	
Driving speed:	2m/s
Operating time:	8h*
Positioning accuracy:	50mm
Tolerance for gaps that can be overcome:	15mm
Tolerance for thresholds that can be overcome:	10mm
Min. corridor width:	1,200mm
Min. passage width:	800mm
Power	
Battery:	Varta Easy Blade 48V
Charging/operating time ratio:	1 / 4 hours
Charging cycles:	1,200
Environment	
Ambient temperature:	Normal 0°C - 40°C
Relative humidity:	30 - 80% (non-condensing)
Communication	
WLAN:	2.4GHz, 5GHz
Mobile network:	4G, 5G
Inputs and outputs:	1x LAN connection: M12 4P B-coded, female 1x I/O connection: M12 17P A-coded, female 1x CanBus connection: M12 5P A-coded female 1x User interface power supply: Battery voltage 46 - 60V permanent and switched: together max. 10A, 24V logic max. 2A
Sensors	
SICK safety laser scanner	2x NanoScan3

*Depending on load condition and driving profile

3.2 Interface specification

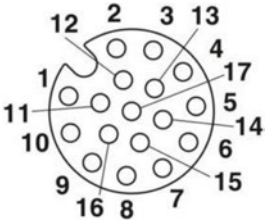
3.2.1 CAN communication

CAN connection socket	Pin no.	Description
	**1**	CAN shield
	2	+24V (max. 1A combined with digital outputs)
	3	GND
	4	CAN HIGH
	5	CAN LOW
SACC-E-FS-5CON-M16/0.5 SCO		

Recommended connection cable: SAC-5P-M12MS/ 1.5-PUR SH

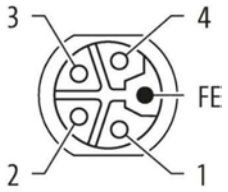
3.2.2 IO interface

IO connection socket	Pin no.	Description
	1	+24V (max. 1A combined with digital outputs)
	2	GND
	3	Digital output 1 (PNP, max. 100mA)
	4	Digital output 2 (PNP, max. 100mA)
	5	Digital output 3 (PNP, max. 100mA)
	6	Digital output 4 (PNP, max. 100mA)
	7	Digital output 5 (PNP, max. 100mA)
	8	Digital output 6 (PNP, max. 100mA)
	9	Digital output 7 (PNP, max. 100mA)
	10	AUX_OUT (reserve, not used)
	11	Digital input 1 (PNP, 24V)
	12	Digital input 2 (PNP, 24V)
	13	Digital input 3 (PNP, 24V)
	14	Digital input 4 (PNP, 24V)
	15	Digital input 5 (PNP, 24V)
	16	Digital input 6 (PNP, 24V)
SACC-E-FS-17CON-M16/0.5 SCO	**17**	Digital input 7 (PNP, 24V)



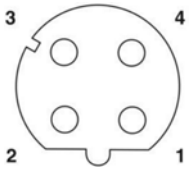
Recommended connection cable: SAC-5P-M12MS/ 1.5-PUR SH

3.2.3 Power interface

Power connection socket	Pin no.	Description
	**1**	+24V (max. 2A)
	2	+Battery voltage permanent (46-61V)*
	3	GND 24
	4	+Battery voltage switched (46-61V)*
M12 power socket flange L-cod. VWM PUR stranded wires 5x1.5 0.5m 7000-P4291-9800050	**5 FE**	GND battery

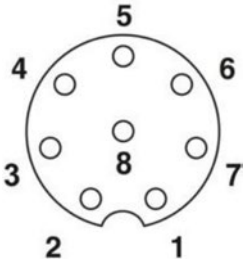
Recommended connection cable: MURR 7000-P4201-P040150 M12 Power L-cod. St.
+Battery permanent and switched max. 12A combined

3.2.4 LAN connection

LAN connection socket	Pin no.	Description
	**1**	TX+
	2	RX+
	3	TX-
0985 806 104/1M	**4**	RX-

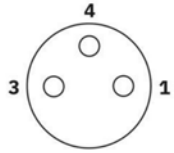
Recommended connection cable: 0985 806 103/1M (Lumberg Automation)

3.2.5 Emergency stop connection

Emergency stop connection socket	Pin no.	Description
	**1**	Normally open contact (reset)
	2	
	3	Normally closed contact
	4	
	5	LED + (reset)
	6	LED - (reset)
	7	Normally closed contact
SACC-E-FS-8CON-M16/0.5 SCO	**8**	

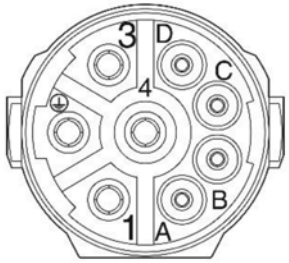
Recommended connection cable: SAC-8P-MS/ 3.5-PUR/MS SH SCO

3.2.6 LED interface

LAN connection socket	Pin no.	Description
	**1**	+5V (4A max.)
	3	GND_5
SACC-DSI-M8FS-3CON-M10/0.5	**4**	LED_SIGNAL

Recommended connection cable: SAC-3P-M 8MS/1.5-PUR

3.2.7 Battery interface/charging socket

Battery interface	Pin no.	Description
	**1**	+ BAT
	2	Housing/earthing
	3	GND_BAT
	4	CAN_GND
	A	CAN_HIGH
	B	CAN_LOW
	C	ON/OFF
M23-7ES198AW500S	**D**	WAKE_UP

Recommended connector: M23-7EP198A8024

4 STRUCTURE AND FUNCTION

4.1 Complete robot

The mobile robot is used exclusively for transporting objects. The robot can be charged via an inductive charging station and a charger. The robot is equipped with two drive wheels and four passive guide rollers, which allow it to move in the plane with three degrees of freedom: forwards/backwards, right/left, yaw around the vertical axis.

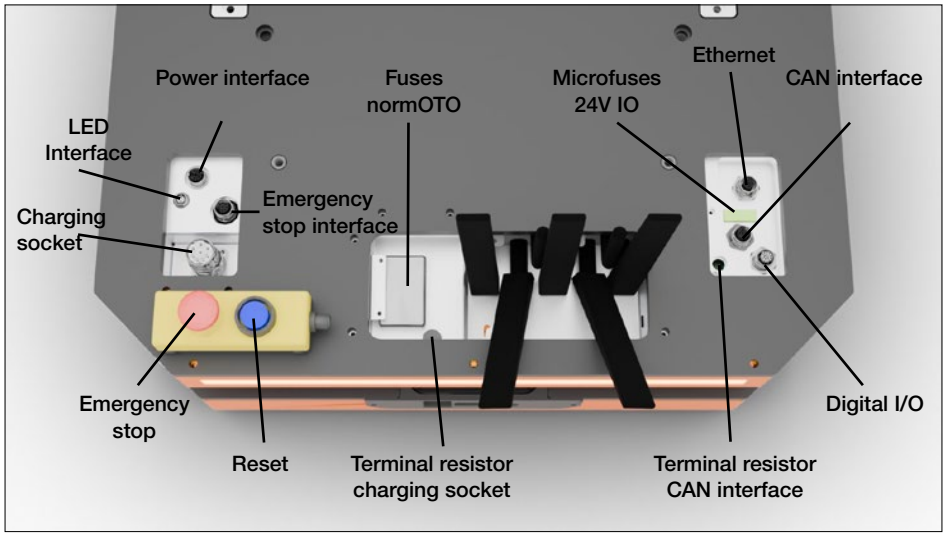


Diagram 1: Interfaces of the ReBeLMove Pro

4.2 Charging station

Safety instructions
- Only use the charger in combination with the *ReBeLMove Pro*, which is suitable for inductive charging.
- Make sure that the charging area is free of metallic objects or interference.
- Avoid standing near the charging station during the charging process.
- Protect the charger from moisture and extreme temperatures.
- No flammable material may be stored within two metres of the charging station
- The *ReBeLMove Pro* must not be moved manually during the charging process

Installation
- Choice of location: Choose a strong and level floor to place the charger on. Make sure that there are no obstacles blocking the loading area.
- Aligned positioning: The robot positions itself automatically for the loading process. Do not manually push the robot onto the charging station.
- Power connection: Connect the charger to a suitable power source that supplies the specified voltage and current for the device. Switch on the device to start charging.

Operation
- As soon as the robot moves into the loading position, the loading process starts automatically.
- During the charging process, the LEDs on the side of the robot flash yellow. A steady green indicator shows that the charging process is complete.

