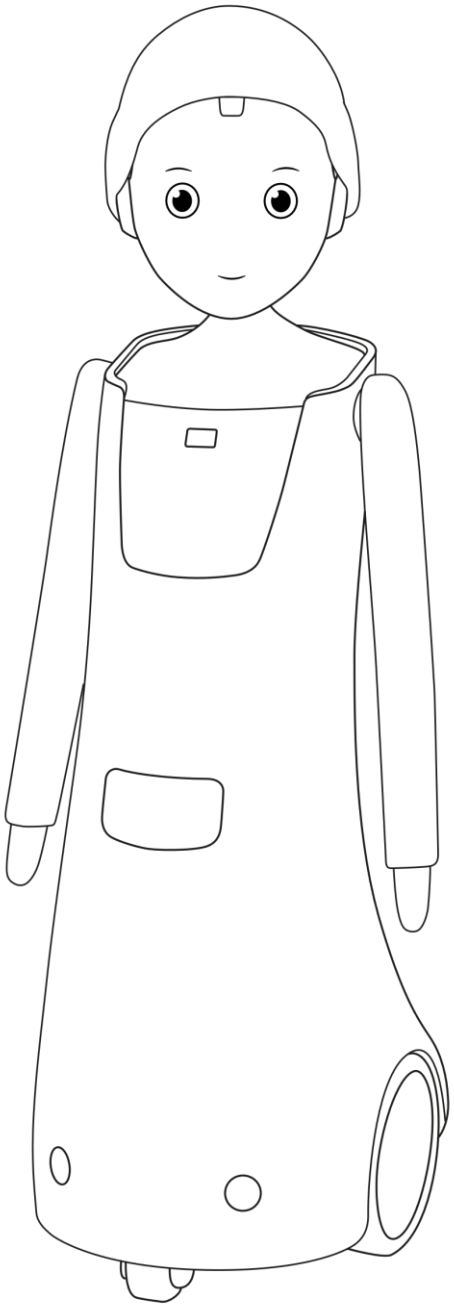
# navel

Instruction manual



English

Version

2026-02-12

## Change history

| Version vom | Änderungen | Autor | Status |
|---|---|---|---|
| 2025-02-21 | Initial Version | PS | Approved |
| 2025-09-18 | Notes on data protection added according to the DPA and the Data Protection Guidelines | AV | Approved |
| 2025-10-14 | Driving function: How-to and safety instructions created; role descriptions for mentor & companion added; cap size included | AV | Approved |
| 2026-02-12 | Addition of software components and hardware components | CT | Approved |
| | | | |

**navel robotics GmbH**
Agnes-Pockels-Bogen 1
80992 Munich, Germany
www.navelrobotics.com
support@navelrobotics.com

www.navelrobotics.com/manuals

# Information

Please read these instructions carefully before using the **Navel** social robot. Keep this document for future reference. The latest version of this document can be found online at: *www.navelrobotics.com/manuals.*

**Navel** is a robot that can move independently. The robot may only be switched on under supervision. Persons operating **Navel** must ensure that the safety guidelines in the chapter "Safety information" are followed.
FAILURE TO DO SO MAY RESULT IN ACCIDENTS AND INJURIES AND MAY INVALIDATE THE WARRANTY.

# Contents

# Safety information

## General information

WARNING: Do not open **Navel**! **Navel** contains moving and live electrical parts. Failure to open and manipulate **Navel** can lead to death or serious injury. This will invalidate any guarantee and warranty. **Navel** may only be opened by authorized persons.

If you detect missing or damaged parts on **Navel** or notice smoke, odor or unusual noises, stop using **Navel** immediately, turn it off and contact navel robotics support.

## Driving in accompanied mode

When the driving function is activated in Control Studio, **Navel** can drive. However, you must keep an eye on him!

Its environmental sensors are not yet fully developed and may not yet reliably detect precipices (e.g. stairs, tables and platforms) or safety-relevant objects (walking aids or small animals). Therefore, **Navel** may only be operated under constant supervision by trained personnel (mentor & companion).

Ensure that the operating personnel of **Navel** (mentor & companion) are instructed in the safety measures. The safety checklist is available for download as a PDF in Control Studio and [>>here<<].

Before starting, please ensure that none of the hazards listed below are present. Persons in the immediate vicinity must be informed of the presence, operation and functions of **Navel**. This will ensure safe operation:

### Duty of supervision

Never leave **Navel** unattended in driving mode.

