

User Manual for SEIT 100
Autonomous Mobile Robot

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1. Introduction

This manual contains important notes and information about the various operating phases of the SEIT 100:

- Transport, initial startup
- Safe operation, removal of any faults, troubleshooting
- Spare parts and applications

In addition to this manual, special contractual agreements and technical documents apply to special versions of SEIT 100 and its additional equipment.

- To ensure trouble-free and safe operation as well as the settlement of possible warranty claims, always read manual first and observe all the information contained herein.
- Keep the installation and operating instructions close to SEIT 100.
- Pass the manual on to any subsequent operator or occupant. Milvus Robotics does not accept any liability for faults or defects due to non-observance of this manual.

If you have any questions after reading the manual, please contact Milvus Robotics.


1.1. Warning Notices in This Document

The warning notices refer to risks which may arise while using SEIT 100. They are available in four danger level identified by the signal word:

Table 1.1: Signal words and their meaning

Signal Word	Meaning
DANGER	Identifies a danger with high risk that can lead to death or serious injury if it is not avoided.
WARNING	Identifies a danger with medium risk that can lead to death or serious injury if it is not avoided.
CAUTION	Identifies a danger with low risk that can lead to minor or medium injury if it is not avoided.
NOTICE	Identifies a danger that can lead to property damages.

1.2. Symbols

 This symbol marks useful and important information.

➤ This symbol marks the steps to be carried out.

1.3. Definitions

This document uses the following terms to describe SEIT 100.

- ▶ **AMR** (Autonomous Mobile Robot) – This term describes SEIT 100 with an attached **attachments**, creating a complete mobile robot.
- ▶ **SEIT 100** – This is the model name.
- ▶ **Attachments** – Any passive or dynamic device attached to and possibly powered by SEIT 100. This could be as simple as a cart for carrying objects such as factory parts or as complicated as a robotic arm that picks up and manipulates factory parts.
- ▶ **MR-AutoC – 100** – Docking station.
- ▶ **RC150** – Roller conveyor for SEIT 100.

2. Safety

This AMR has been built to comply with the state of the art. Nevertheless, users may encounter hazards during its use.

WARNING

Disregarding the notices in this manual may lead to serious injury.

- ▶ Carefully read the manual and follow its content.
-

2.1. General Hazards



The following list informs you about the various types of danger or damage that may occur while working with SEIT 100.

Safety Devices

- ▶ Perform any maintenance and repair work on SEIT 100 only in de-energized state and ensure that it cannot be started accidentally.
- ▶ Do not remove protective covers or housing.
- ▶ Regularly check safety devices.

Electricity

- ▶ Reach into SEIT 100 only if it is de-energized.

Rotating Parts

- ▶ Never wear loose clothing.
- ▶ Never wear jewelry, such as necklaces or bracelets.
- ▶ If you have long hair, always wear a hair net.

Parts Lying Around or Falling Off

- ▶ Remove equipment or material which is not required from the workspace.
- ▶ Wear safety shoes.
- ▶ Specify and monitor careful placement of the goods on SEIT 100.

Risk of Injury Due to Faults During Operation

- ▶ Regularly check the SEIT 100 for visible damage.
- ▶ Immediately determine the cause of the fault by a qualified personnel.
- ▶ Immediately remove any escaping gear oil.
- ▶ Do not step on SEIT 100 during operation.
- ▶ Do not ride on the AMR.
- ▶ Do not exceed the maximum weight limit. Be aware that the maximum payload decreases as the floor's incline increases.
- ▶ Do not exceed the maximum recommended settings as speed of the AMR becomes more significant when the payload's center of gravity is increasingly offset from the AMR's center of gravity.
- ▶ Do not allow the AMR to drive through an opening that has an automatic gate or door unless the door and AMR are configured correctly.
- ▶ Do not continue to run the AMR if hair, yarn, strings, or any other items have become wound around its axles, casters, or wheels.
- ▶ Do not expose the AMR to rain or moisture.
- ▶ Do not operate the AMR in potentially explosives environment.

2.2. Intended Use

The SEIT 100 may only be used for industrial applications and in an industrial environment to convey SEIT 100-ready goods such as small packages, cartons, boxes, or different pallet sizes up to 100 kg.

SEIT 100 is dimensioned only for a certain field of use (*see Technical Data, page 18*) and may not be operated outside of these specific limits.

Any other use is considered inappropriate. Deviating operating conditions require additional clarifications, a special release of SEIT 100 and new contractual agreements.

Any modifications that affect the safety are not permitted.

2.3. Personnel Qualification

Unqualified personnel does not recognize risks and, as a result, is subjected to greater dangers.

- ▶ Authorize only qualified personnel with the activities described in these operating instructions.
- ▶ The operating company must ensure that the personnel follows locally applicable regulations and rules during their work with regard to safety and dangers.

WARNING

Personal Risk of Injury

- ▶ It is the end user's responsibility to perform a task-based risk assessment and to implement appropriate safety measures at the point of use of AMR.
 - ▶ It is the end user's responsibility to make sure that the AMR design and implementation complies with all local standards and legal requirements.
-

The following target groups are addressed in these operating instructions:

Operators

Operators have been instructed in the operation and cleaning of SEIT 100 and follow the safety guidelines.

Service Personnel

The service personnel features a technical training and performs the maintenance and repair tasks.

Electricians

Persons working on electrical equipment must have undergone technical training and training provided by the manufacturer.

2.4. Operating Modes

Normal Mode; the AMR is set up at the customer into a complete system and operated as part of the system.

Special Mode; special operation refers to all operating modes which are required to guarantee and maintain regular operation.

Special operating mode	Explanation	Comment
Transport/Storage	Loading and unloading, transport and storage	-
Assembly/Initial start-up	Installation at the end customer and performing the test run	-
Cleaning	External cleaning without removing protective devices	When de-energized
Troubleshooting	Troubleshooting in the event of a fault	-
Fault elimination	Eliminating Fault	When de-energized
Shutdown	Removing from the complete system	When de-energized
Disposal	Removing from the complete system and disassembly	When de-energized

2.5. Environment

Make sure that the operating environment remains safe for SEIT 100.

WARNING

Personal Injury or Damage Risk

- ▶ An AMR can be unsafe if operated under environmental conditions other than those specified in this manual.

Environmental Hazards – these are areas where it is unsafe for SEIT 100 to operate. For example, steep ramps (greater than 5.0 degrees).

Provide physical barriers that SEIT 100 can detect accurately with its scanning laser so that it does not attempt to drive near the hazard. Be aware that in addition to being easily detectable, a barrier must be strong enough to resist a fully-loaded AMR traveling at speed.

Public Access

The AMR is designed to operate indoor industrial environments. You must deploy it only in applications where you anticipate and mitigate potential risks to personnel and equipment.

Milvus does not intend SEIT 100 for use in uncontrolled areas without risk analysis. For example, in areas open to public access. Use of SEIT 100 in such areas requires deployment of additional safety measures. For support, please contact Milvus Robotics.

Side Clearances

SEIT 100 is designed to operate in environments that contain doors, passageways, or other constrained areas that are wide enough for it to traverse. However, you must maintain adequate free space on both sides of the AMR so that it cannot trap a person against a wall or other fixed object.

An AMR must often maneuver close to machinery, conveyors, or other fixed objects. In such cases, operating standards usually allow an exception to side clearance requirements.

SEIT 100 generally travels in a forward direction. It only reverses when leaving its docking station. To change direction, SEIT 100 rotates on its center of rotation.

2.6. Battery Safety

CAUTION

Battery Damage Risk

- ▶ SEIT 100 is shipped when the Li-ion batteries' state of charge is 50%. This state of charge supplies 24 VDC nominal voltage. SEIT 100 must be charged in 45 days after the delivery. Failing to do so might cause the battery to discharge below a usable state, requiring its replacement.
-

Effective April 1, 2016, IATA regulations (UN 3480, PI 965) require that air-shipped lithium ion batteries must be transported at a state of charge not exceeding 30%. Fully charge the battery immediately upon receipt to avoid total discharge. (The battery might arrive fully charged if it is not shipped by air.)

Precautions

- ▶ Never expose battery to water.
- ▶ In case of fire, use a type D extinguisher: foam, dry chemical, or CO₂.

3. Product identification

3.1. Product Overview

3.1.1. SEIT 100

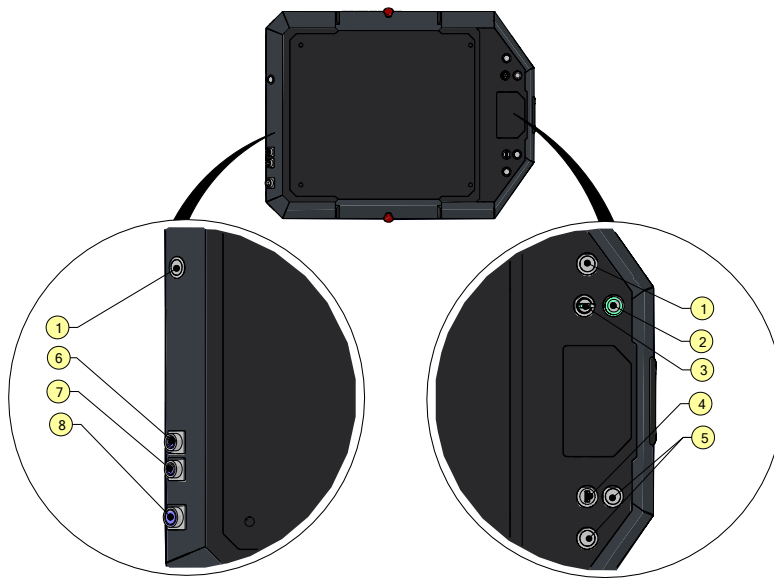


Figure 3.1: Top view of SEIT 100

1	Brake Release Buttons	5	User Buttons
2	Start/Stop Button	6	AUX I/O Connector
3	On/Off Switch	7	AUX Power Connector
4	USB Port	8	AUX Charge Connector

User Buttons – interactive programmable instruments for users to take a certain action.

Aux I/O Connector – to provide communication between robot and top modules. *(detail: page 16)*

Aux Power Connector – providing required power for top modules to operate. *(detail: page 17)*

Aux Charge Connector – to charge SEIT 100 manually.

Brake Release Buttons – to release motor brake.

USB Port – direct communication interface with PC unit.

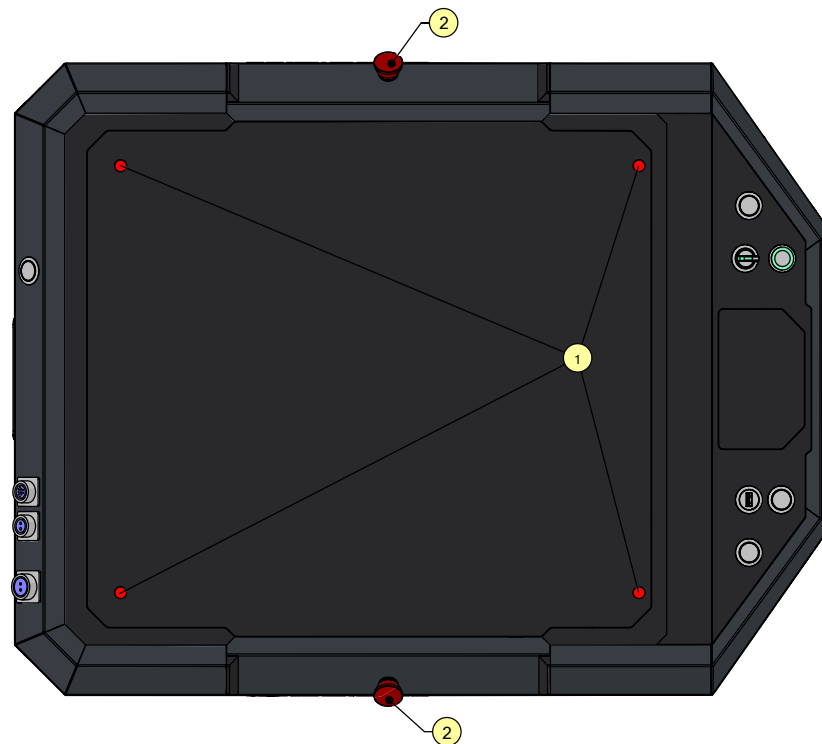


Figure 3.2: Top view of SEIT 100

1 Lifting Holes

2 Emergency Stop Buttons

Lifting Holes – M8 lifting holes for fixation of top module, e.g. RC150 conveyor, and to lift SEIT 100. (See [“Applications”](#) for dimensions of the holes, Page. 50)

Battery Access Lids – to access battery of SEIT 100.