Maintenance and care
- Clean the loading bed regularly to avoid dirt and dust accumulation. Use a soft cloth and mild detergent.
- Check the cables and connections regularly for visible damage.
- If the charger displays malfunctions, contact customer service for support.

Technical data
- Input voltage: 220-240V, 50/60Hz
- Charging time: 2 hours 10 - 90%
- Operating temperature: 0°C to 40°C

Troubleshooting
- *Problem:* The robot is not being loaded.
  Solution: Check that the robot is positioned correctly and that there are no foreign objects in the loading area.
- *Problem:* The status indicator flashes red.
  Solution: Check the power supply and ensure that no connections are interrupted.

5 SAFETY INSTRUCTIONS

DANGER

Observe the safety instructions!
- Observe the safety instructions in section 2 "Safety instructions", in particular section 2.4 "Safety instructions for transport, assembly and initial commissioning".

5.1 Transport

The robot must be set up by employees of igus® SE & Co KG. Connecting the charging station of the robot to the power supply is included in the scope of delivery of igus® SE & Co. KG and must be carried out by specialised personnel from igus® SE & Co. KG. Risks arising from the integration of the robots into the control system and the electrical supply were assessed and validated by igus® SE & Co. KG. The initial commissioning must be carried out by specialised personnel from igus® SE & Co. KG.

5.1.1 Packaging

Use the original packaging (if supplied) to transport the robot. The original packaging consists of the pallet base and lid, the frame parts and the side and top foam inserts.

5.1.2 Battery

If the robot is to be sent in for maintenance or repair, the battery connector must be disconnected from the battery.
Special transport regulations apply to lithium batteries in accordance with the United Nations Recommendations on the Transport of Dangerous Goods, UN 3171. Special transport documents are required to comply with the regulations. This can affect both the transport time and the transport costs.
Different regulations apply depending on the mode of transport, such as land, sea or air transport. For further information, please contact your distributor.

5.1.3 Packing the robot

Before packing the robot, it must be switched off as follows:
1. Stop the robot and press the red illuminated switch-off button to switch off the robot.
2. Switch off the battery isolator switch. The robot must always be packed and transported in an upright position. Packing or transporting the robot in a different position will invalidate the guarantee.

5.2 Working environment

The robot's working environment must fulfil a number of requirements for the robot to function properly and safely. This section describes the factors that must be taken into account when the robot is put into operation in a working environment.

Surfaces
For proper and safe operation, the robot requires a floor base with a good surface quality and evenness. Industrial floors with an epoxy resin coating have proven their worth. The floor must be non-slip and slip-resistant. Media such as oil, water, dust, etc., impair the function of the robot and the safety device: emergency brake. The responsibility for ensuring the ground conditions lies with the operator.

Light, reflections and materials
Sunlight and reflective or transparent objects can impair the performance of the robot's laser scanners and cameras. This can lead to the robot recognising non-existent objects or not recognising real objects. Docking on markings made of very high-gloss or transparent materials can also impair the effectiveness of the robot's scanners and prevent successful docking. It is the responsibility of the client to test whether sunlight, reflections from high-gloss materials and transparent objects affect the performance or safety of the robot.

Space
The robot must have sufficient space to be able to work efficiently. During commissioning, check whether the robot has enough space to drive, dock, turn and perform other tasks. Test each task under the likely operating conditions to determine if there is space for the robot to manoeuvre.

Dust
Dusty environments can affect the performance and durability of the robot. Dust can penetrate the computer and the mechanical parts of the robot and impair their performance and durability; dust can also obstruct the view of the robot's sensor system.

Static landmarks and dynamic obstacles
The robot uses fixed landmarks to orientate itself. If it cannot recognise enough distinguishable landmarks, it cannot navigate efficiently through the map.

Temperature and humidity
Temperatures outside the permissible temperature range can impair the performance and durability of the robot

6. STARTING THE REBELMOVE PRO

The robot is operated via a web app with the operating and information elements.

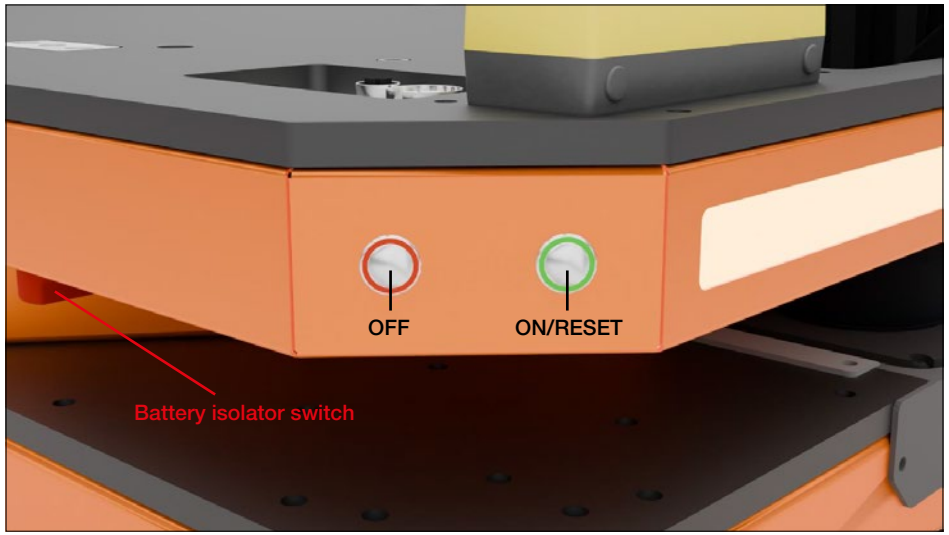


Diagram 2: LEFT: Off switch RIGHT: On/Reset

Once the robot is charged, it can be started using the button circled in green on the front right edge. The button outlined in red is used to shut down the robot. After pressing the red button, it takes approximately 60 seconds for the robot to shut down. The red battery isolator switch is located below the buttons. The battery isolator switch should be set to "OFF" for transport or prolonged decommissioning.

In normal operation, the *ReBeLMove Pro* is charged using the wireless inductive charging station.

If the *ReBeLMove Pro* does not start because the battery is too discharged, for example after a long downtime, the *ReBeLMove Pro* must be charged using the wired charger. This is plugged into the battery interface with the hybrid connector and locked.

To open the safety interlock, the
ON/RESET button and battery isolator switch must be acknowledged after each restart or emergency stop.

7. OPERATION OF THE SOFTWARE

7.1 Starting the software

Firstly, a connection must be established with the robot's WLAN. The name of the WLAN begins with "*ReBeLMove Pro* ..."; the respective password is transferred on delivery. The user interface can be accessed via a web app. The web address is the IP of the respective *ReBeLMove Pro* server (usually 192.168.12.XX:13579) and is also transferred on delivery.

7.2 Overview

The top bar shows the current status of the *ReBeLMove Pro* (Ready, Busy and Offline) and the current battery status. The four options Missions, Variables, Queue and IOS can be found on the right-hand side of the main view of the interface.

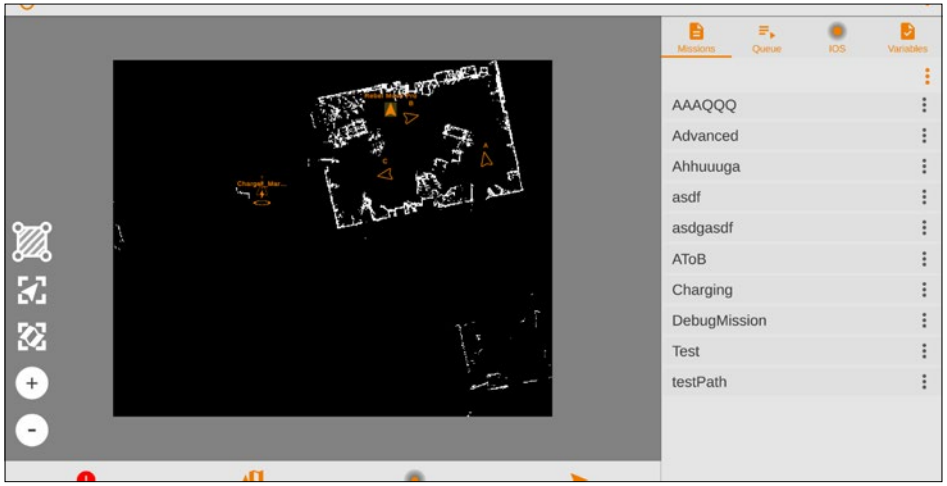


Diagram 3: User interface: Overview

The "STOP" button can be used to end the current task of the *ReBeLMove Pro* and stop its movements. If the robot has been moved after being switched off, it must be localised via **"Localise"** so that it can start at the correct position within an existing map.