### Risk of falling

Do not operate **Navel** near stairs, ramps or precipices. Do not use it on tables or platforms.

### Risk of tipping over

Ensure that the floor is firm, dry and level. **Navel** must not be driven on glass surfaces or deep-pile carpets. It could trip over door thresholds, gaps and carpet edges.

### Limited field of view

**Navel** may not recognise objects directly in front of it (at a distance of less than approximately 5cm). Its field of vision is limited to the front.

### Risk of collision

Ensure that there are no pets, babies or safety-relevant objects (e.g. walking aids) in **Navel's** environment.

### Risk of vulnerable persons falling

Explain the driving function to people around **Navel** – and remind them regularly. Make sure that no one leans on **Navel**, trips over him or is startled by his movements.

## Cable management

Ensure that the charging and network plugs from **Navel** are disconnected before each journey.

## Location and surroundings

**Navel** may only be used indoors.

The environment must be dry. The humidity must be below 80%.

The floor must be flat, level, firm and clean.

**Navel** has been developed for an ambient temperature of 0°C to 30°C and must not be operated outside this range.

**Navel** must not be operated in potentially explosive atmospheres or in the vicinity of flammable gases or vapors.

## Requirements for operators (mentor & companion) and end users

**Navel** may only be operated under the supervision of the operator. The roles and responsibilities differ as follows:

Mentors:

- Main contact person for navel robotics
- Operator of **Navel** (e.g. switching on, charging, cleaning or configuring)
- Administrators in Control Studio and authorised to activate new functions
- Must be familiar with the functions of **Navel**
- Must be familiar with the safety guidelines
- Before each use of **Navel**, ensure that there are no hazards in the environment (see Safety Checklist; PDF download [>>here<<])
- Responsible for instructing companions. A one-time instruction and regular reminders are recommended.

Companions:

- Operators of **Navel** (e.g. switching on, charging, cleaning, but not configuring)
- Require instruction from the sponsor
- Must be familiar with the functions of **Navel**
- Must be familiar with the safety guidelines
- Before each use of **Navel**, ensure that there are no hazards in the environment (see Safety Checklist; PDF download [>>here<<])

End users:

- Persons who interact with **Navel**, e.g. via dialogue (e.g. nursing home residents, patients, children, etc.)
- Require instruction from the mentor or companion, especially with regard to hazard warnings

**Navel** may only be serviced by trained personnel from navel robotics.

## Supervision

**Navel** is not intended for use by children under 14 years of age or by persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge, except for the following

- they are at least 14 years old and have been instructed in its safe use and understand the dangers involved.

OR

- they are supervised by operators, i.e. by a person who is responsible for their safety and has read and understood these instructions.

Other persons must be appropriately supervised to ensure that they interact safely with **Navel**.

## Liquids

In general, please keep liquids away from Navel to avoid spills or splashes. **Navel** is not waterproof. **Navel** must not be doused with liquids.

However, if liquids have penetrated **Navel**, remove the charging cable if necessary, switch off **Navel** and contact navel robotics support.

## Mechanical hazards

**Navel** has moving parts, some of which are driven by powerful motors.

CAUTION! Keep hair and objects away from moving parts of **Navel**. There is a risk of getting caught in moving parts.

CAUTION! Do not hold your fingers or other body parts on or near the base plate, wheels, arms or neck of **Navel** during operation. There is a risk of crushing. If parts of your body are caught or trapped in the appliance, switch Navel off immediately. If you have trapped your hand between the arms and the body, the arms can be pulled off to the side. Motors can be moved when switched off.

**Navel** may fall over when moving around. Because the contact surface is small, there is a risk of tipping over when driving over ramps or obstacles. It may only be operated on level, clean surfaces.
WARNING: Never lean on **Navel**.
WARNING! Do not transport any objects with **Navel**.
Do not knock **Navel** over.

**Navel** is equipped with obstacle detection sensors. Unfavorable environmental conditions may cause these sensors to malfunction and may result in contact with obstacles or living creatures.
WARNING! Persons at risk of falling in particular must therefore always maintain a sufficient safety distance of 150 cm.