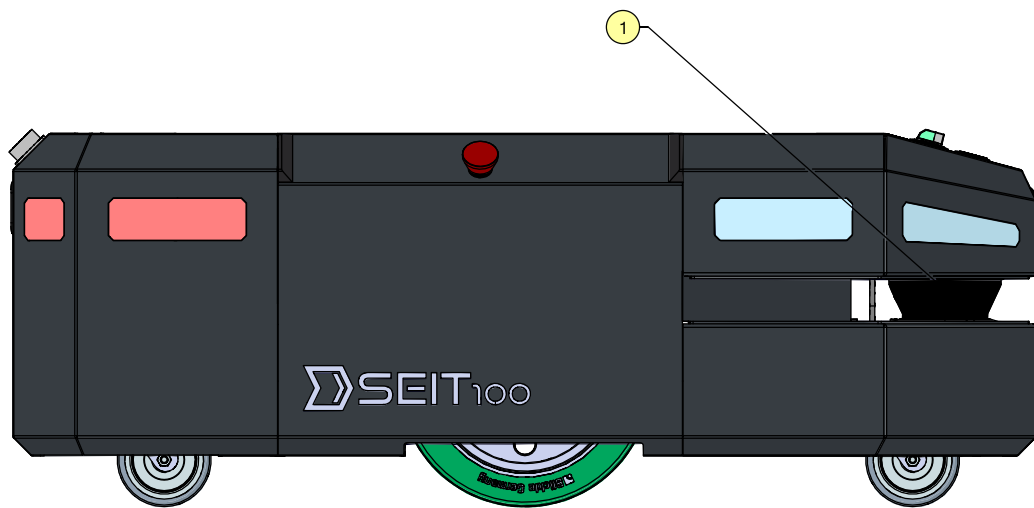


Figure 3.3: Side view of SEIT 100

-
- | | |
|---|---|
| 1 | Navigation and Safety Lasers (category 3 PL d in accordance with ISO 13849-1) |
|---|---|
-

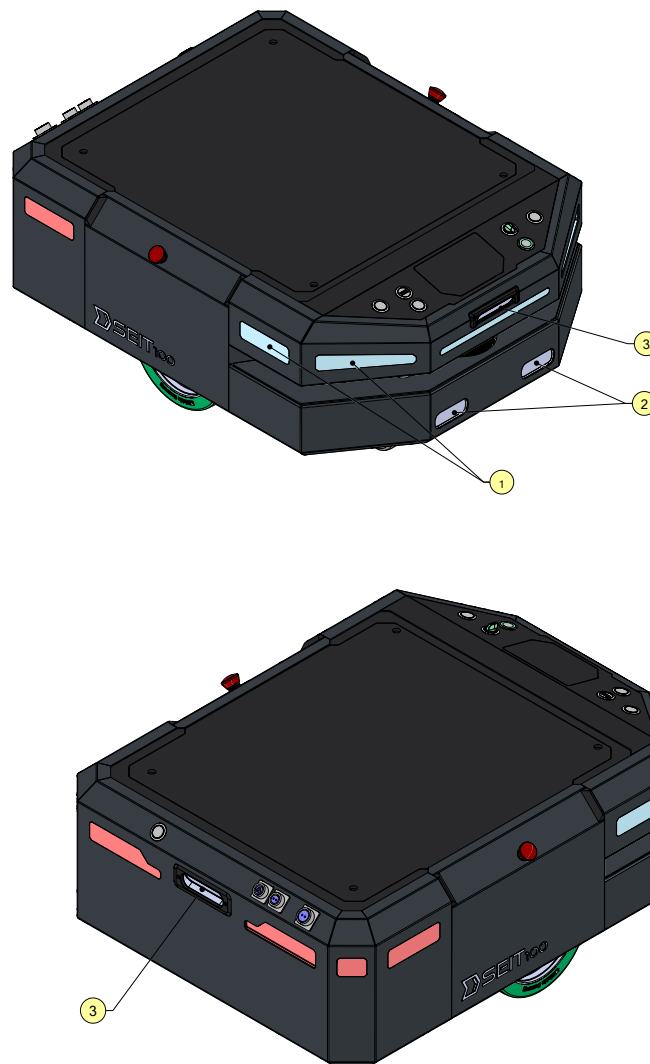


Figure 3.4: Isometric view of SEIT 100

1	Led Indicators	2	Charging Pads
3	Depth Camera		

Led Indicators – letting the surround know which operation is executed by SEIT 100.

Charging Pads – to charge SEIT 100 via charging station.

Depth Cameras – detect objects in front of the robot.

3.1.2. SEIT 100 Manual Remote Controller

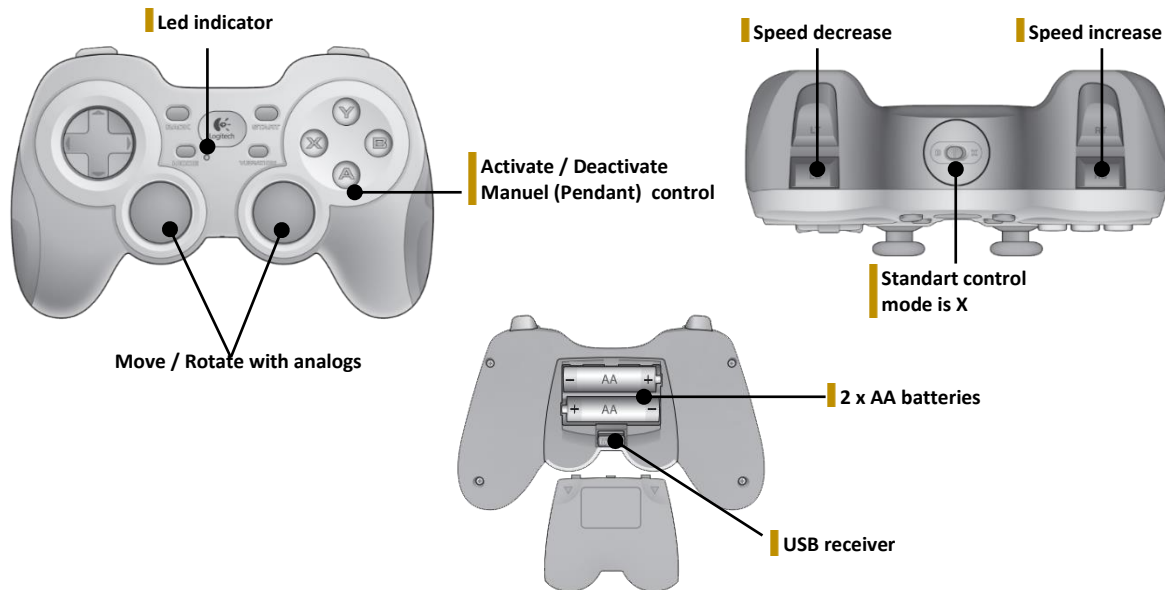


Figure 3.5: Manual remote controller

3.1.3. AUX I/O

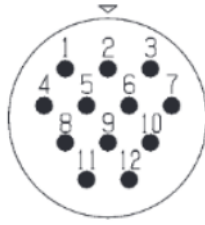


Figure 3.6: Contact Arrangement (When viewed from connector side)

1	IN1 (Safety)	7	TX (RS232)
2	IN2	8	GND (RS232 GND)
3	IN3	9	24V+
4	IN4	10	24V-
5	IN5 (AUX Emergency, Safety)	11	O1
6	RX (RS232)	12	O2

AUX connector supports low current/power devices, and it has 5 inputs and 2 outputs.

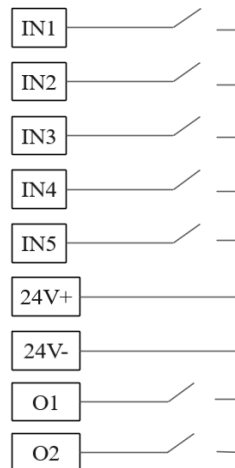


Figure 3.7: Inputs and 24 V + pin are used to receive signal from the attachments, and outputs and 24 V - pin are used to send signal to the attachments.



NJC 2012 PM male connector is needed to connect to the robot's AUX signal connector.

3.1.4. AUX Power



Figure 3.8: Contact Arrangement (When viewed from connector side)

1	24V+ (Max 15A)	When an emergency or a protective stop situation occurs, the power is shut down. It is controlled by a Safety PLC and a contactor.
2	GND	

CAUTION

Damage Risk

- ▶ Power pin supply voltage is unregulated, and it varies between 21.0 V and 29.5 V.



NJC 202 PM male connector is needed to connect to the robot's AUX power connector.

3.2. Technical Data

SEIT 100	
Payload	100kg
Load Type	Application specific – on top loading, cart towing, conveyor – chain, roller, lift deck
Brake	Electric, fail safe
Approx. Weight	80 kg (Unloaded)
Gradeability	8% - fully loaded
Dimensions	814 mm x 630 mm x 300 mm (LxWxH)
Loading Plate Dimensions	595 mm x 510 mm (LxW)
Operating temperature	0 °C to +40 °C
Battery	24 V, 40 Ah Li-ion Battery
Run Time	8-10 Hours
Charge Time	2-3 Hours
Safety Features	2 Safety LIDARS 3D depth cameras Emergency stop buttons Indicator light bars E-stop buttons Buzzer

4. Transport and Storage

4.1. Transport

SEIT 100 arrives in a wooden box secured by draw latches to a pallet. Use only the pallet, and a rated lifting device to move the shipment.

WARNING

Risk of injury during transport

- ▶ Fix SEIT 100 securely and slip-proof for the transport.
- ▶ Ensure that the lifting device (crane, forklift, etc.) is rated for the weight of SEIT 100.
- ▶ Ensure that no persons are located under the suspended load while lifting and moving SEIT 100.

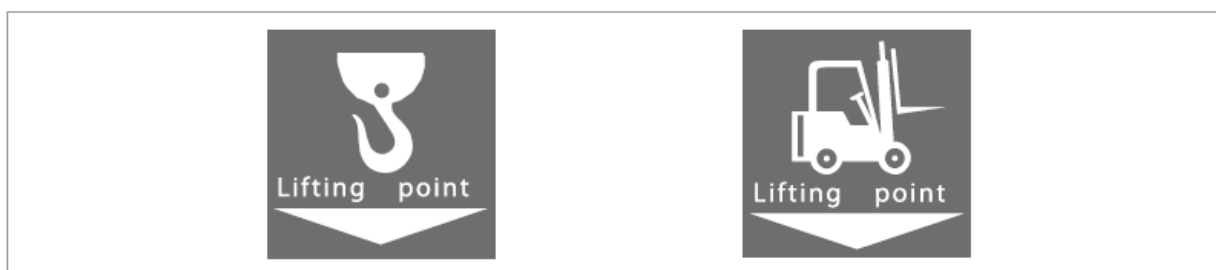


Additional information about the transport is located on an information sheet that accompanies SEIT 100.

- ▶ Data about weight and requirements for loading capacity and lifting tackle are located on the information sheet.
- ▶ Remove any person from the danger zone.
- ▶ Wear safety shoes.
- ▶ Check the correct fastening for the transport.

The load lifting points are marked on the packet.

4.1.1. Identification of Load Lifting Points



4.1.2. After the Delivery

- Inspect SEIT 100 for transport damages.
- Immediately notify the carrier and manufacturer in case of damages to avoid losing any claims for compensation.