After pressing the button, you can move the *ReBeLMove Pro* on the map by holding down the left mouse button (on the marker) and moving it. Thereupon, compare the blue laser lines with those on the static map, place the *ReBeLMove Pro* approximately at the corresponding location and press the tick mark to confirm. The robot corrects slight inaccuracies. If the lines are not aligned, repeat the process.

The robot can be moved manually via **"Move"** using the "Joystick". By deselecting the "Safety Field" checkbox, the safety field can be greatly reduced **(CAUTION!)**, allowing the *ReBeLMove Pro* to manoeuvre through narrower spaces without stopping automatically.

Diagram 4: User interface: Localise

DANGER

- By switching off this function, the robot no longer stops automatically at bottlenecks and is controlled by the operator.
- This action must only be carried out by trained personnel.
- If this safety function is bypassed, there is no entitlement to compensation for accidents or injuries.

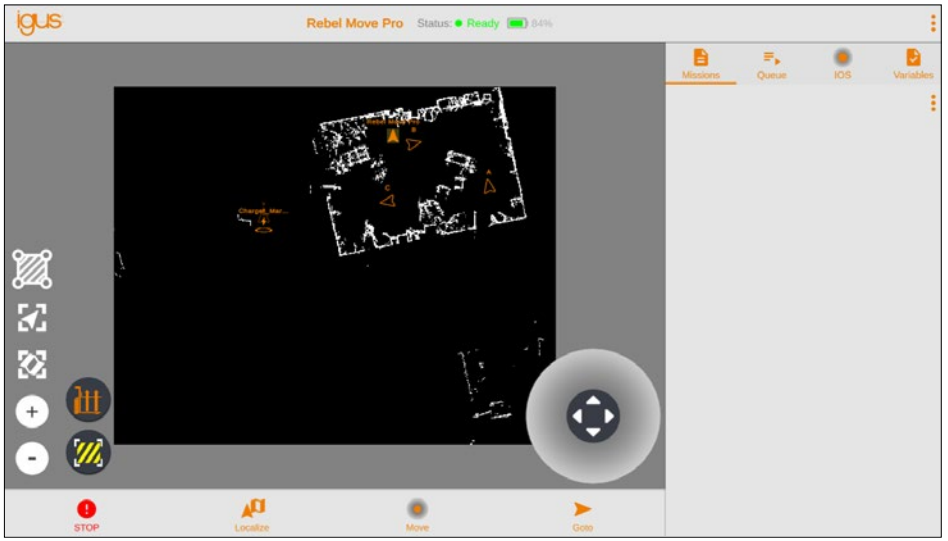


Diagram 5: Manual procedure user interface

The robot can be moved to a specific location on the map using **"GOTO"**. To do this, the future position must be defined on the map, as with localisation. The robot then moves autonomously to this position.

Diagram 6: User interface: GOTO function

Under the menu in the top right-hand corner you will find **"Map"**. Here you have the options of switching to another map **"Change"**, creating/recording a new map **"New"** and reloading a map **"Reload"** or editing the current map with **"Edit".** The most important functions are explained in the next section.

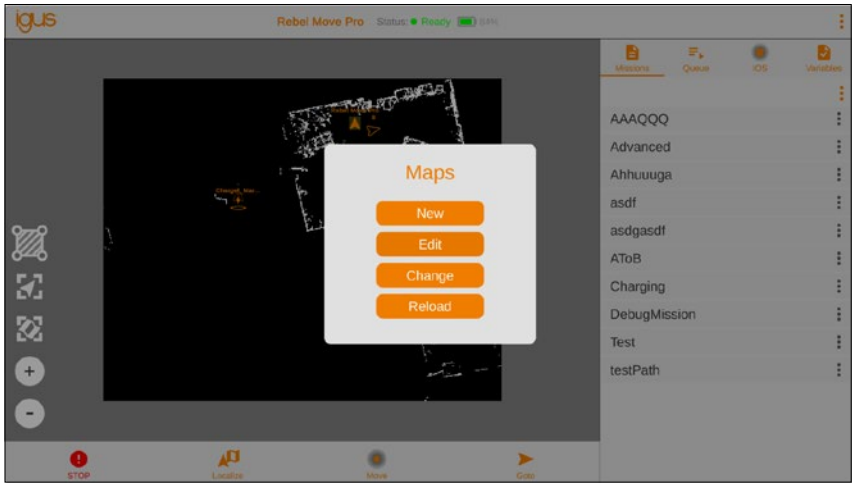


Diagram 7: User interface: "Map" menu

Under the hamburger menu in the top right-hand corner you will find the **"Backup"** function, with which you can save a current version or load a backup. Clicking on **"Map"** takes you to the menu mentioned above.

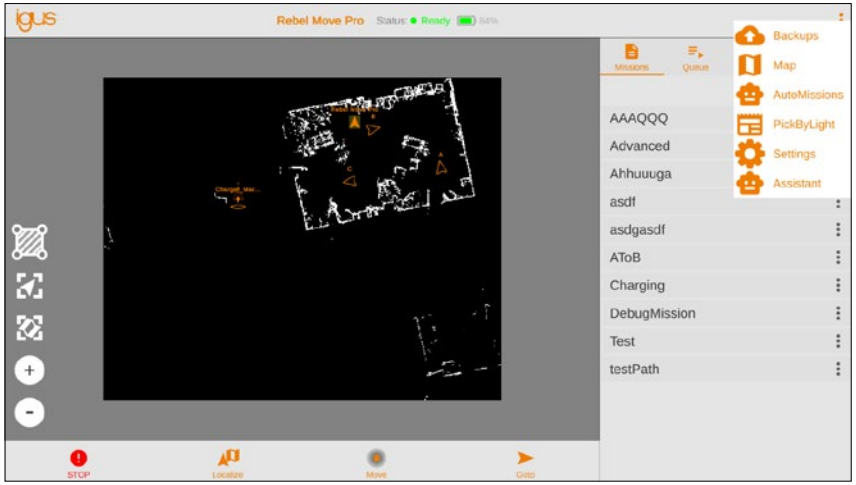


Diagram 8: User interface: Hamburger menu

The **"Auto Mission"** button can be used to program so-called "Idle" functions. With these "background missions", the robot automatically carries out missions that are linked to certain conditions. For example: "If the battery drops below 20%, carry out the "charging" mission or if no mission is carried out within one second, carry out the "endurance test" mission". These missions are only activated if "Enable" is on.

Diagram 9: User interface: Operations

7.3 Map creation and management

Before using the *ReBeLMove Pro for the first time*, a map of the environment must be created. This is possible via the "Record New Map" button after selecting a *ReBeLMove Pro*.
Step-by-step instructions for creating a new map:

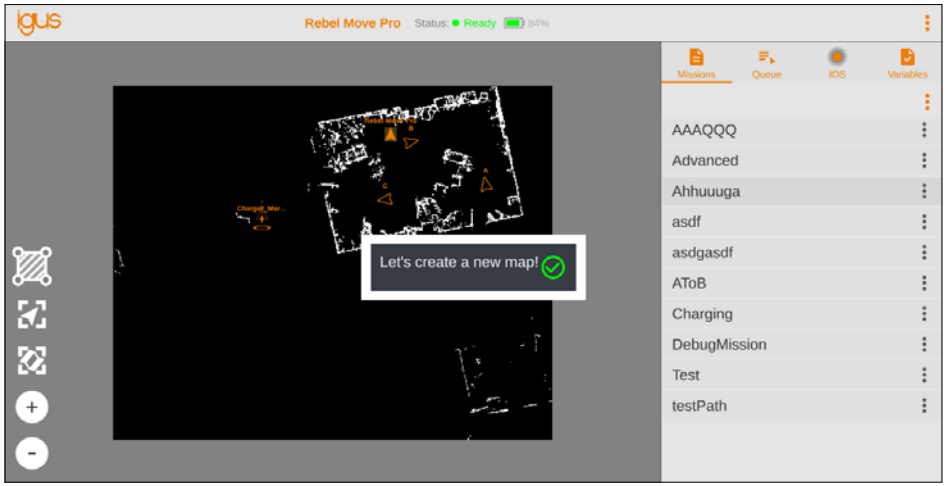


Diagram 10: Create new map 1

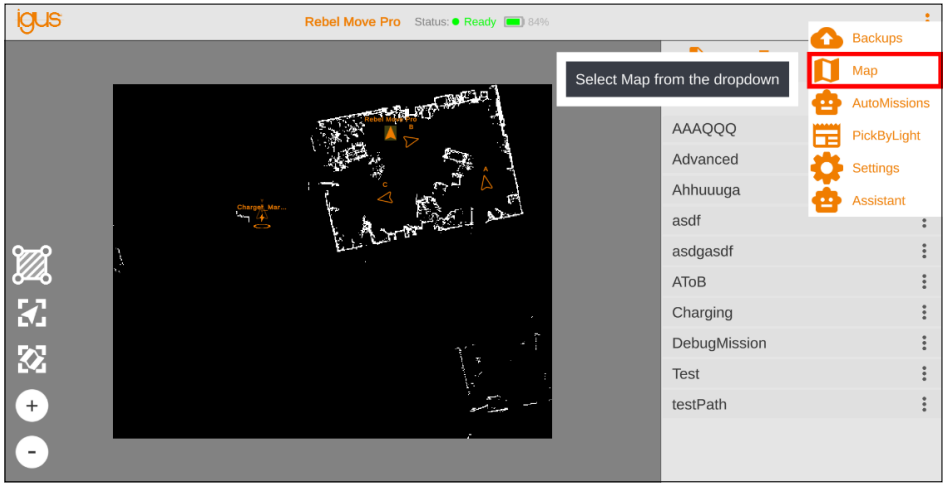


Diagram 11: Create new map 2

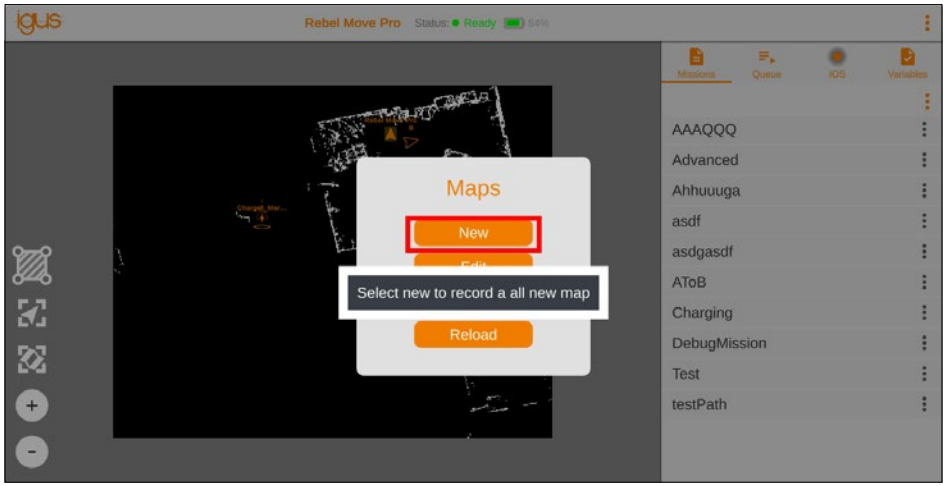


Diagram 12: Create new map 3

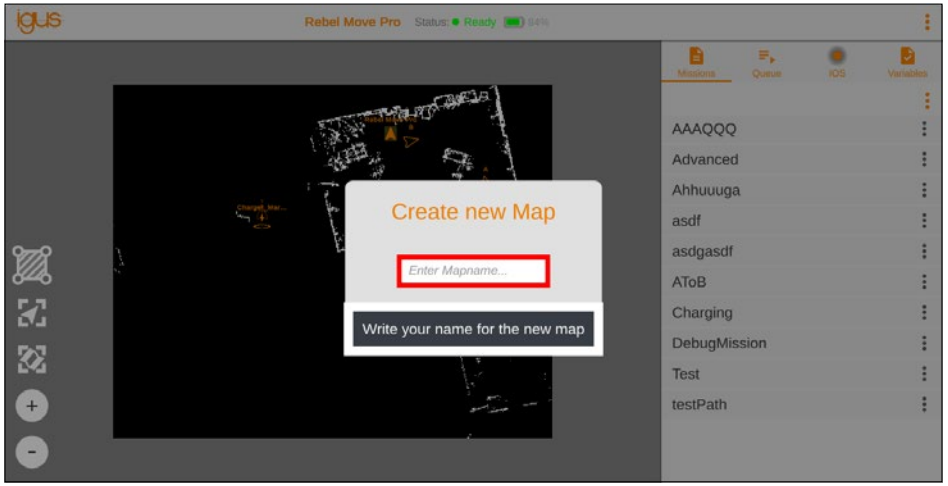


Diagram 13: Map - Name

A name for the new map must be defined here.

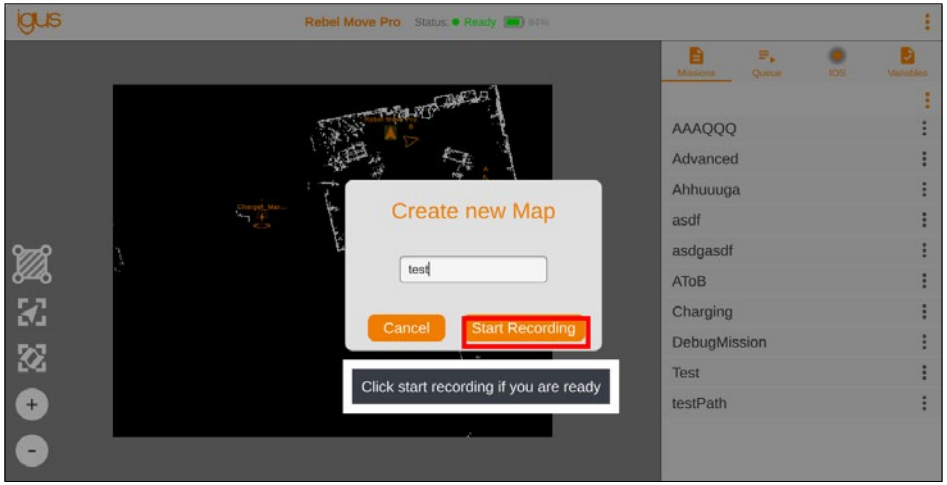


Diagram 14: Start recording

Once you have defined the name for the map, click on "Start Recording" and start recording the environment.

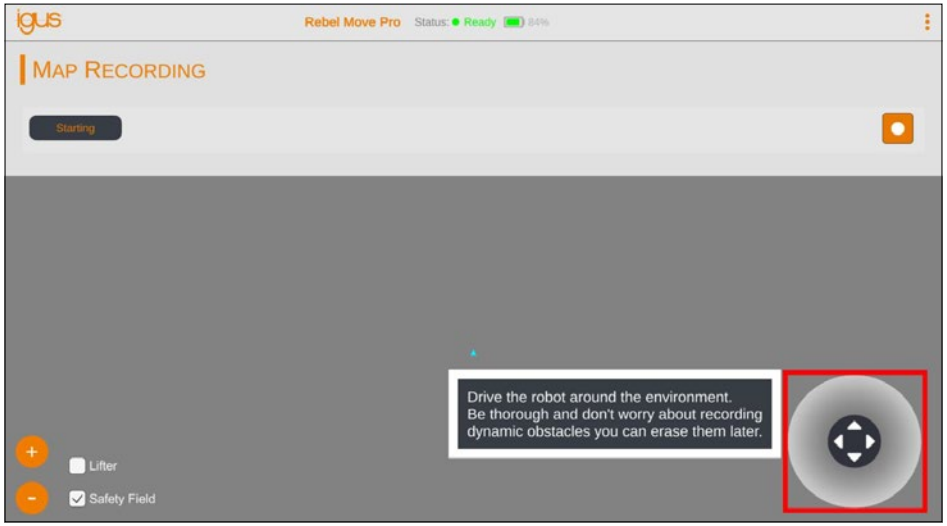


Diagram 15: Recording the environment with the free-drive function

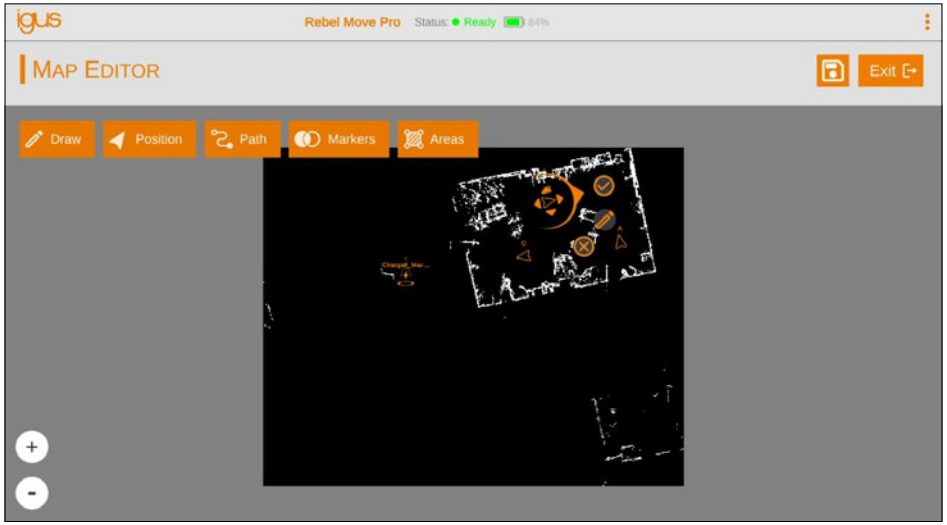


Diagram 16: User interface: Edit map

To begin with, a new map must be created, the appropriate name chosen and the robot selected, which will travel through the working environment by manual control system.