**Navel** is equipped with sensors for abyss detection. It cannot be ruled out that unfavorable ambient conditions (crevices, non-load-bearing floor, light sources) may prevent a relevant abyss from being detected. During commissioning, the manufacturer or operator must check whether the product recognizes critical environments and has no difficulties with the wider environment.

WARNING! Do not operate **Navel** near precipices such as stairs or on tables! In particular, do not switch on Navel in the immediate vicinity of precipices!

**Navel** has a bulge on the upper back for carrying.
CAUTION! **Navel** must not be lifted by the head, arms or other recesses (for lidar). These parts are not designed to carry the weight of **Navel** and may fail.

## Heat

Internal parts such as motors, batteries and processors can become hot during operation and must not be touched to avoid burns.

The ventilation slots on the back of **Navel** must not be covered or otherwise closed.

WARNING! Warm exhaust air escapes from the housing. Do not expose body parts directly to this for long periods of time.

## Fire hazard

There are four lithium-ion batteries in **Navel**. Lithium-ion batteries are flammable. Do not damage the batteries and keep your distance from damaged batteries.
WARNING: Do not expose **Navel** to high heat or high mechanical stress.

The housing of **Navel** is made of plastic with fire-retardant properties.

When burning, batteries can burst and spread mist. The mist is flammable, toxic and corrosive. WARNING! Firefighting poses a great potential risk to yourself! Suitable personal protective equipment, such as protective gloves and face protection, must be used as a precaution. Call the fire department and get yourself and other people out of the danger zone.

Do not restart **Navel** after a fire. Consult with navel robotics support.

## Batteries

**Navel** has four lithium-ion batteries. Therefore, objects must not be inserted into **Navel**. **Navel** must not be doused with or immersed in liquids.

CAUTION! The **Navel** battery may only be charged using the charger supplied. Failure to do so may result in damage or ignition.

The battery must be charged regularly and must not be left uncharged for long periods. Ensure that the battery is charged to at least 80% at least every three months or, if the battery level is very low, within a week.

The battery must not be dismantled, opened, disassembled or tampered with. **Navel** must not be operated if the battery is damaged. If the lithium-ion battery is damaged or leaking, please contact navel robotics support.

The parcel shipping of devices with rechargeable batteries is regulated depending on the provider.

## Electricity

Only use the charger supplied to charge the batteries. The charger can become very hot during charging. You can plug the charger into a standard 230 V socket. Observe the usual rules for safe handling of power sources.

Unplug the charger from the socket and from Navel immediately if:

- the charger or the cable shows signs of damage.
- You suspect that the charger needs to be serviced or repaired.
- you want to clean the charger.

## Laser

**Navel** has lidar sensors for orientation (one at the front, one at the rear) and an IR projector on the 3D camera.

CAUTION! Even if these are permitted for use with people (laser class 1), do not look directly into the lasers.

## Electromagnetic radiation

**Navel** generates electromagnetic radiation.

The use of certain radio technologies or radio frequencies may be prohibited in certain countries, buildings and means of transportation such as aircraft. Make sure that the technologies used in Navel are permitted at your place of use before you switch it on.

Note: Especially in hospitals, outpatient health centers, doctors' surgeries and other medical facilities, follow the instructions and directions of authorized persons to switch off radio devices in order to avoid interference with sensitive medical equipment.

CAUTION! Ask your doctor or the manufacturer of your medical device (pacemaker, hearing aid, implant with electronic control, etc.) whether it will function properly when using Navel.

CAUTION! If necessary, maintain the minimum distance of 15 cm recommended by medical device manufacturers to avoid interference with your medical device.

Use in countries outside the EU:
Please inform yourself about local regulations on electromagnetic radiation.

## Dialog content

**Navel** generates the dialog with the help of artificial intelligence, among other things. The dialog content is partly invented by the artificial intelligence and does not necessarily correspond to reality.

Navel cannot provide a reliable assessment of confidentiality. Do not share confidential or secret information with Navel. Accidental overhearing and storage of private information from the surrounding environment—such as from people present in the room—cannot be completely ruled out from a technical perspective, but is highly unlikely according to the dialog logic.

WARNING! Do not trust the dialog content of **Navel** but form your own opinion before you take any further action.