4.2. Storage

WARNING

Risk of injury due to improper storage

- ▶ Do not stack SEIT 100. Do not place any other objects on SEIT 100.
 - ▶ Check SEIT 100 stability.
 - ▶ If SEIT 100 is not immediately placed in operation, store it at a location protected against humidity and dust or cover SEIT 100 with something that protects it from such conditions.
-

5. Getting Started Guide

5.1. Unpacking

WARNING

Risk of injury

- ▶ Follow all unpacking safety instructions and use appropriate tools and equipment. Failure to do so could result in personal injury and equipment damage.
-

5.1.1. Box Content

- Dimensions; 990 x 710 x 830 mm (LxWxH)
- Weight; 100 kg

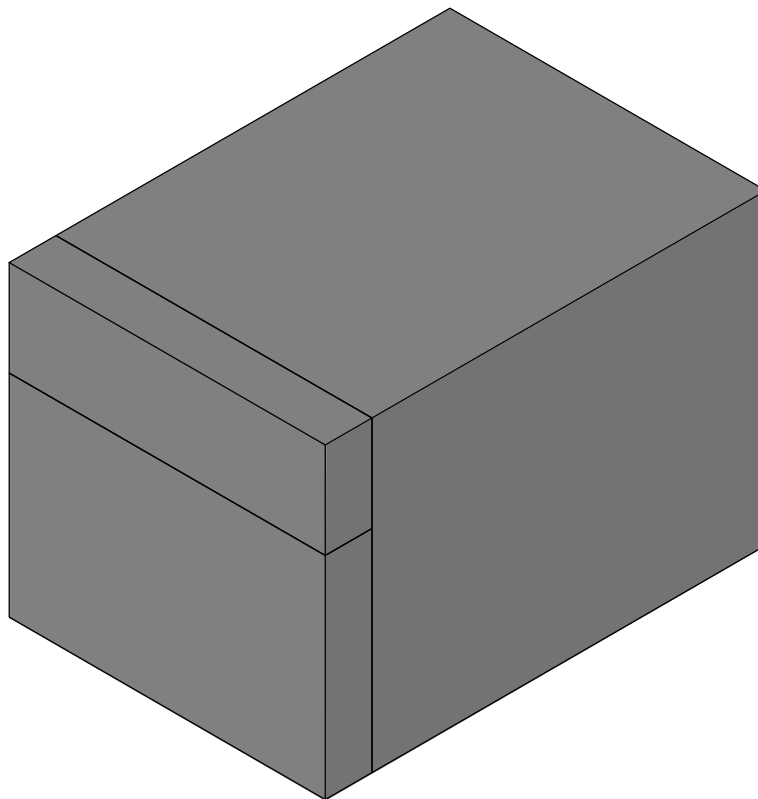


Figure 5.1: Box, containing SEIT 100 and its equipments

5.1.2. Unpacking

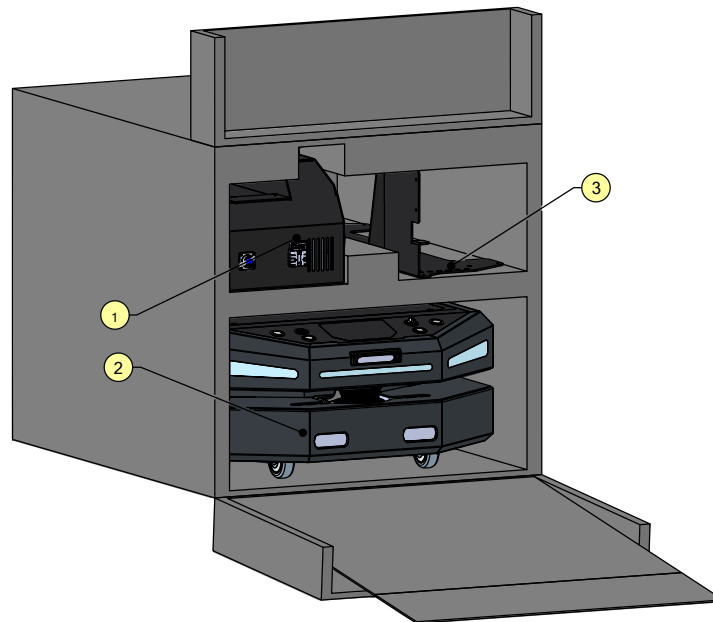


Figure 5.2: Open view of the box

1	MR AutoC – 100	3	Free standing installation apparatus
2	SEIT 100		

5.2. Initial Start-up

5.2.1. Start Up

- Switch the position of “main power switch” (1) as ON as in the *Figure 5.3*.

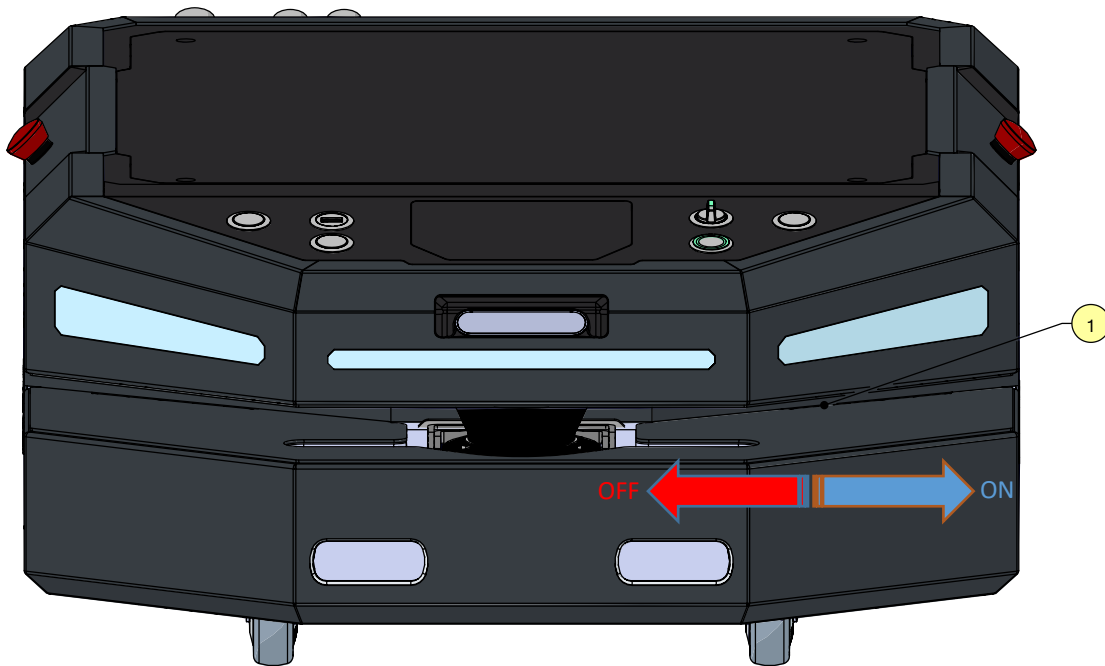


Figure 5.3: Location of main power switch on SEIT 100

- Turn on “[on/off switch](#)” (1) located on the front panel by rotating it in CW direction,
- Wait for 10 seconds until “[start/stop button](#)” (2) starts blinking,
- After blinking starts, push the button (2),

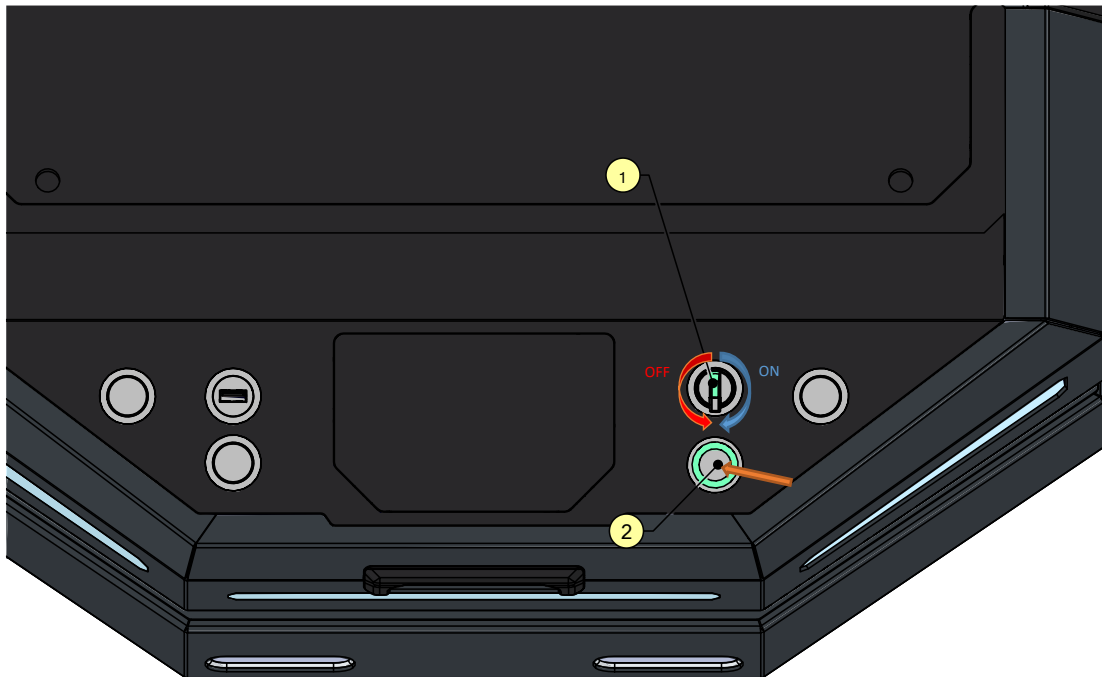


Figure 5.4: Front panel view of SEIT 100

- Wait for the system to boot for about 30 seconds. While the system is booting, “[led indicators](#)” (See page 14) blink.
- You may hear contactors are switched on, and when “[led indicators](#)” (See page 14) become solid, SEIT 100 is up and running.
- One may check whether SEIT 100 is ready or not through software interface part on this manual. Also, for further procedures on SEIT 100 such as mapping, localization, etc., check out the software interface part.

If SEIT 100 fails to start, power it OFF and:

- Verify the battery’s state of charge and connection.

WARNING

Risk of injury due to improper connection

- ▶ Electrical assembly tasks should be performed only by authorized electricians. Observe the safety information.
 - ▶ Carefully install all connections, such as cables, and check for correct fit.
-

WARNING

Risk of injury due to incorrect handling

- ▶ Check electrical connections and protective devices.
 - ▶ Remove the materials from SEIT 100.
 - ▶ Remove unauthorized persons from the danger zone.
 - ▶ Wear safety shoes and work clothing.
-

5.2.2. Driving SEIT 100 Manually by Using “*manual remote controller*”

- Make sure that all the emergency stop buttons are in released state.
- Press “[activate manual pendant control](#)” (See page 15) on manual remote controller,
- Led indicator on manual remote controller turns off and SEIT 100 is ready to be driven.

NOTICE

Risk of Property Damage

- ▶ Make sure that manual remote controller is secured when it is not in use. This prevents unauthorized persons from operating SEIT 100.

5.2.3. Driving SEIT 100 Manually by Using “[brake release button](#)”

- Turn on “[On/Off switch](#)” (See page 11) located on the front panel,
- Make sure that at least one emergency stop button is activated.
- Now, SEIT 100 can be driven by pressing the button and pushing the robot at the same time.

5.3. Operation

Before proceeding with any tasks described in this chapter, you should complete the procedures in the [“Initial start-up”](#) (See page 23).

5.3.1. Operating Environment

5.3.1.1. Intended Use

SEIT 100 is designed to operate in indoor industrial environments.

DANGER

Risk of Injury

- ▶ There is a risk of serious injury by crushing if the AMR tips over as a result of improper operation on inclines that do not comply with the operating specifications.

The following guidelines apply:

- **Floor** – Clean and dry floors that you sweep regularly and routinely keep free of debris, dust and liquids.
- **Typical Inclines** – SEIT 100 is intended to operate in a workspace that has a mostly flat floor. Be aware that the payload structure and any loads transported can:
 - Reduce SEIT 100’s ability to traverse an incline.
 - Change its operating center of gravity (CG).
- **Inclines (Ramps)** – with a properly designed and stable payload, SEIT 100 can operate on ramps at full payload capacity.

5.3.1.2. Side Clearance

SEIT 100 is intended to operate in an environment that has a generally flat and level floor. There should be no doors or other restricted areas that are too narrow for the AMR to pass through.

Make sure that you maintain adequate clearance on each side of the AMR, so that a person cannot get trapped between the AMR and a wall or other fixed object. Consult the applicable standards for your locale for information about required safety clearances. However, Milvus suggests that 50 cm clearance is preferred between the AMR’s footprint or sweeping area and other fixed objects.