The robot is now guided along the edges of the working environment, i.e. along shelves, walls and workstations, using the manual control system in the bottom right-hand corner of the screen.

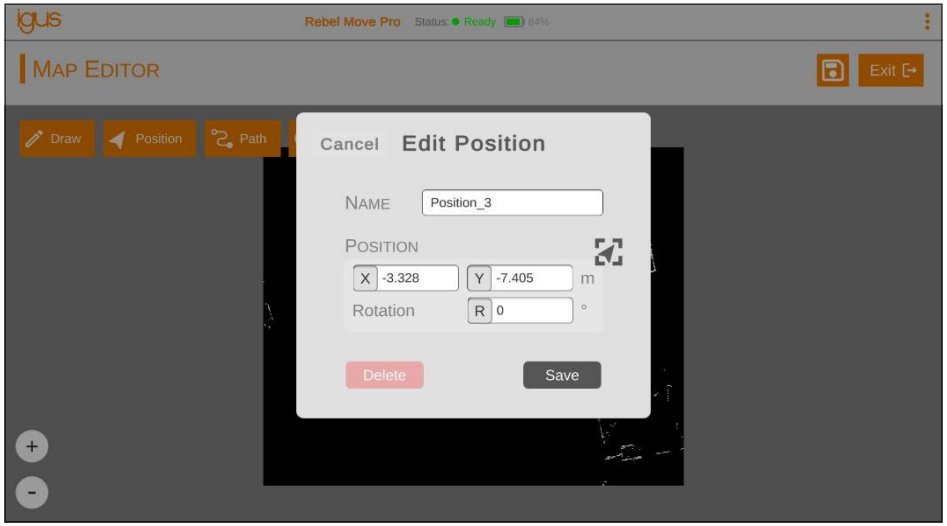


Diagram 17: Create map position

Diagram 18: Create path

As soon as you have recorded and processed the map, you can edit it in the Map Editor.

This allows the robot to recognise its surroundings and create an accurate map. In the bottom left-hand corner, the "Safety Field" can be activated, which automatically stops the robot before colliding within a radius of approx. 10cm. Once you have travelled through the entire working environment, save the map using the save button.

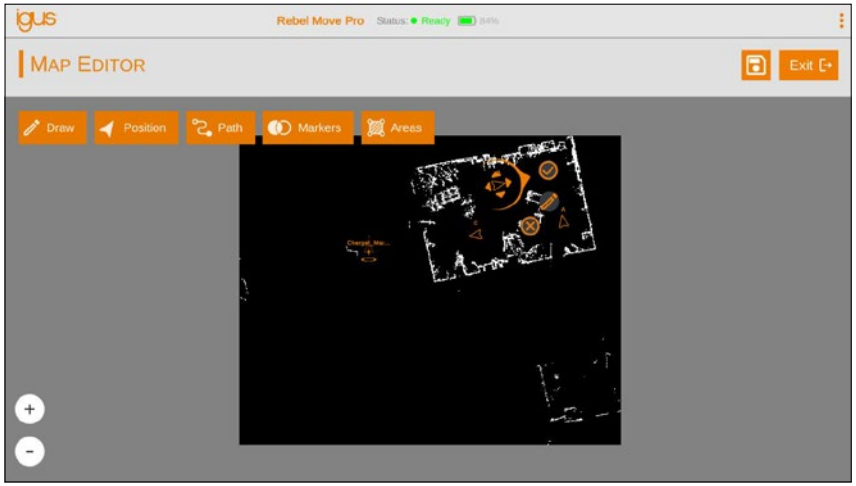


Diagram 19: Edit map user interface

Once the map has been recorded, it can be edited using the **Map Editor** (accessible via the **Edit map button** in the top left-hand corner of the map displayed on the main page after selecting the robot).

The **"Position"** function is used to define positions that the robot should travel to. These can be defined with coordinates or moved manually on the map.

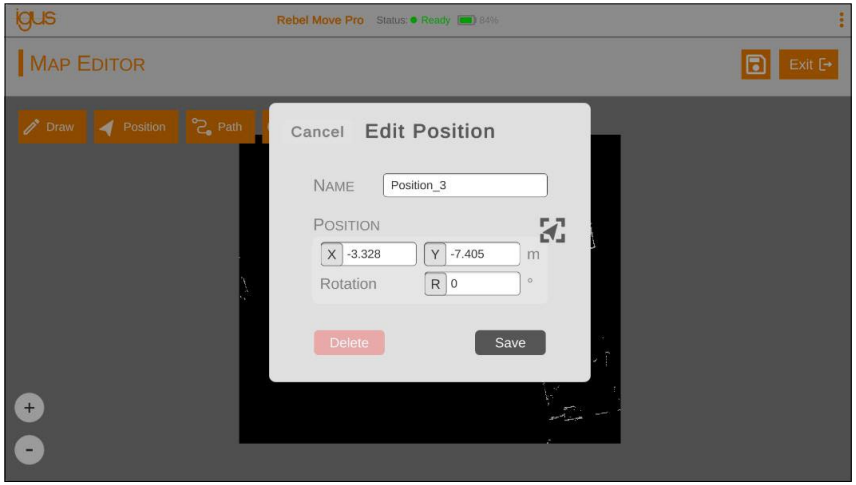
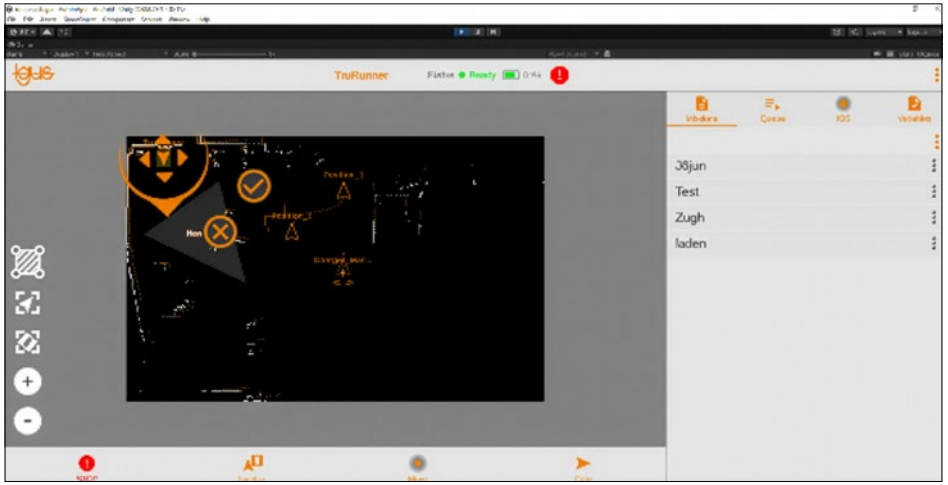


Diagram 20: Create map position



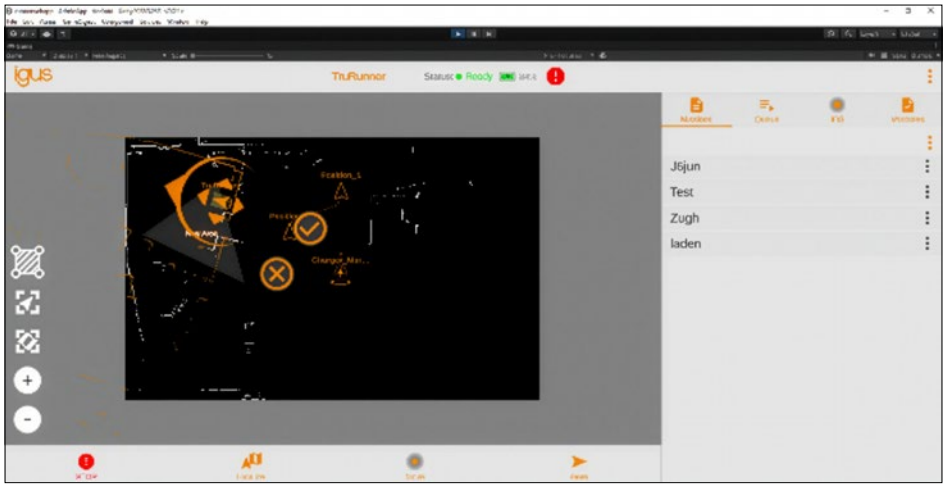


Diagram 21: Move map position

Using the **"Path"** function, defined paths between positions can be travelled linearly (backwards or forwards), which means that the robot does not automatically drive around obstacles, but remains on the path until the obstacle disappears. This function is useful for narrow movement spaces over long distances.