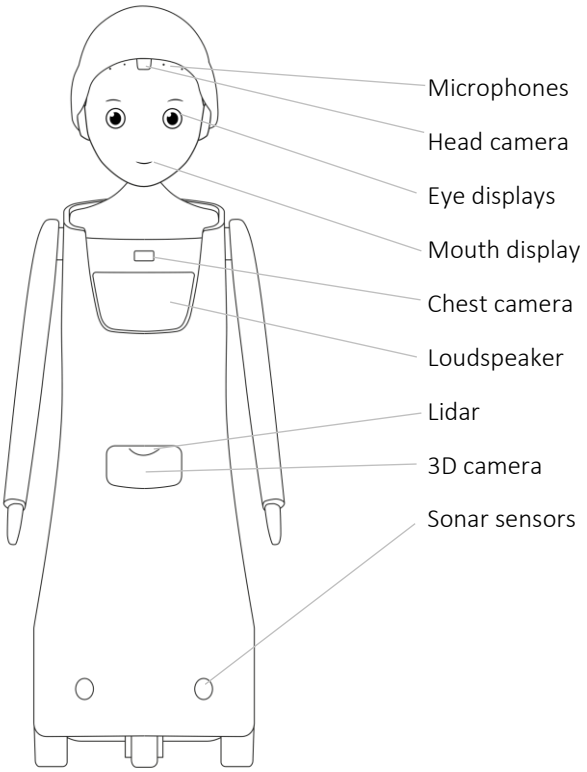
# Product description

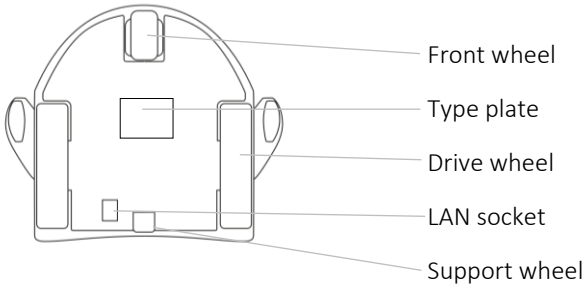
**Navel** is a social robot that has been developed for pleasant human-robot interaction in various application areas.

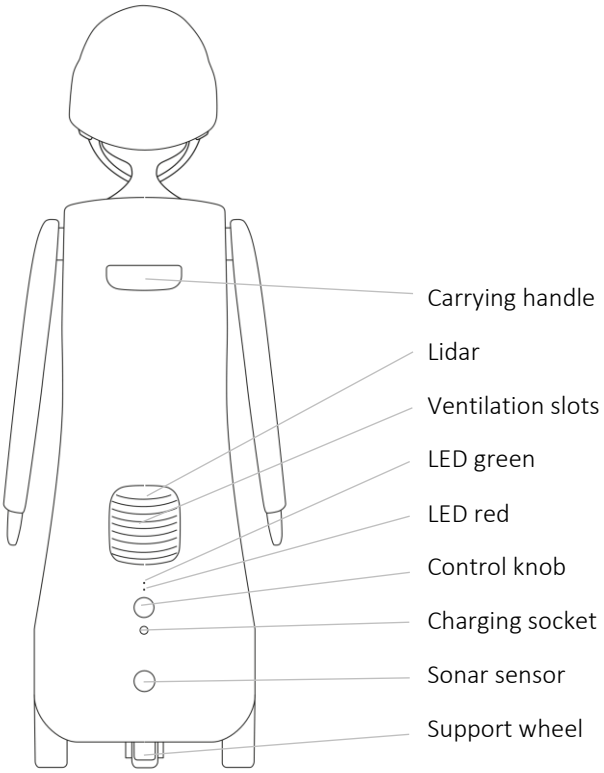
Researchers can use **Navel** to explore human-robot interaction. The behavior of operators can be individually controlled and configured via a browser interface or freely programmed using scripts.