An exception to side clearance requirements might apply at pickup and drop off locations, where the SEIT 100 must closely approach conveyors or other fixed objects.

5.3.1.3. Obstacles

If SEIT 100 enters high-traffic areas, take appropriate precautions to alert people in those areas that a SEIT 100 might enter.

Take care to avoid:

- Glass doors and walls,
- Pits without railings or low bumpers,
- Floors with access panels removed,
- Loose cables, hoses or any other obstacles that temporarily cross the workspace floor.
- Large, highly-reflective objects. For example, retro-reflectors can influence the measurement result of SEIT 100.
- The device can be dazzled by incident sunlight. Do not arrange stroboscope and fluorescent lights or other strong light sources directly on the scanning area since they can influence the device under certain circumstance.



WARNING

Persons or parts of the body to be protected may not be recognized or not recognized in time in case of non-observance

- ▶ Keep the area to be monitored free of smoke, fog, vapor and other air impurities. No condensation must be allowed to form at the light emission window. The function of the device may otherwise be impaired, which can lead to unintended shut-downs.
 - ▶ Avoid strongly reflective objects in the scanning area of the device. Example: Retro-reflectors can influence the measurement result of the device. Highly specular objects inside the protective field can blank part of the surface to be monitored in some cases.
-

5.3.1.4. Floor

Floors must provide good traction, typical of good walking conditions. The following specified limits assume that the AMR's wheels are in good operating condition.

- **Flatness and Texture**

Driving on rough or uneven floors can affect traction and navigation and reduce the life of drive train components. Safety might be affected because the laser's sensing plane is not always parallel to the floor.

Even on smooth, level floors, dust, dirt, grease, and water (or other liquids) can affect traction. If the drive wheels slip, it can potentially affect operating duration and navigation accuracy.

- **Steps and Gaps**

Typical floor characteristics that are considered to be steps include any height difference caused by floor slab settling, expansion gaps, or cracks. Other environmental objects might create a temporary bump, such as a wood pallet fragment, dropped fasteners or a temporary floor covering.



WARNING

Risk of property damage

- ▶ SEIT 100 is intended for smooth, hard, and level floors. Although it is capable of driving over steps and gaps, frequent or high-speed driving over such obstacles shortens the lifespan of drive train components.

The following limits apply for certain floor characteristics.

Table 5.1: Physical limits of SEIT 100 considering certain floor characteristic

Characteristic	Operating Limits
Inclines and load	Incline of 5° for maximum payloads
Step or door threshold height	Up to 5 mm at 0.5 m/s
Gap width	Up to 40 mm at 0.5 m/s

5.3.2. Power

SEIT 100 recharges its battery autonomously when necessary all on-board systems function continuously while the battery recharges. Recharge time is 2 hours for 80%, 3 hours for 100%.

Run-time (with no payload) is approximately 10 hours. This varies significantly depending on use and accessory power consumption.

5.3.3. Charging

5.3.3.1. MR-AutoC – 100

MR-AutoC - 100 provides both a manual and an automated method of recharging SEIT 100.

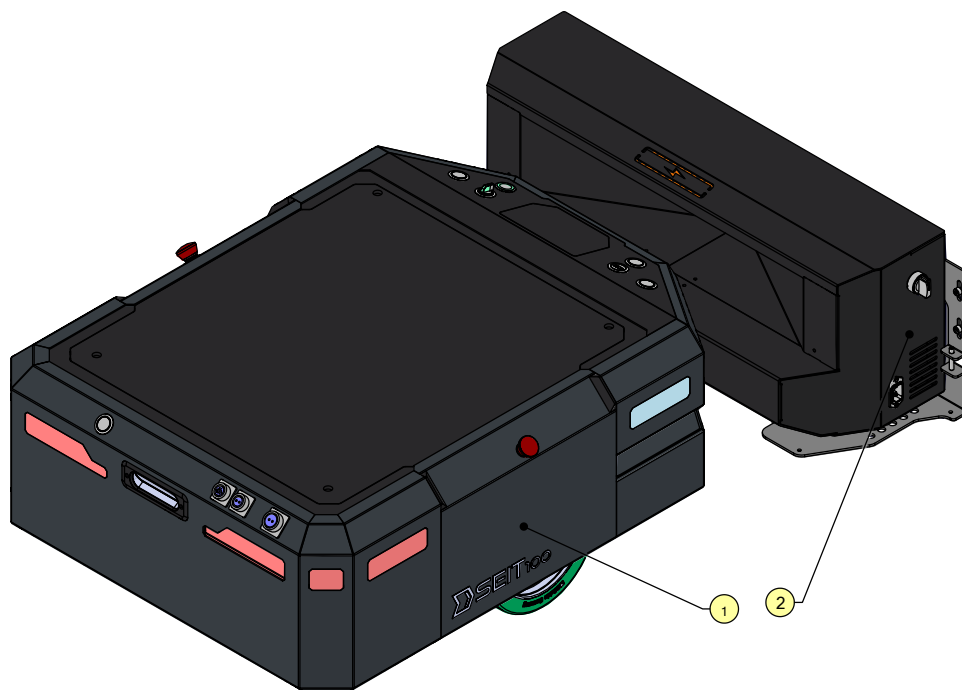


Figure 5.5: MR-AutoC – 100 and SEIT 100

1 SEIT 100

2 MR-AutoC – 100

Figure 5.6 shows the exterior features and parts of MR-AutoC – 100. This figure includes the floor plate for free-standing installation.

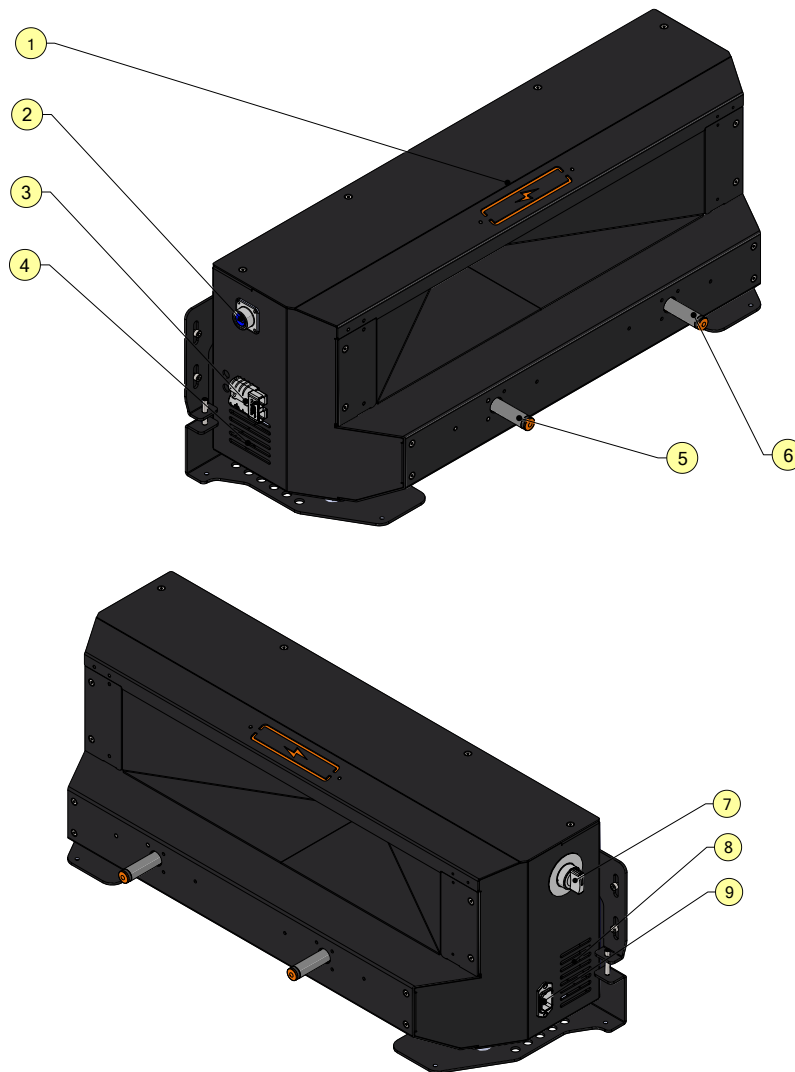


Figure 5.6: MR-AutoC – 100

1	Led indicator	6	±24 VDC charger pin
2	AUX charge connector	7	On/off switch
3	Anderson charge connector (not applicable in this version)	8	Air inlet/outlet
4	Air inlet/outlet	9	110/220V AC socket
5	±24 VDC charger pin		

Figure 5.7 shows that the detail view of charger pins.

These pins have 3 different parts. Each one is designed to charge SEIT 100 effectively without harming the surrounding. Pin isolator separates charging contact (1) from pin (3) so that there is no electric charge at the pin.

Although, it is well-designed to protect the surrounding from electric shock, do not touch both pins and do not short-circuit them with a conductive material. In case of unwanted scenarios, docking station has protections such as short-circuit protection, over voltage protection and over temperature protection.

Charger pins are spring supported products, so they have a stroke length. The stroke length of the pins is 30 mm which must be taking into consideration in docking procedures.

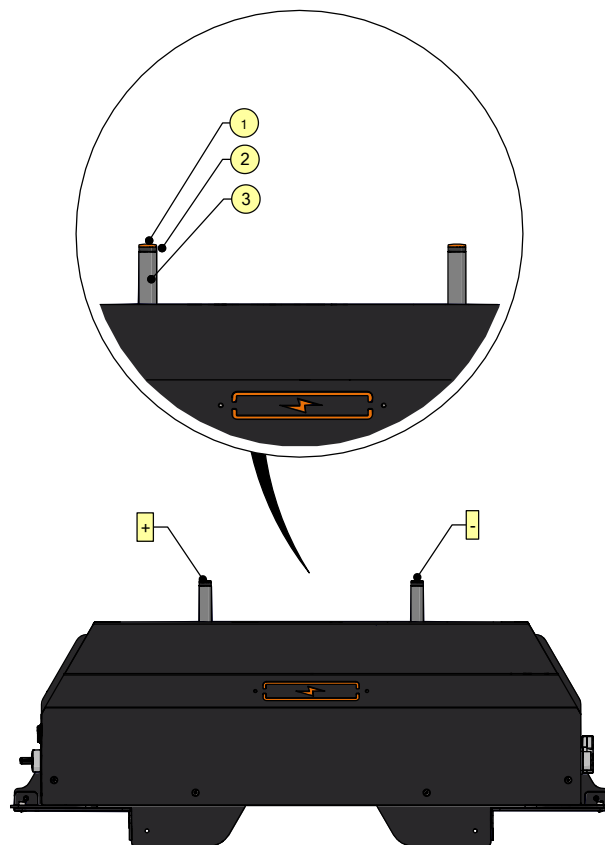


Figure 5.7: ± 24 VDC charger pins

1	Charging contact	3	Pin
2	Pin isolator		

MR AutoC – 100 comes with a floor plate to fix it to the ground and leveling plates to level MR AutoC – 100.

- Fixing the floor plate;
 - The floor plate is placed where the docking station would take place,
 - The floor is marked through fixing holes,
 - The marked points are drilled,
 - With proper fasteners, the floor plate is fixed to the ground.