Diagram 22: Create path

The **"Draw"** function can be used to draw an artificial wall that the robot cannot drive over and thus limit the working area, as well as to **"Erase" walls** in order to correct faulty images.

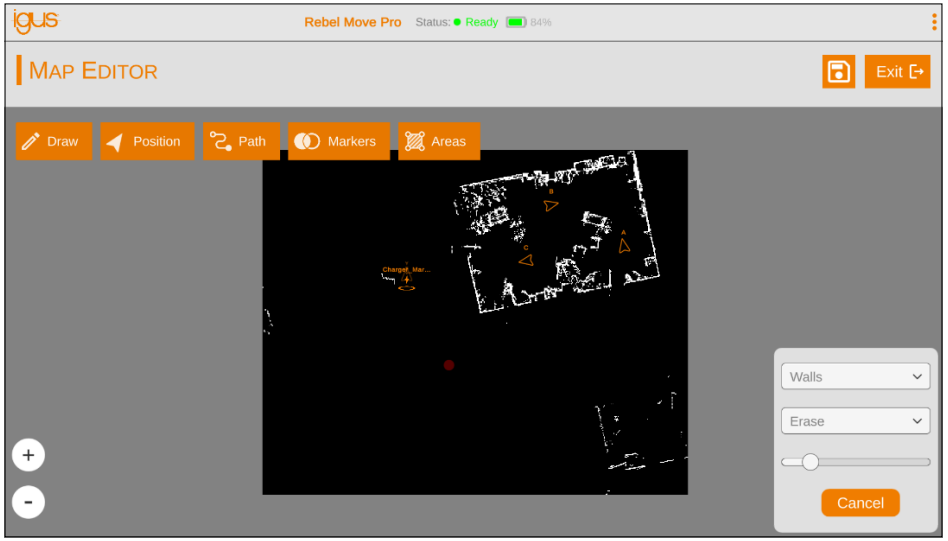


Diagram 23: Draw function

Areas have different specifications depending on the selection.

"Forbidden" = The area is not entered by the robot
"SpeedLimit" = Not yet implemented
"Critical" = The robot ignores obstacles, but the "Safety Field" is still active. Useful in highly dynamic working environments.

Destinations or locations can be defined using the **"Marker"** function. First define the type of marker (e.g. a charging station ["Charger"]), then a suitable name, followed by the coordinates, i.e. the position on the map (created markers can be moved manually on the map). The offset is the relative target position to the marker. With "Entry" you can adjust the entry of the robot to the respective position if the automatic approach of the robot is not sufficient. (Experience has shown that this data should be added to the charger)

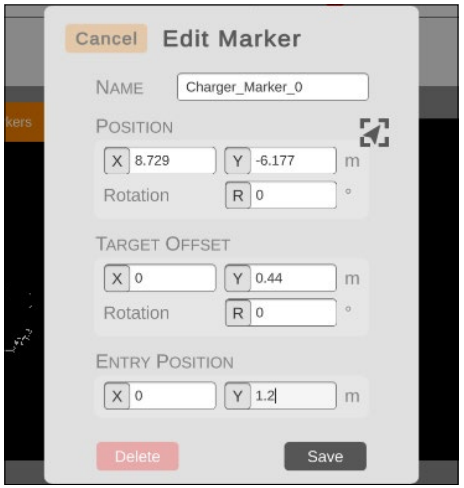


Diagram 24: Create marker

Areas:
This function can be used to add areas to the map.

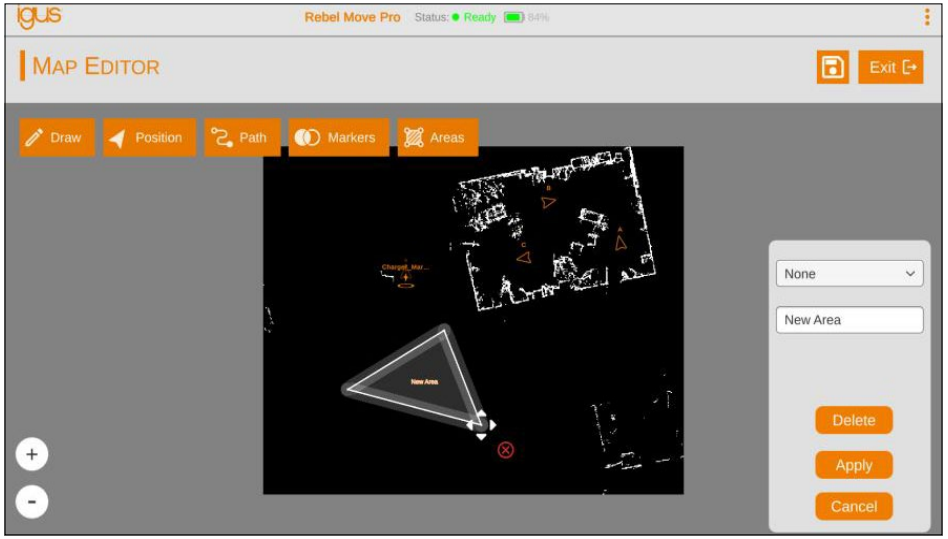


Diagram 25: Adding areas

Saving the map:
Once you have finished editing the map, click on the save icon at the top.

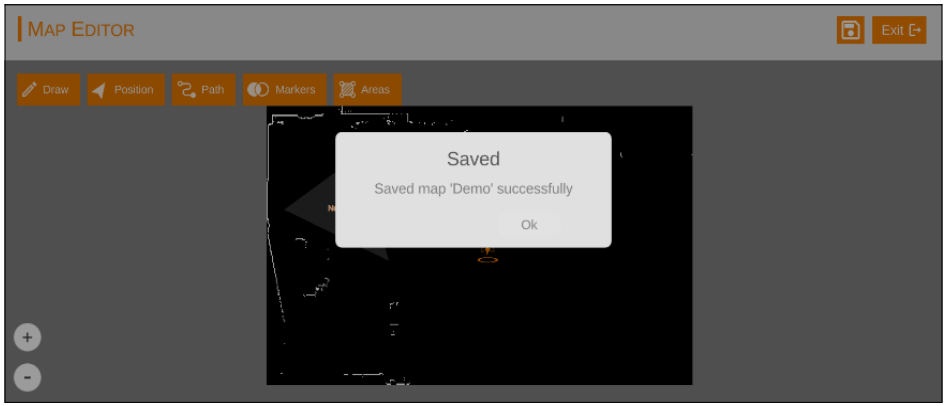


Diagram 26: Saving the map

7.4 Missions

The **"Missions" tab on the main page** allows you to create new missions and edit existing ones. The buttons displayed to the right of the missions enable editing, adding to the current **queue (of missions)**, direct execution, deletion of missions and direct assignment to a robot.

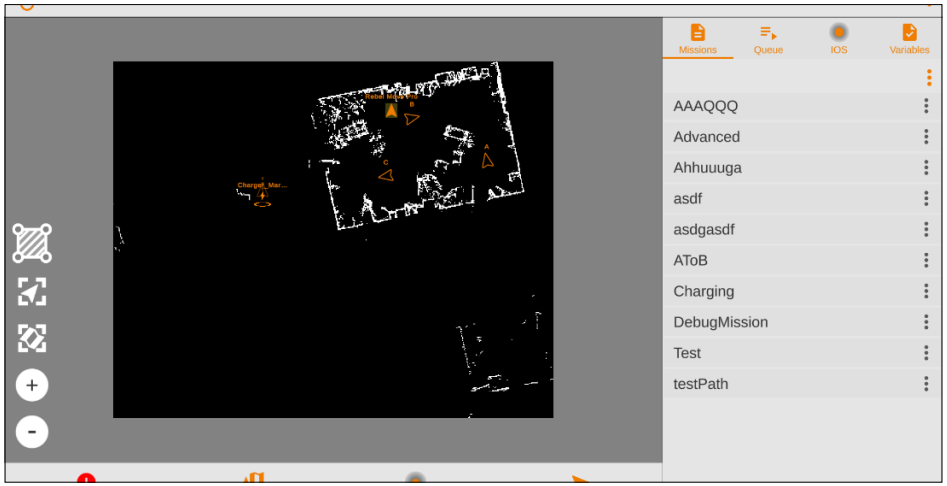


Diagram 27: Missions user interface

A new task can be created using the **"New Mission" button**. This first requires a name. You can also select the applications that you want to use for the respective use case and/or "top module". Basically, however, "AGV" is required to be able to control the robot.