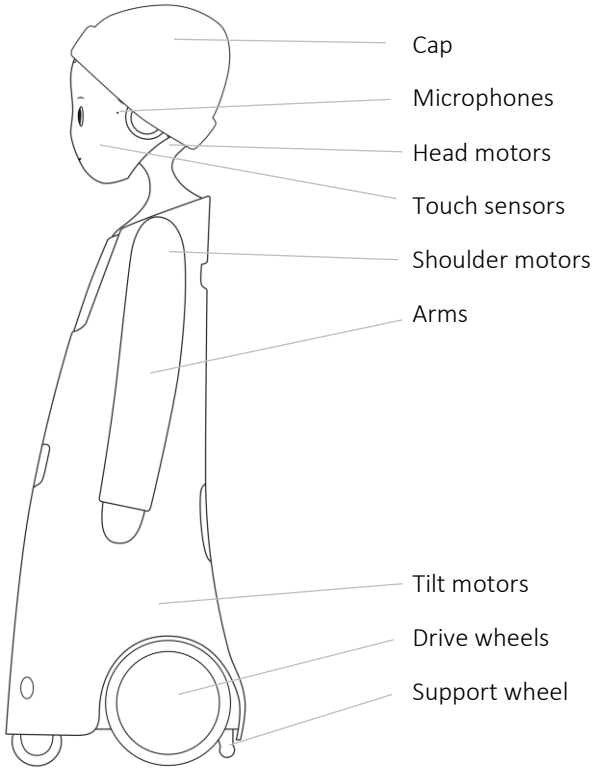
In social institutions, Navel can use the specific care application to emotionally and cognitively activate people in need of care. The data is processed in compliance with the GDPR.

**Navel** has sensors (cameras, microphones, sonar, lasers) to perceive its surroundings and motors and output modules (displays, loudspeakers) to interact with its environment. The focus is on verbal and non-verbal communication with people.




Carrying handle
Lidar
Ventilation slots
LED green
LED red
Control knob
Charging socket
Sonar sensor
Support wheel


Cap
Microphones
Head motors
Touch sensors
Shoulder motors
Arms
Tilt motors
Drive wheels
Support wheel

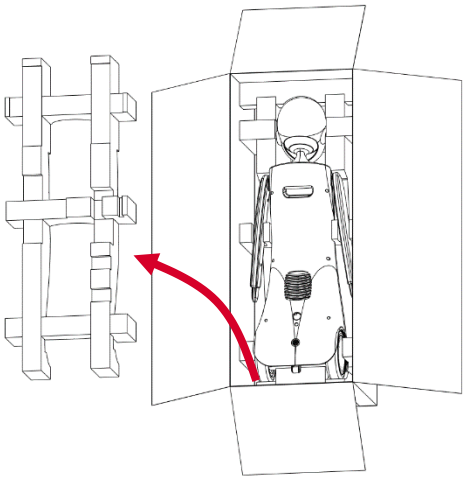
# Unpacking

The box contains the following items:

- Navel - the social robot
- Charger
- LAN cable with angled plug
- Cap
- Operating instructions (Manual)

The items are packed in a foam insert for safe transportation. Proceed as follows when unpacking:

1. Remove all accessories
2. Carefully remove the upper foam insert



3. Remove Navel from the packaging. It is best to hold Navel with one hand around the neck and with the other hand on the support wheel. Place Navel with the wheels on a level, firm, stable, dry and clean floor.

Keep the packaging box with the foam parts so that Navel can be safely shipped or stored again if necessary. Proceed in reverse order when packing. Make sure that Navel is placed face down and without the cap on its head in the box with the foam insert. When shipping Navel, observe the national/international regulations for the shipment of dangerous goods, particularly with regard to the lithium-ion batteries it contains.

# First commissioning

Proceed as follows for initial commissioning:

| | |
|---|---|
| 1. Put on your cap | Put the cap on so that it covers about half of your ears. When putting on the cap, make sure that neither the head camera nor the microphones are covered by the cap and that it does not block your neck. |
| 2. Connect LAN cable | Plug the angled LAN plug of the LAN cable into the LAN socket at the back right on the underside of **Navel**. Plug the other end into your computer. |
| 3. Connect charging cable | **Navel** is supplied with a transport lock that prevents it from being switched on. To deactivate this, plug the charger into the socket and the charging plug into the charging socket on the back of **Navel**.<br>The batteries may have a low charge level on delivery and must be charged. |
| 4. Switch on **Navel** | Press the control button to switch on. The switch-on process can take a few minutes. During this time, the arms, head and torso can move. The switch-on process is complete as soon as<br>• the eyes blink and the head moves (Navel Care).<br>• blink your eyes (Navel Research). |
| 5. Connect to **Navel** via LAN | To connect to **Navel** via the LAN cable, enter the IP address of the robot in the address field of the browser on your computer. The default address is 169.254.254.1 if your network infrastructure does not assign a different IP address.<br>NOTE: Your computer does not need an Internet connection for this because you are connecting directly to the robot.<br><br>The Navel Control Studio appears in the browser.<br>NOTE: The password for logging in via LAN cable can be found on the last page of these operating instructions. |
| 6. Initial setup of WLAN | Go to the "System" tab. Establish a WLAN connection with **Navel** under "Network". This is required for proper operation.<br>Make a note of the displayed IP address of **Navel** in the WLAN, e.g. on the last page of these operating instructions.<br><br>Now remove the LAN cable, which is no longer required. You can now always connect to the Navel Control Studio and **Navel** via WLAN using the address noted. |
| 7. Individual configuration | Additional settings for **Navel** can be made in the Navel Control Studio as required. |