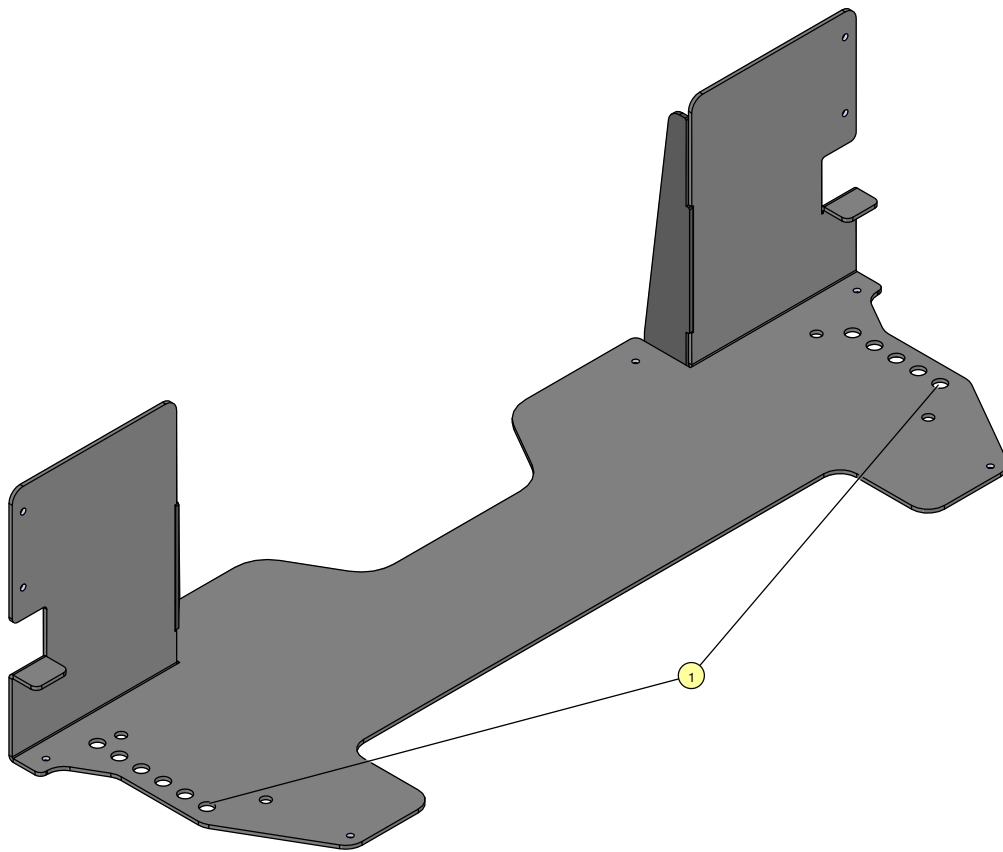


Figure 5.8: Floor plate to fix MR AutoC – 100 to the ground

1	Fixing holes
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- Fixing the leveling plates;

The leveling plates is fixed with supplied fasteners as in the *Figure 5.9*.

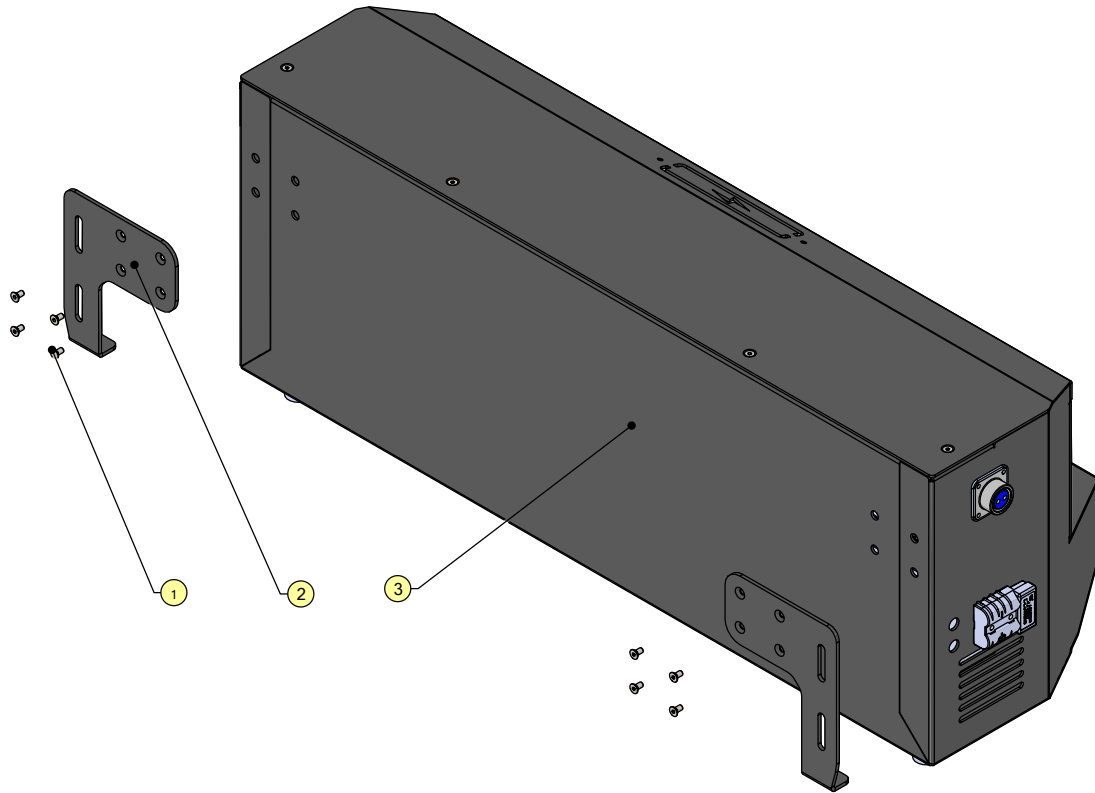


Figure 5.9: Fixing the leveling plates

1	Countersunk Socket Head Screws	2	Leveling Plates
3	MR AutoC – 100		

- Fixing MR AutoC – 100 to the floor plate;

MR AutoC – 100 is fixed to the floor plate with supplied fasteners as in the *Figure 5.10*.

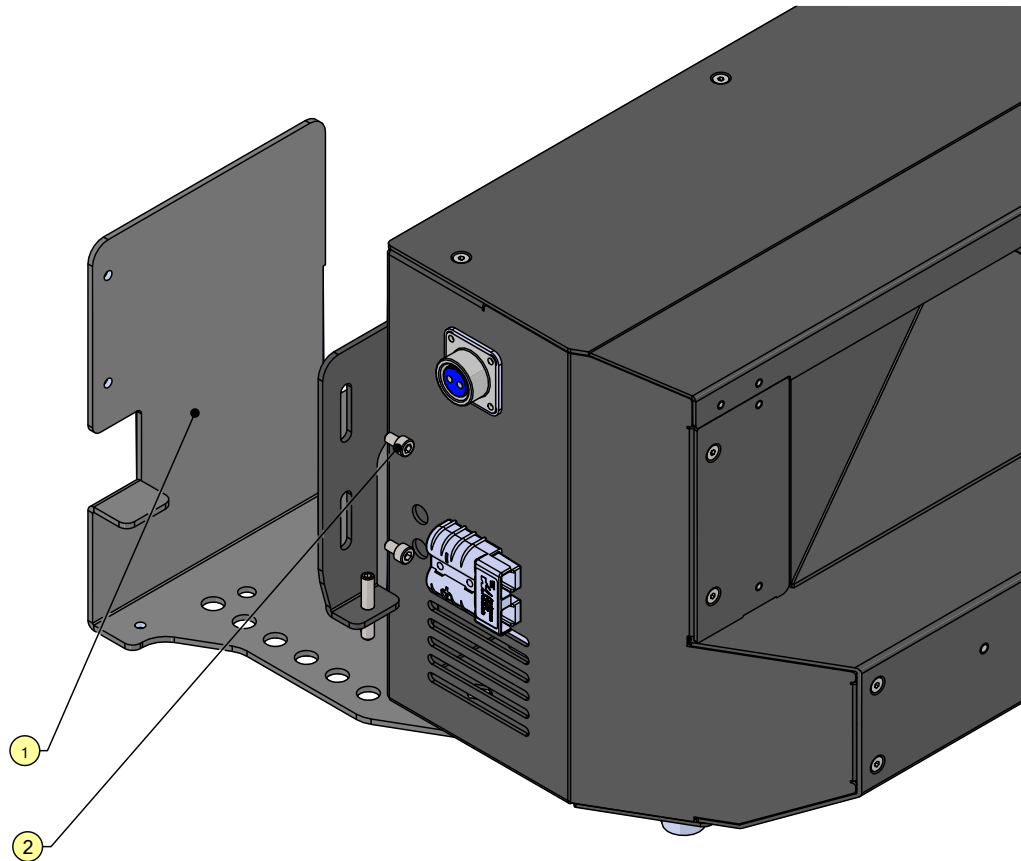


Figure 5.10: Fixing MR AutoC – 100 to the floor plate

1	Floor Plate	2	Socket Head Cap Screws
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- Leveling MR AutoC – 100;

“Charging pads” (See page 14) of SEIT 100 and MR AutoC – 100’s “[±24 VDC charger pins](#)” (See page 32) are not at the same level, initially. To level them, following steps must be done, accordingly.

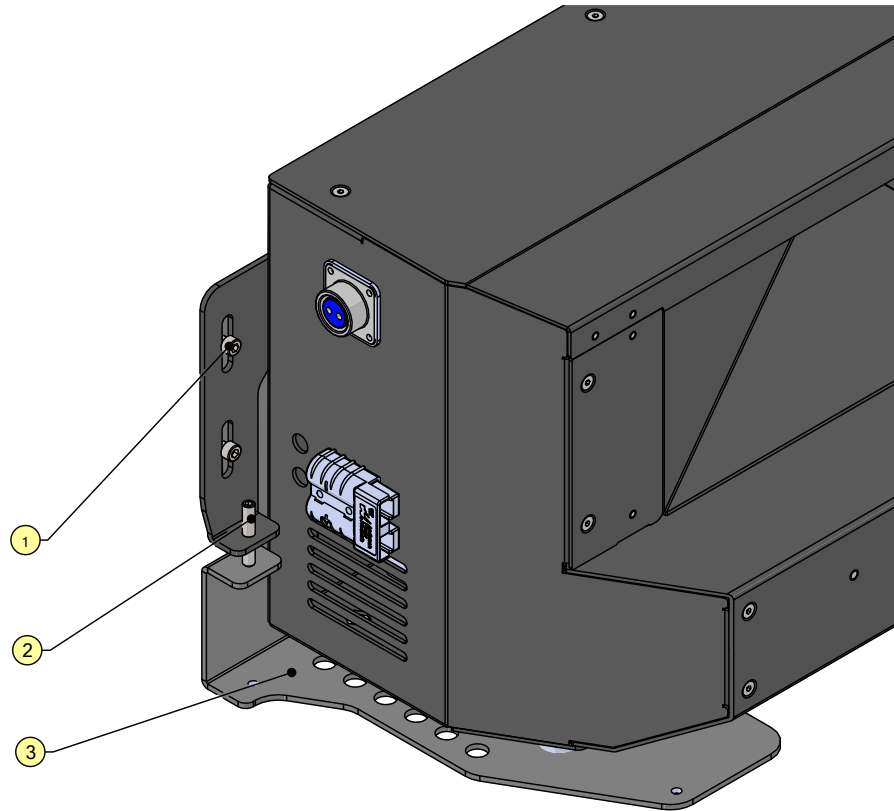


Figure 5.11: Leveling the docking station

1	Socket Head Cap Screws	3	Floor Plate
2	Socket Set Screws		

- Slightly loosen the socket head cap screws (1),
- By rotating socket set screws (2) in CW and CCW direction, height of the MR AutoC – 100 is adjusted.
- When the middle of SEIT 100’s “charging pads” (See page 14) and MR AutoC – 100’s “[±24 VDC charger pins](#)” (See page 32) are at the same level, secure the level by fastening up socket head cap screws (1).