Individual steps can be added using the *"AGV"*, *"Conveyor"*, *"IO"*, *"Lifter"* and *"Logic"buttons*. (There are more than 20 additional product range modules, which are adapted and developed for each use case)

Diagram 28: Creating a new mission

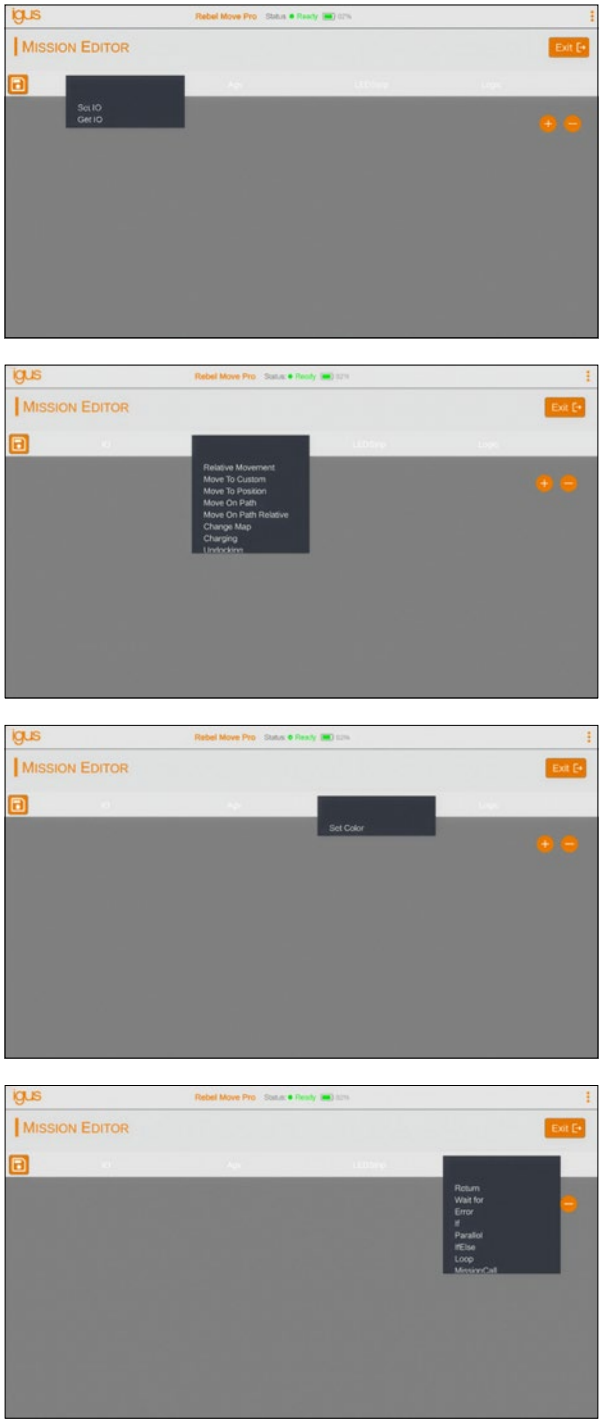


Diagram 29: Mission programming

1. **"AGV" button** *(programming the AGV)*
   a. With "*RelativeMove*", the robot moves in one direction by a specified range (in metres)
   b. With "*Move to Custom*", the robot moves to a selected location
   c. With the "*MoveToPosition*" function, a robot can automatically move to a position specified on the map
   d. With "*Move On Path*", the robot moves between positions on paths
   e. With "*Move On Path Relative*", the robot moves along a path for a specified range
   f. The "*Change Map*" function can be used to change the robot's map (e.g. if the robot changes floors or buildings).
   g. With "*Charging*", the robot automatically moves either to the next charging station or to a self-defined charging station.
   h. With the "*Undocking*" function, the robot undocks itself from a marker (e.g. moves down from a charging station)
   i. With the "*Docking*" function, a robot can be sent to a position relative to a marker
   j. With "*SetSpeed*" you can set the speed of the robot
   k. "*Change Footprint*" defines the width and length of the robot, which can be reduced in narrow areas
   l. With "*Safety Field*", the safety field can be enlarged or reduced
   m. "*IsAreaFree*" is used to explicitly check whether a robot is already travelling in a predefined area (this function is possible with other mobile robots from various manufacturers)

2. **"Conveyor" button** *(programming the conveyor belt)*
   a. One half of the conveyor belt is loaded with the "*LoadOnce*" function
   b. With "*UnloadOnce*", one half of the conveyor belt is unloaded
   c. "*Barrier Up*" raises the slip guard at the open end of the conveyor belt
   d. "*Barrier down*" lowers the slip guard at the open end of the conveyor belt

3. **"IO" button** *(configuration of the definable input and output signals)*
   a. With "*Set IO*" you can set IO signals true or false
   b. "*Get IO*" can be used to query IO signals and determine the status

4. **"Lifter" button** (programming the lifting column)
   a. With "*LifterHeight*", the lifter can be moved to a self-determined, exact height (observe limits)

5. **"Logic" button**
   a. With "*Return*", you can end the mission gracefully at any point. This means that if you end a mission that was started via "Missioncall", the "mother" mission continues.
   b. With the "*Wait for*" function, you can make the robot wait at the position (in seconds)
   c. Press "*Error*" to pause the mission and a message appears in the interface with the information specified in the text field. The error can be reset via the info in the interface. (Debugging tool)
   d. With the "*If*" function, a further command is only executed if a condition is fulfilled
   e. With "*Parallel*", two different missions can be executed/programmed at the same time.
   f. With the "*IfElse*" function, the If function is executed first; if the condition is not fulfilled, the product range jumps to the "Else" function
   g. With the "*Loop*" function, commands can be repeated up to 100 times
   h. With "*MissionCall*", it is possible to start another program within a program, which is executed and after the termination of this external program the "main mission" continues
   i. With the "*While*" function, the robot will execute the commands within this function as long as the condition is fulfilled (e.g. variable x = 1)
   j. The"*Set Variable*" function can be used to change the value of a variable.

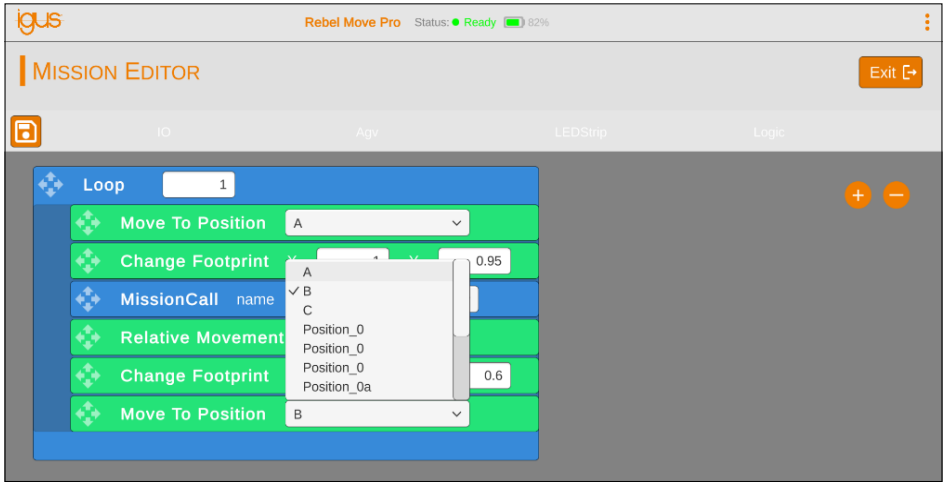


Diagram 30: Mission programming example

Diagram 31: Mission programming: Hook

6. **"Hook" button** *(programming the hook)*
   a. With the "*SetHook*" function, you can retract or extend the hook
   b. With the "*ParkRack*" function, the rack (movable shelf or similar) is parked, whereby the *ReBeLMove Pro* moves to a predefined position, parks the rack and moves out forwards
   c. With the "*DockRack*" function, racks can be moved to a specific position, whereby the *ReBeLMove Pro*, by recognising the markers, compensates for small position deviations of the station itself, and the hook is automatically activated
   d. With "*UndockRack*", the *ReBeLMove Pro* sets the rack down without moving to a position and moves out forwards

7.5 VAR tab

Variables can be created and edited via the **VAR tab**. Variables can be used as a condition for If, IfElse and While functions. You can also change variables with the SetVariable function. For example, after the robot has reached a position, you could change a variable so that another robot can continue its mission.