# Network connection

## LAN

**Navel** has a socket for a LAN connection on the underside. With an angled plug, as with the LAN cable supplied, this can also be used when **Navel** is standing still. The Navel Control Studio can always be accessed via the LAN connection by entering the IP address of the robot in the address bar of the connected browser. The LAN connection is primarily required to configure **Navel** for a WLAN, which is used for further use.

The port is configured so that it can be connected directly to a computer and **Navel** can be reached via the link-local address 169.254.254.1 by default.
It is possible that your network infrastructure assigns **Navel** a different IP address. You can note the individual LAN address on the last page of these operating instructions.

Note: When the LAN cable is plugged in, the user must ensure that **Navel** does not receive any movement commands so that the cable or the robot is not damaged.

## WLAN

**Navel** automatically connects to the set WLAN during normal operation. Your computer must be connected to **Navel** via LAN for the setup. In the Navel Control Studio, enter the access data - the SSID (WLAN name) and password - of the desired WLAN.

An individual IP address is assigned to **Navel** by the WLAN and displayed in the Navel Control Studio. Make a note of this WLAN address on the last page of these operating instructions. From now on, you can connect to **Navel** and the Navel Control Studio via this individual WLAN address. It is advisable to set a bookmark.

In certain countries, buildings and means of transportation such as aircraft, the use of certain radio technologies or radio frequencies may be prohibited. Make sure that the technologies used in **Navel** (see Technical data) are permitted before you switch it on.

### Technical requirements for the WLAN

WLANs with the WPA2-PSK standard are supported.

In its current configuration, **Navel Care** relies on Internet access via WLAN. Cloud services are contacted via https.

**Navel** has a browser interface that can also be accessed via WLAN. Settings can be made via this interface. For ease of use, it is necessary that

- **Navel** always receives the same IP address from the DHCP server,
- an end device with a browser is available that is located in the same WLAN,
- the WLAN is configured in such a way that the browser interface can be accessed from the end device via the IP address (no client isolation).

The following connections are established by **Navel**:

- Debian manages DNS, NTP etc.
- The browser interface can be accessed via WLAN using HTTP on port 80
- Updates access various APT servers via HTTP(S), as well as pypi and npm
- In service mode, an SSH connection is established to a server (service-bridge.n3l.de) on port 80 (for reverse tunneling)
- Local SSH access to port 22 is possible at any time for the service
- **Navel Care**: Voice interaction is handled via HTTPS by Azure servers (ASR, GPT)

## Temporary WLAN via smartphone hotspot

For temporary use at other locations (e.g. for presentations), it can be helpful to provide **Navel** with Internet access via a smartphone, as local WLANs are not always suitable.

To set this up, proceed as follows:

ATTENTION: Before you change the WLAN setting, make sure that you have the access data for the previously registered WLAN so that you can set up this connection again later.

1. Activate the Wi-Fi hotspot on your smartphone (refer to the operating instructions for your smartphone if necessary)
2. Switch on **Navel**
3. Connect **Navel** to your computer via LAN cable
4. Open the Control Studio on your computer (start the browser and enter http://169.254.254.1 in the address window)
5. Enter the password (see last page of these operating instructions)
6. In Control Studio, switch to the "System" tab
7. Under "network", enter the SSID (Wi-Fi name) and password of your smartphone hotspot (you will find this information on your smartphone). Click on "Save".
8. As soon as a new IP address is displayed under "Wireless", a connection has been established.
9. Test whether **Navel** works as desired.