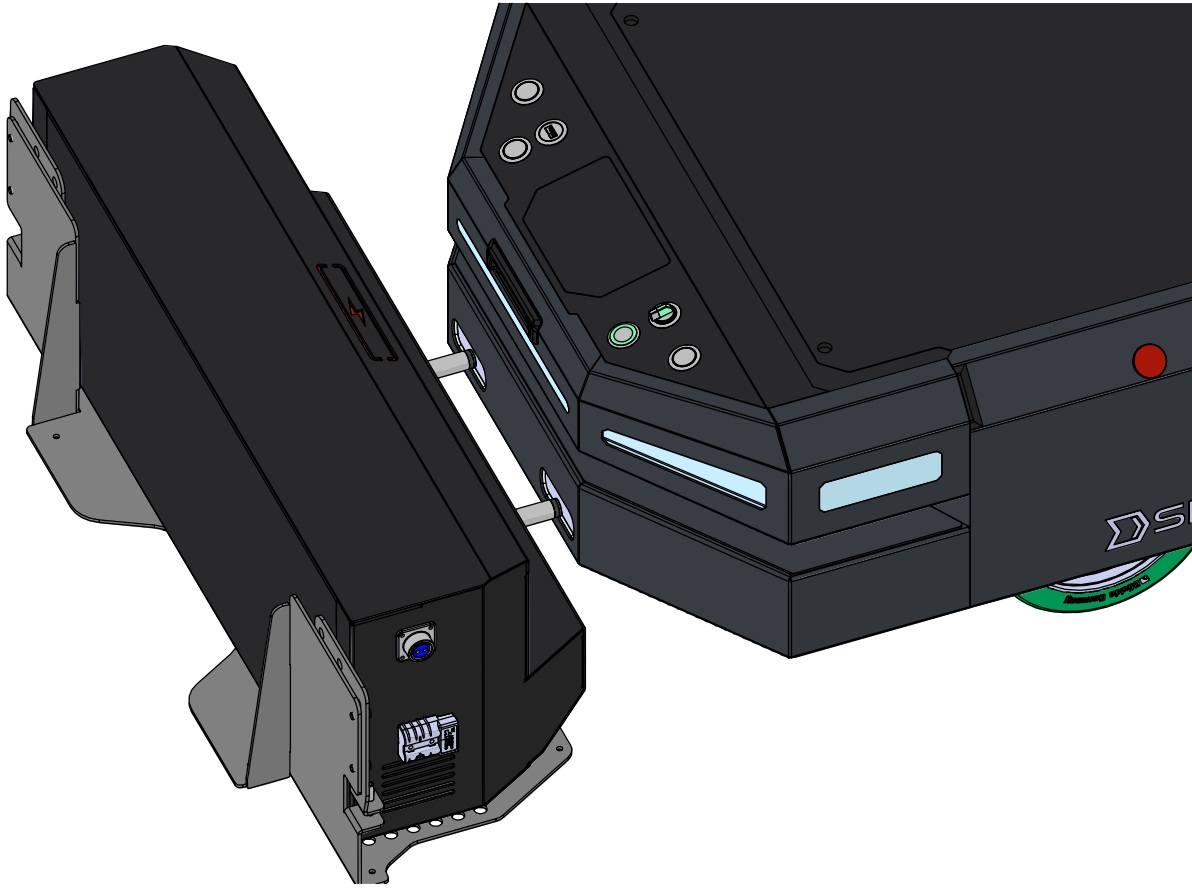


Figure 5.12: Charging pads and charger pins' appropriate level demonstration

- On-off procedure of MR AutoC – 100

After MR AutoC – 100's setup is prepared, one must follow the following procedures to initialize the docking station.

- Plug supplied cable's one end into "[110/220V AC socket](#)" (See page 31) and plug the other end into the 110/220V AC grid.
- Turn "[On/off switch](#)" (See page 30) in CW direction to initialize MR AutoC – 100.
- "[Led indicator](#)" (See page 31) of MR AutoC – 100 starts to show sliding effect in white color, which means it is booting.
- When led indicator turns solid white, it is ready to charge SEIT 100.

By turning "[On/off switch](#)" in CCW direction, one may turn off the docking station.

5.3.3.2. Charging Procedure of SEIT 100

- General Overview of Components



Figure 5.13: Connection cable between the robot and MR AutoC – 100



Figure 5.14: Connection cable between MR AutoC – 100 and the grid

- **Setting Up the Charger**

After MR AutoC – 100's setup is prepared, one must follow the following procedures to initialize the docking station.

- Plug connection cable's one end into "[110/220V AC socket](#)" (See page 31) and plug the other end into the 110/220V AC grid. (See Figure 5.14 for connection cable)
- Turn "[On/off switch](#)" (See page 31) in CW direction to initialize MR AutoC – 100.
- "[Led indicator](#)" (See page 31) of MR AutoC – 100 starts to show sliding effect in white color, which means it is booting.
- When led indicator turns solid white, it is ready to charge SEIT 100.

By turning "[On/off switch](#)" (See page 31) in CCW direction, one may turn off the docking station.

DANGER

Risk of injury

- ▶ ELECTRICAL SHOCK HAZARD. DO NOT TOUCH BOTH PINS WHILE ENERGIZED.
-

- **Charging Manually**

Either SEIT 100's battery is charged manually via charging pads or directly via AUX charge connector.

To charge via AUX charge connector, one must follow the following procedure;

- Plug the connection cable's one end into "[AUX charge connector](#)" (See page 31) and plug the other end into "[AUX Charge Connector](#)" (See page 11). (See Figure 5.13 for supplied connection cable).

To charge via charging pads, one must "*drive the SEIT 100 manually*" and draw it up to MR AutoC – 100 as in the Figure 5.12. (See page 26 to check manual drive).

- **Charging Automatically**

To charge automatically, please refer to software interface part on this manual.

WARNING

Risk of property damage

- ▶ Do not put any liquid on MR AutoC – 100 and do not place it near wet spots.
- ▶ Make sure that air inlet/outlet at both sides of MR AutoC – 100 is open.

Table 5.2: Indicator light's colors on the dock station and their meanings

Color	Effect	State	Description
White	Slide	Booting	MR AutoC – 100 is initializing
White	Solid	Idle	Ready to charge
White	Fade	Starting to Charge	The dock is starting to charge SEIT 100
Orange	Slide	Charging	Charging
Green	Solid	Fully Charged	Battery is full
Red	Fade	Failure	Restart the dock

5.3.4. Sensors

SEIT 100 uses an on-board laser for navigation and safety. Moreover, 2 “depth cameras” (See: page 14) are placed at the front and back of SEIT 100 to detect obstacles that are below and above the scanning plane of the safety laser.

5.3.4.1. Safety Scanning Laser

SEIT 100 safety scanning laser is SICK S300. It is a precise scanning and navigation sensor with the following characteristics:

- Parallel to the floor at a height of 165 mm.
- 240 ° field of view.
- Protection level is category 3 PL d in accordance with ISO 13849-1.

WARNING

Risk of injury and property damage

- ▶ The laser cannot reliably detect glass, mirrors and other highly reflective objects. User caution when operating SEIT 100 in areas that contain such objects.
-

5.3.4.2. Depth cameras

The depth cameras detect obstacle below and above the scanning plane of the safety laser, such as an empty pallet.

- FOV
 - H: 87 ± 3 / V: 58 ± 1 / D: 95 ± 3

Isometric figure shows that the approximate location of the depth camera's scanning field.

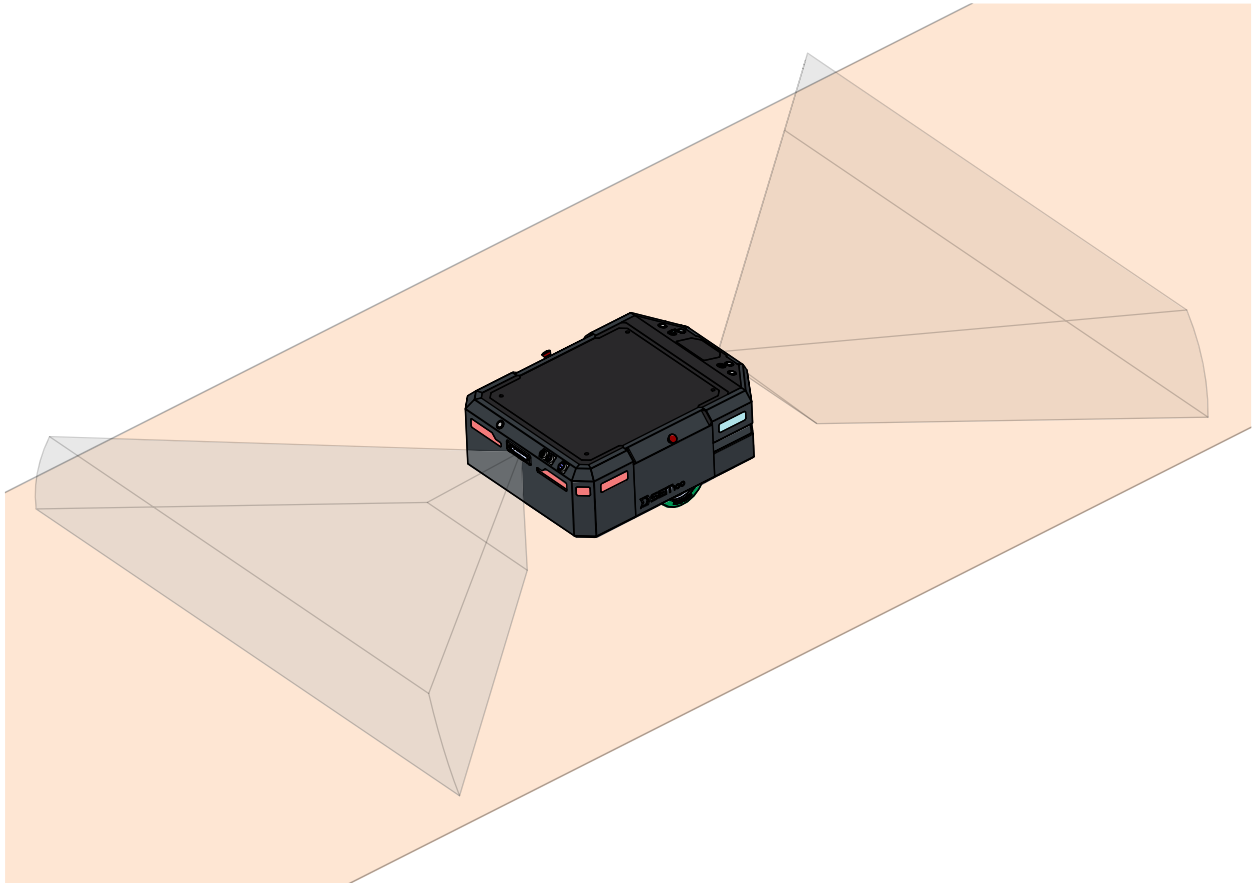


Figure 5.15: Depth camera's scanning field

5.3.4.3. Safety Scanning Laser Operational Consideration

Figure 5.16 shows that SEIT 100's approximate locations of the sensor fields. As this figure shows, there are blind spots to the left and right of SEIT 100.

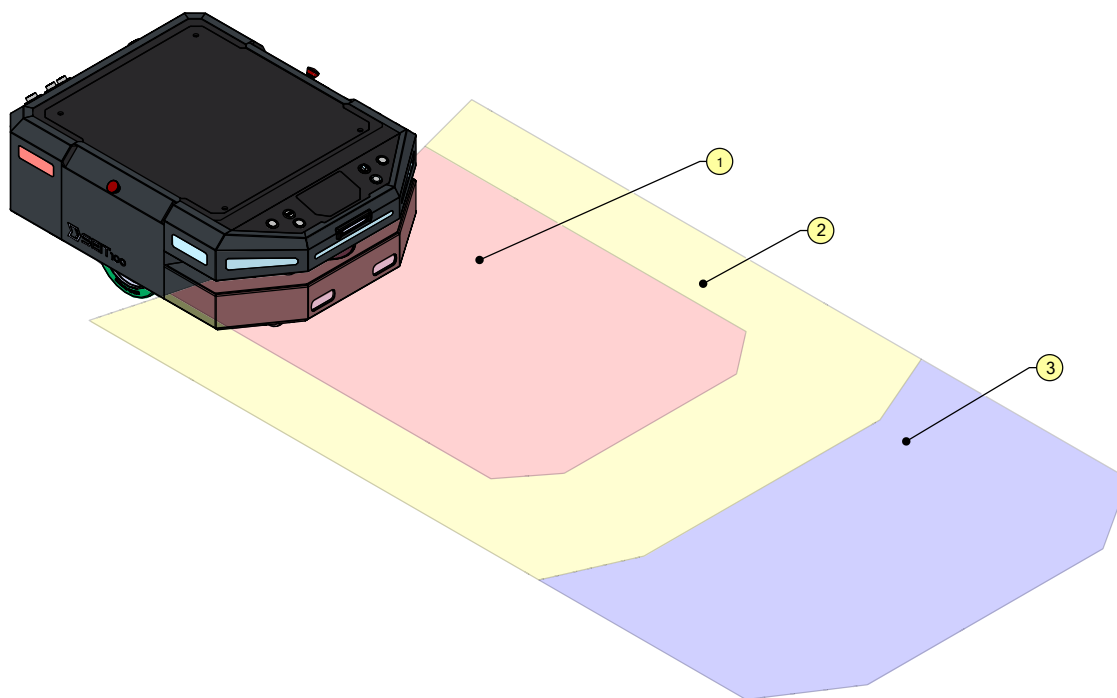


Figure 5.16: Navigation and safety laser's scanning field

1	Protective field	3	Warning field 2
2	Warning field 1		

It is unlikely that an AMR can drive into a person because of these sensor's blind spots. However, under certain circumstances, the AMR can be commanded to turn, and it is possible that a person or object might move into the sensor's blind spot without being detected by the AMR.