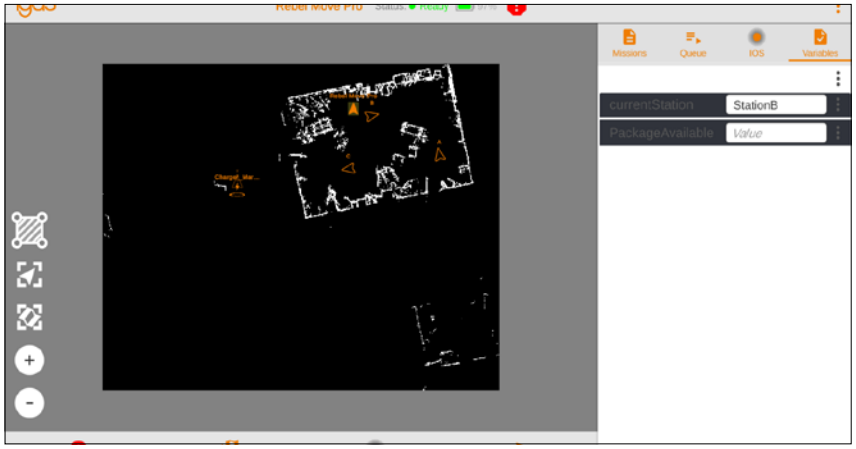


Diagram 32: User interface: VAR tab

7.6 IOS tab (optional)

The digital inputs/outputs (0-7) can be monitored and activated via the IOS tab. This can be used to activate and deactivate the hook, for example, or to test and control other external modules. An output is activated by pressing the fields.

Diagram 33: User interface: IOS tab

7.7 Operation in normal mode

The robot must first be put into operation. The first step is to pick up the map, or "mapping", i.e. travelling along the "edges" of the working environment with the robot. You then have to teach the robot missions and link them to matching symbols on the map (e.g. drive to station A -> pick up a shelf -> drive to station B -> set down the shelf). The last step is to assign the mission and then the robot carries out the various missions in the selected order.

7.8 Dealing with emergency stop

7.8.1 Manual emergency stop switch

The emergency stop shuts down the robot immediately. Operation:

7.8.2 After the emergency stop

1. **Check the surroundings:** Make sure that there are no obstacles or people in the way.
2. **Troubleshooting:** Remove obstacles and check the system for faults.
3. **Restart:** Start the robot by releasing the emergency stop and pressing the "Reset" button

7.8.3 Troubleshooting for repeated emergency stop

- Check error messages via the user interface.
- If you continue to experience problems, please contact the technical support of igus® SE & Co. KG.

7.9 Dealing with connection errors

Connection errors occur when the robot loses communication with the control station or other systems. This can manifest itself in missing or interrupted connections to the router.

Firstly, it is important to check the status of the wireless network or radio connection. Restarting the robot can help to re-establish the connection.

If the error persists, it is advisable to check the system for possible software or hardware problems. If connection problems persist, the technical support of igus® SE & Co. KG should be contacted in order to obtain a detailed diagnosis and solution.

8. MAINTENANCE AND TROUBLESHOOTING

8.1 Safety instructions for maintenance and troubleshooting

Improperly performed maintenance and troubleshooting

WARNING

Risk of injury due to improperly performed maintenance and troubleshooting work!

Improper maintenance and troubleshooting work can lead to injuries and damage to property.

- Ensure sufficient installation clearance before starting work.
- Ensure tidiness and cleanliness at the assembly site! Loose components and tools lying on top of each other or lying around are sources of accidents.
- If components have been removed, ensure correct assembly, reinstall all fastening elements and observe the screw tightening torques.
- Observe the following before recommissioning:
  - Ensure that all maintenance and troubleshooting work has been carried out and completed in accordance with the information and instructions in this manual.
  - Ensure that there are no persons in the danger zone.

8.1.1 Maintenance schedule

Maintenance intervals

The following sections describe the maintenance work required for optimum and trouble-free operation of the robot. If regular inspections reveal increased wear, the required maintenance intervals must be shortened in accordance with the actual signs of wear.

Daily maintenance schedule

Part	Maintenance work
Laser scanner	Visual inspection, for contamination or wear. If slight dirt deposits are visible, clean with an ESD wipe.
Idler wheels (the four corner wheels)	Visual inspection, for contamination or wear. If slight dirt deposits are visible, clean with a damp cloth.
Drive wheels (the two centre wheels)	Visual inspection, for contamination or wear. If slight dirt deposits are visible, clean with a damp cloth.
LED strips	Visual inspection, for contamination or wear. If slight dirt deposits are visible, clean with a dry, soft cloth.

Weekly maintenance schedule

Item	Maintenance work
Laser scanner	**Clean the optical covers of the scanners for optimum performance. Avoid aggressive or abrasive cleaning agents.**
	Static charge causes dust particles to be attracted to the lens cover. You can minimise this effect with the antistatic plastic cleaner (SICK part number 5600006) and the SICK lens cloth (part number 4003353). See the manufacturer's documentation.
Idler wheels (the four corner wheels) Drive wheels (the two centre wheels)	Remove the dirt with a damp cloth and make sure that nothing is caught in the wheels.
LED strips	Check whether the LED light strip is intact. Make sure that the light around the robot is illuminated. Clean it with a soft cloth to ensure even lighting around the robot.
Battery	To prevent the battery from discharging, it is necessary to fully charge the robot at least once a week. This is particularly necessary if the robot has not completed a work order within a week.

NOTE

If other faults occur and the cause cannot be determined, please contact igus® SE & Co. KG directly.

8.2 Software

If faults occur on the software side, please contact igus® SE & Co. KG directly.

9. CLEANING THE ROBOT

DANGER

Danger to persons and the robot!

- Cleaning work must only be carried out when the robot is switched off.

9.1 General cleaning

See 8.1.1 (page 48)

10. DISMANTLING AND DISPOSAL

For disposal, the robot must be professionally dismantled and the individual parts properly recycled.

DANGER

Risk of injury due to improper disassembly work!

There is a risk to life and limb of the user and/or third parties if the robot is not dismantled by specialised personnel.

- Only qualified personnel should be authorised to dismantle the robots.
- Disconnect power to the robot before starting disassembly.
- If necessary, secure the area for dismantling over a wide area.
- Before starting work, switch off the robot, detach the battery isolator switch and wait 15 minutes.

DANGER

Danger to life due to falling load!

- Secure the danger zone over a wide area and put up warning signs.
- It is forbidden to stand under the raised load.
- Only transport the load vertically.
- Always pick up the load symmetrically.

NOTE

Environmental pollution!

- Dispose of operating and auxiliary materials safely and in an environmentally friendly manner.
- Observe manufacturer's instructions.
- Do not allow hazardous substances to enter the sewage system/soil.

The following points must be observed during disposal:

- Drain all operating fluids, if present, before dismantling and collect them in suitable containers.
- If necessary, secure the area for dismantling over a wide area.

11. SERVICE LIFE

An additional contract for inspection/maintenance of the systems listed in the quotation may be concluded between the contractor and igus® SE & Co. KG under the following conditions and based on the contractor's terms of delivery and payment.

The maintenance interval is carried out every six months and includes:

- Function test
- Safety inspections
- Static measurements
- Replacement of spare parts, minor repairs up to max. 2h*
- Travel expenses, any overnight accommodation, per diem and daily allowances
- Inspection sticker and service report, measurement logs and proof of use
- Update service
- Test run

Larger, more extensive repairs that are identified during the assignment will only be carried out following a cost estimate and separate commissioning and approval. Payment is due 30 days after invoicing and submission of the customer service report, strictly net without deduction plus the legally applicable VAT. The service life expectancy is six years with regular maintenance.

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Notes

Notes

Please feel free to contact us - quick and easy.

Whether you have questions about our ReBeLMove Pro, or on other ReBeLMove Pro models or concrete support - we are there for you.

Just fill in the form online - our specialist will contact you shortly.

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