# Operation

## Control knob

The control knob, which has the following functions, is located at the bottom rear of **Navel**:

| | |
|---|---|
| Switching on: | If **Navel** is switched off, **Navel** is switched on by briefly pressing the control button. The green LED starts to flash. This process can take up to 3 minutes. When **Navel** is ready for operation, the green LED lights up continuously. The eyes blink. |
| Switch off: | When **Navel** is in operation or service mode, a short press on the control button initiates a switch-off. Motors are switched off immediately. The green LED flashes until **Navel** is completely switched off. |
| Service mode: | It may be necessary to start service mode if instructed to do so by support. To do this, press the operating button for at least 5 seconds when the device is switched off until the green LED starts to flash. |
| Transport lock: | The transport lock prevents the appliance from being switched on accidentally (e.g. during shipping). It is activated by pressing the operating button for at least 5 seconds when the device is switched on. **Navel** then shuts down and cannot be switched on again until the charger has been connected. |

## LED displays

There are two LEDs above the control knob. These are only visible behind the housing when lit and indicate the following statuses:

**upper/green LED**

| | |
|---|---|
| from | **Navel** is from |
| flashes | Transition phase during switching on or off |
| flashes permanently | Service mode (via WLAN remote access), motors off |
| lights up permanently | **Navel** is on |

**Lower/red LED**

| | |
|---|---|
| from | Normal state (no charging current and batteries not low) |
| lights up permanently | Battery is charging |
| flashes | Battery voltage is low; please charge the batteries |
| flashes after switching on and **Navel** does not start up | |
| 1 time | Battery is empty or transport lock is active. Please carry the robot to the charging station and charge it. |
| 3 times | Battery is overheated and needs to cool down for 30 minutes. **Navel** was switched off automatically. |
| 5 times | please contact navel robotics service |

## Charging the battery

The charging socket is located on the back of **Navel** and under the control button. The red LED on **Navel** lights up while the battery is charging.

There is also an LED on the charger. It lights up red while charging and green when charging is complete. A full charging cycle takes approx. 6 hours.

In the Navel Control Studio, there is a display in the top right-hand corner that shows the battery charge status.

The operating time with fully charged batteries is approx. 6 to 8 hours - depending on **Navel**'s activities. Driving in particular reduces the operating time.

Note: **Navel** can also be operated while charging. In this case, the user must ensure that **Navel** does not receive any movement commands so that the charging cable or the robot is not damaged.

## Driving

**Navel** can drive on flat, smooth, dry and clean surfaces. It has two large drive wheels and a passive front wheel. An additional support wheel is attached to the underside at the rear to prevent tipping, which does not normally touch the ground.

**Navel** can tilt forwards and backwards or sideways using two motors. These movements can be stopped by human power.

## Cameras

**Navel** has two RGB cameras and a 3D camera:

| | |
|---|---|
| Head camera | 80° opening angle |
| Chest camera | 110° opening angle |
| 3D camera | 87° aperture angle, Intel RealSense D430 |

## Microphones

**Navel** has a microphone array with seven microphones to localize and focus sound sources in the room. From the outside, the microphones are only visible through small holes. There are two on each side of the head camera on the forehead, one in front of each ear and one on the chin. Make sure that the holes are not covered, e.g. by the cap. Do not insert any objects into these openings and keep liquids away.

## Voice output

A software license from the Acapela Group is installed on **Navel** for speech synthesis. The Acapela speech synthesis included may not be passed on. The license code is bound to the product and may not be redistributed.

Language settings are described in the online documentation.

## Volume

The volume of the voice output can be changed in two ways:

1. In Control Studio under the ‘System’ tab
2. By voice command, for example by saying to Navel, ‘Please speak louder’ or ‘Speak more quietly’.

To avoid damage to your hearing, use low or medium volume settings for the voice output and increase them if necessary.

## Arms

**Navel**'s arms can rotate. They are clipped to the body with a clip mechanism and can be released if they are pulled sideways or if something is clamped between the arm and body.

You can clip the arm back on. Make sure that the arms are oriented correctly. This is best done after switching on **Navel**, when the arms are pointing straight down.

## Cap

Make sure that the cap does not cover the head camera or microphones or block the neck.

The cap has no function that is necessary for operation. However, it makes **Navel** appear more appealing, which supports interaction with the user. In principle, Navel can also be operated without a cap.

## Carry

**Navel** has a bulge on the upper back for carrying as a handle. **Navel** must not be lifted by the head, arms or other recesses.