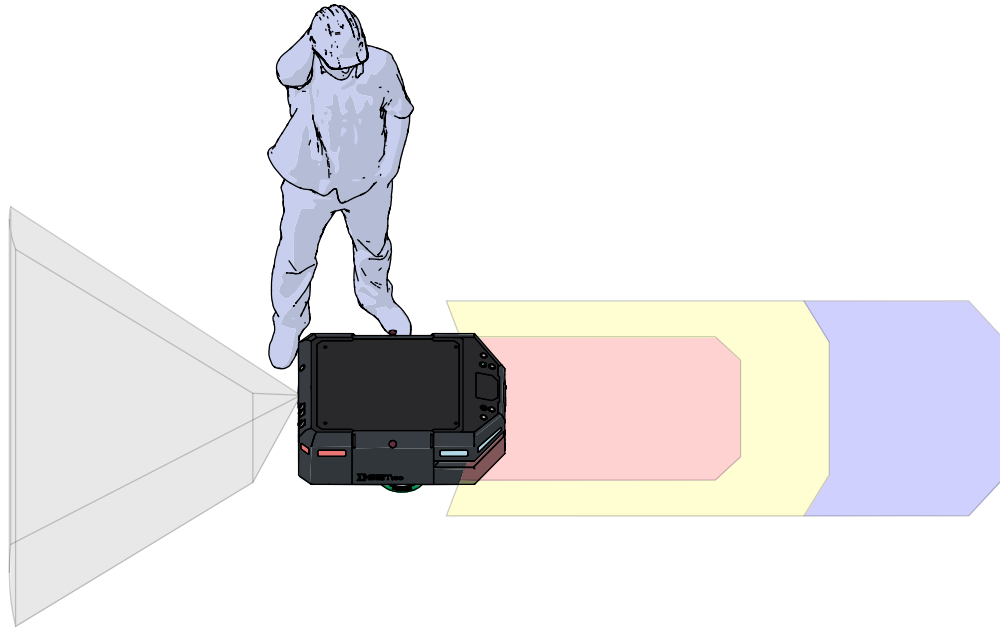


Figure 5.17: A person who is present at the blind spot of the robot during turning maneuver

The AMR is operating at low speed during such maneuver, but an AMR with its payload has a considerable mass and might tip a person over. If SEIT 100 operate in the same workplace as people, provide information and training for people so that they:

- Have complete understanding of the potential directions of movement that an AMR might take, such as rotating in place.
- Know not to stand in or move toward the immediate vicinity of a working AMR.
- Do not leave or place obstacles where the AMR might not detect obstacle.

To reduce the possibility of an accident, adhere to the recommendations.

Protective and warning fields can be switched and muted according to speed and task that SEIT 100 executes. For example; *Figure 5.19*, *Figure 5.20*, *Figure 5.21*, and *Figure 5.22* represent field sets related with the speed sets of SEIT 100.

Each speed set has a specific protective and warning fields, and these fields has different dimensions for each speed set.

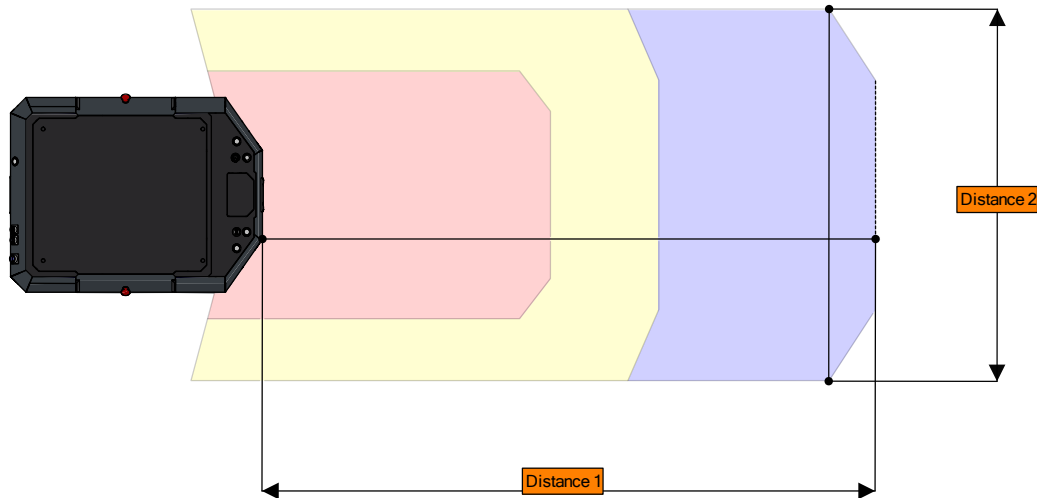


Figure 5.18: Demonstration of field sets' distance

Table 5.4: Distances according to speeds and field

Distance	Field	High Speed (mm)	Medium Speed (mm)	Low Speed (mm)	Stopping (mm)
Distance 1	Protective Field	1000	450	250	120
	Warning Field 1	1350	1300	400	300
	Warning Field 2	2050	1350	600	600
Distance 2	Protective Field	800	800	700	700
	Warning Field 1	1200	1120	700	800
	Warning Field 2	1200	1200	700	1000

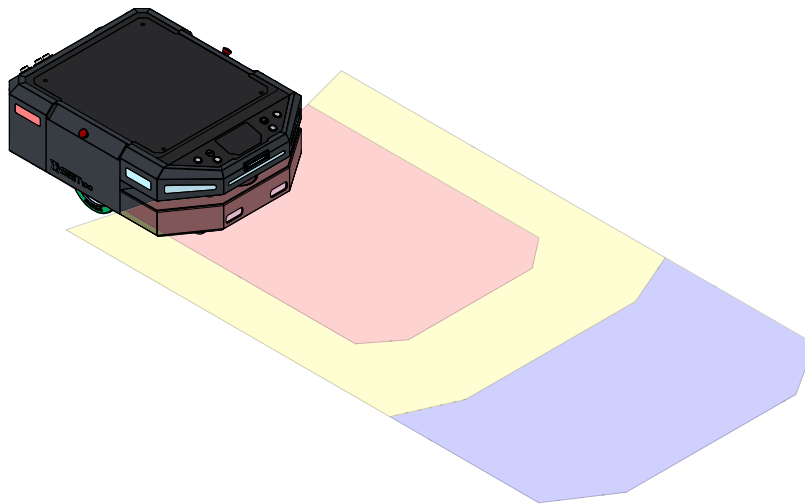


Figure 5.19: Navigation and safety laser's field set at high speed

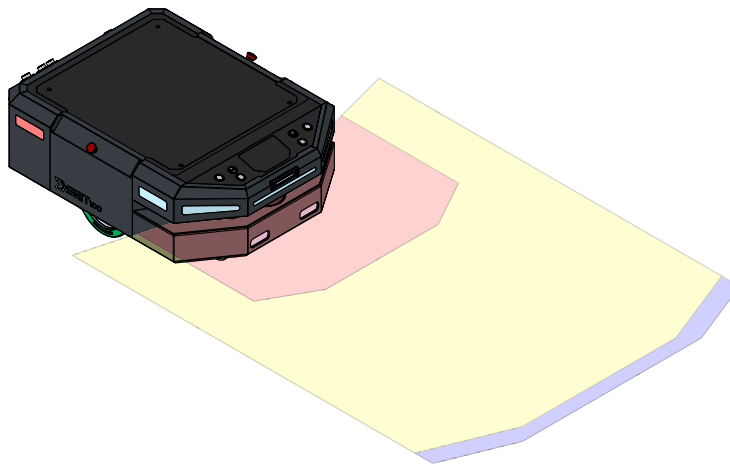


Figure 5.20: Navigation and safety laser's field set at medium speed

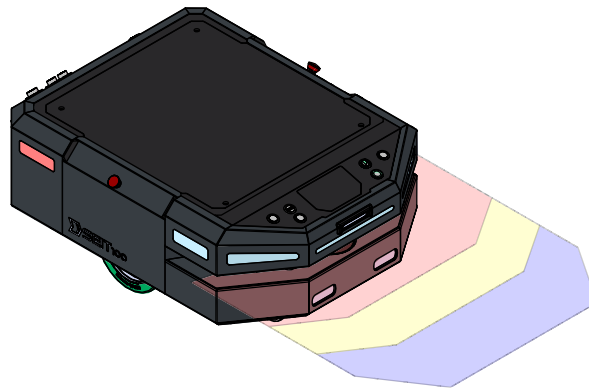


Figure 5.21: Navigation and safety laser's field set at low speed

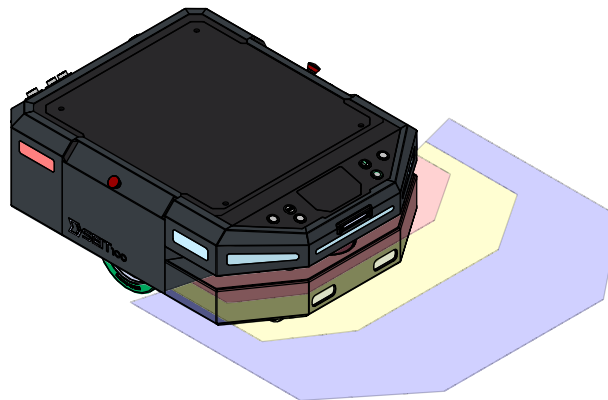


Figure 5.22: Navigation and safety laser's field set at stopping

WARNING

Risk of injury and property damage

- ▶ It is the end user's responsibility to perform a task-based risk assessment so that appropriate protective and warning field sets can be applied. Otherwise, unwanted accidents may occur.
-

WARNING

Risk of injury

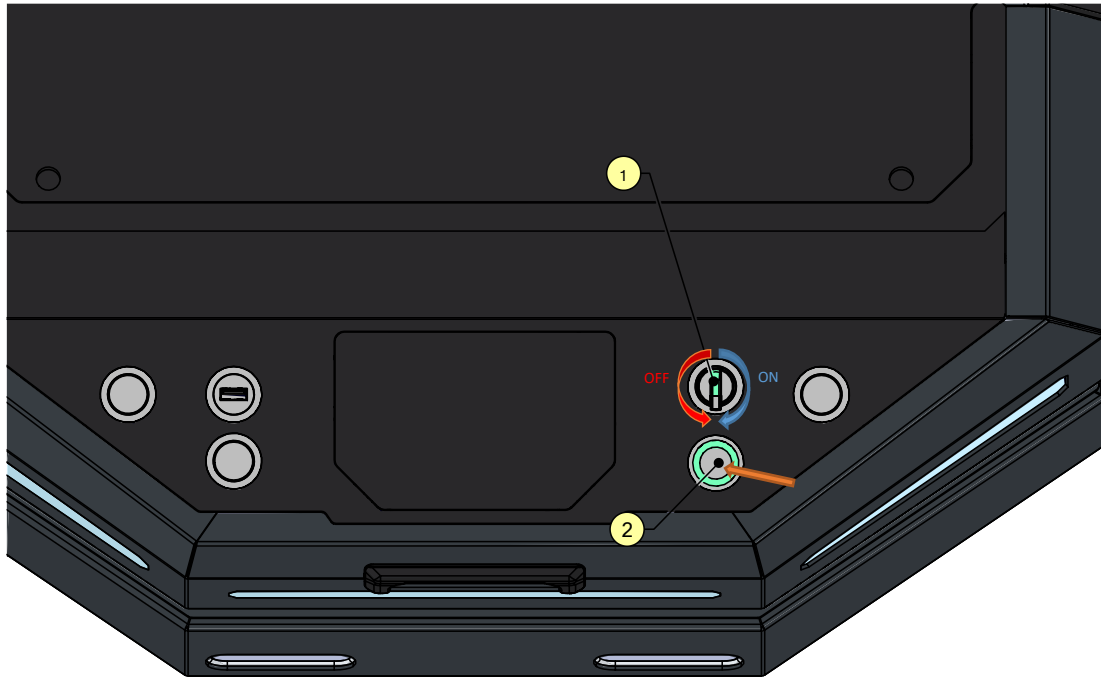
- ▶ To prevent the risk of a person approaching too close to moving AMR, follow the operational guidelines in this section.
-

To reduce the possibility of an accident, adhere to the recommendations.

5.4. Shutting Down the Robot

To shut down SEIT 100, follow the steps;

- Ensure that the robot is not moving or executing an action.
- Press the start-stop button (2).



- The robot starts to shutdown process.
- When the robot finishes the shutdown process, "[led indicators](#)" (See page 14) becomes inactive, the "[start/stop button](#)" blinks green.
- One may turn off on/off switch (1) located on the front panel by rotating it in CCW direction and the "start/stop button" light goes off.

6. Applications

Attachments can be installed onto SEIT 100 for specific applications. For more information, contact Milvus Robotics.

Mounting an Attachment

SEIT 100 has 4 M8 lifting holes that are used to mount an attachment onto SEIT 100. See *Figure 6.1*. Also, additional holes can be added for a specific type of attachment such as lifting attachment.

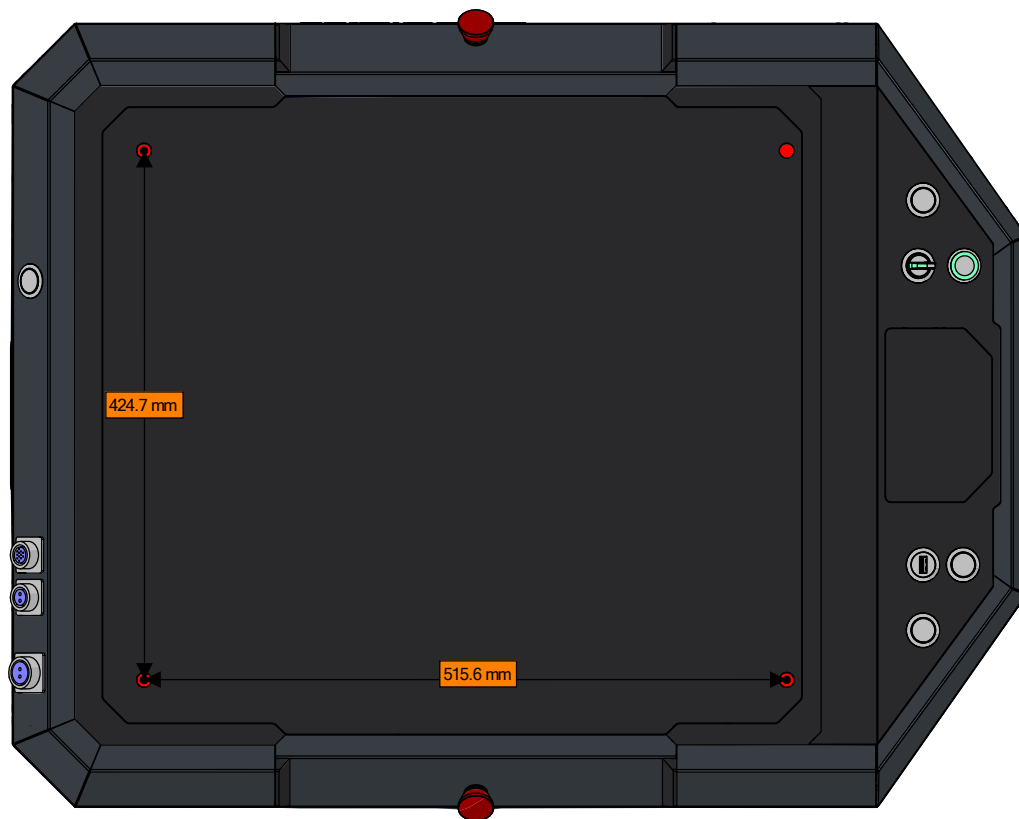


Figure 6.1: Mounting holes

7. Payload Placement

The graphics in this section show the calculated safe CG dimension and placement for payload structures (that must also comply with the specified weight limit). The payload structure's CG, in each instance, must be within the defined area.

WARNING

Risk of injury and property damage

- ▶ If the load on the robot is not positioned or fastened correctly, the load may fall or the robot may overturn and cause injury to personnel and damage to equipment.

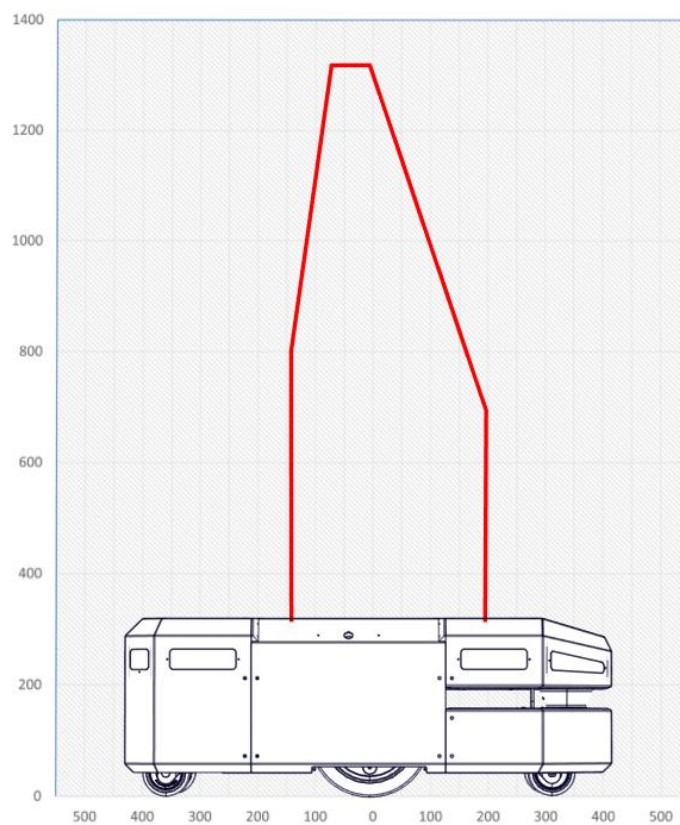


Figure 7.1: Side view of recommended payload CG

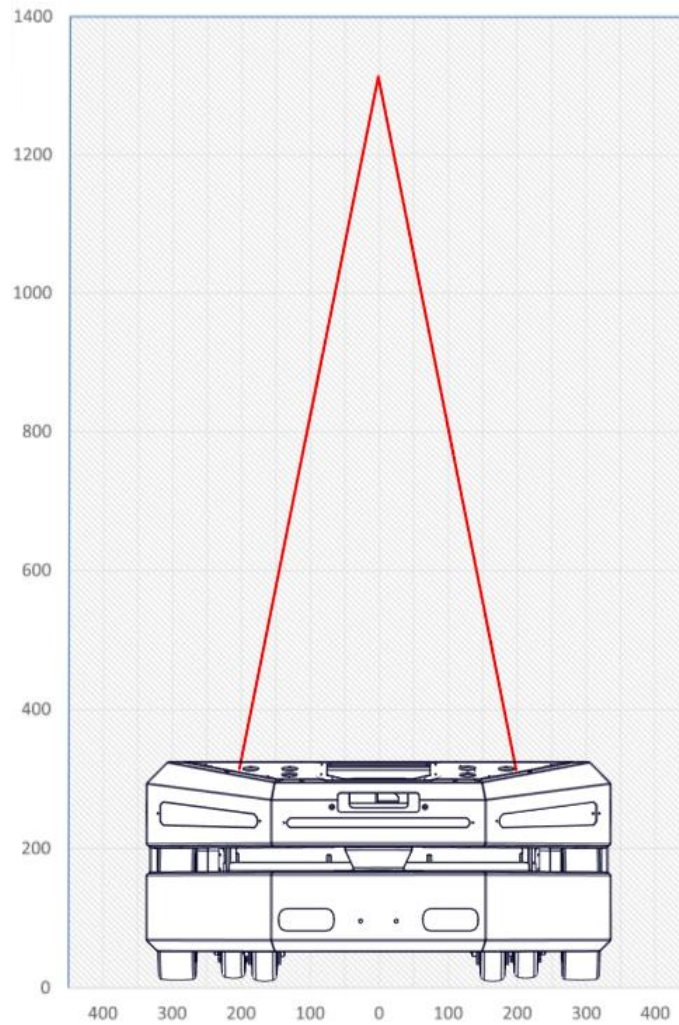


Figure 7.2: Front view of recommended payload CG

8. Cleaning



WARNING

Risk of injury due to incorrect handling

- ▶ Only perform cleaning work on SEIT 100 after you have switched off the power.
 - ▶ Do not remove protective devices.
 - ▶ Wear safety shoes and close-fitting work clothing.
-

- ▶ Use only suitable cleaning agents (water-soluble, free of phosphate, silicone and potassium, non-acidic). Observe the manufacturer's instructions.
 - ▶ The best type of product is a mild detergent solution with warm water.
-

Safety Laser Scanner

The safety laser scanner is largely maintenance-free. The optics cover on the safety laser scanner should however be cleaned regularly and also if contaminated.



NOTICE

Risk of property damage

- ▶ Do not use aggressive cleaning agents.
 - ▶ Do not use abrasive cleaning agents.
-



NOTE

- ▶ Static charges cause dust particles to be attracted to the optics cover. This effect can be diminished by using the anti-static plastic cleaner (SICK part no. 5600006) and the SICK lens cloth (part no. 4003353)
-

9. Troubleshooting

9.1. In Case of a Fault

DANGER

Danger - electrocution

- ▶ Only perform maintenance and repair work after you have switched off power.
 - ▶ Faults on an electrical equipment may be removed only by a trained electrician!
-

Requirement: The danger spots on SEIT 100 are covered by protective plates and other protective devices.

- Immediately de-energize SEIT 100 and ensure that it cannot be started accidentally.
- Remove material and blocking objects.
- Before switching it on again, ensure that no persons are at risk.

9.2. Troubleshooting

Fault	Possible cause	Remedy
Manual remote controller does not work	“Activate / deactivate manual pendant control button” is not pressed.	Press “Activate/ deactivate manual pendant control button”
	An emergency stop button is pressed	Release all the emergency stop buttons
	An obstacle blocking the way of SEIT 100.	Remove the obstacle
	SEIT 100 is off	Start SEIT 100
Buttons, switches and ports on SEIT 100 do not work	Damaged or broken	Replace the related part
	No supply voltage	Check SEIT 100 is on
SEIT 100 is constantly in emergency state	An obstacle blocking the way of SEIT 100	Remove the obstacle
	An emergency stop button is pressed	Release all the emergency stop buttons
	Navigation and safety laser’s orientation is corrupted	Contact Milvus Robotics
	Navigation and safety laser does not work	Change navigation and safety laser
SEIT 100 cannot move	An obstacle blocking the way	Remove the obstacle
	An obstacle is jammed between a wheel and floor	Remove the obstacle

	The battery needs recharging	Charge the battery
	Battery level is below a usable state	Replace the battery
SEIT 100 cannot be charged	There is an error in docking station.	Restart the dock
	Battery level is below a usable state	Replace the battery

10. Spare and Wear Parts

All spare and wear parts are available from Milvus Robotics. Maintenance and repair work may be performed only by qualified personnel. Milvus Robotics offers training sessions about required maintenance and repair tasks upon request.

10.1. Ordering Information

Ordering spare and wear parts requires the exact identification of SEIT 100.

The following information is required for an order:

- AMR number
- Designation
- Comment

For information about the spare parts portfolio, please contact Milvus Robotics.

11. Decommissioning and Disposal

- ▶ When disposing the motor oil, observe the disposal documents of the motor manufacturer.
- ▶ The packaging must be recycled to provide environmental relief.

Environmental protection regulations

For all work on and with SEIT 100, the legal regulations concerning waste avoidance and proper disposal and recycling must be followed.

NOTICE

Substances with a water hazards class, such as greases and oils, hydraulics oils, coolants or cleaning agents with solvents may not be allowed to come into contact with ground or reach the sewer system!

- ▶ Store, transport, catch and dispose these substances in suitable containers!
 - ▶ Observe the notices on the supply containers.
 - ▶ Observe any additional national regulations.
-