At approx. 8 kg, **Navel** can be carried with one hand. It has proven helpful to place the thumb of the carrying hand on the collar to create a firm grip. When switched off, you can use your second hand to provide support on the ground in the area of the support wheel. Take care not to get trapped.

## Store

If **Navel** is not used for a while, store it in its original packaging in a dry and clean place between 10 and 30°C.

Please note that the batteries discharge themselves over longer periods of time. Ensure that the batteries are not deeply discharged. Keep the charge level between 30% and 80% during longer periods of storage.

## Configuration

General settings can be made via the Navel Control Studio. The **Navel** Control Studio can only be accessed when **Navel** is switched on and booted up. In Navel Control Studio, security-related settings can be configured. Access is strictly limited to authorized users.

## Service mode

**Navel** has a service mode in which navel robotics support can access **Navel** externally. This requires a connection to the Internet. No other interaction functions are running on **Navel** in this mode. This service mode can only be activated locally using the operating button. Read the section on the control button to find out how to start and stop service mode.

# Interaction with Navel Care

This chapter describes the interactions with the care application that is delivered with **Navel Care** but is not included in **Navel Research**.

As soon as **Navel** is fully switched on and ready for operation, **Navel** displays an autonomous standard behavior consisting of lively facial expressions and head movements. **Navel** now recognizes faces, makes eye contact and responds to speech.

## Voice dialog with Navel

To be able to respond, **Navel** must first understand the request and then generate a response. **Navel** uses an Internet service for both steps, which can cause delays.

**Navel** begins to generate a response as soon as there is a pause in speech. The default setting is 2 seconds. The pause in speech can be adjusted manually in Control Studio from 0.5 to 6 seconds.

### Starting a dialog

User: "Hello <name>".

<Name> stands for the name assigned to **Navel** in the Navel Control Studio. By default, "Navel" is set as <Name>.

**Navel** usually responds with: "Hello, what's your name?". If the user says their name, the dialog is saved for this name. If there has already been a dialog with this user, Navel first summarizes the last conversation in one or two sentences and the dialog begins.

For example, if the person introduces themselves with "I am Mr. Smith", **Navel** usually uses the last name. Otherwise, **Navel** uses the first name.

If you work in groups, you can log in with "we are a group" so that the memory content is assigned to this group. **Navel** may also address the group as "you".

### Ending a dialog

User: "Goodbye"

Navel says "Bye" or says goodbye.

## Settings for conversation content

The Navel Control Studio can be used to make various settings that affect the content of the conversation. The name of the robot can be changed. Content can also be stored for a "topic of the week".

## Memory of Navel

For data protection reasons, **Navel** only remembers call content on a personal basis for each user. This means that Navel can only access previous conversations with the current user and not those of other users.

If you do not want **Navel** to remember any of your users' conversation content and also temporarily not take any of the previous reminder content into account (e.g. in presentation situations), you can activate the "Private mode" checkbox under the "Overview" tab in the Navel Control Studio.

## User data management

User data can be managed and data subject rights can be exercised in the Navel Control Studio.

In the "Overview" tab, all users recorded by Navel are listed by name in the "data" area. Using the two icons to the right, you can delete the reminder content for each user or delete the user completely.

Below the list there are three buttons to delete all reminder content at once, delete all users at once or reset Navel completely.

## Possible interactions and dialogs

- Greeting
- Changing the volume of Navel
- Get to know
- Small talk, e.g. about the topic of the day, which can be stored in Navel Control Studio
- Jokes
- Quiz
- Poems including explanation etc.
- Hobbies: cars, sports, literature, music, traveling
- Recipes
- Stories:
  "tell me a short story involving a princess, a frog and a watering can
- If you don't want the current topic or don't want to answer the question, simply suggest your own topic

## Navel outside of dialogue

When **Navel** is switched on, he listens to his surroundings. If he detects a sound or a voice, he turns his head and tries to find a face with his head camera. Once **Navel** has found a face, he maintains eye contact and waits for you to start a conversation with him (“Hello <name>”).

## Identification

**Navel** always tries to identify the person he is talking to. This allows him to access his memory and previous conversations. When you say your name or **Navel** recognises your face, he can assign you to a stored identity or create a new one.

## Face identification for user recognition

Facial recognition simplifies the dialog. Instead of **Navel** asking for the name after the greeting, **Navel** uses facial recognition. If **Navel** recognizes the person through facial recognition, **Navel** does not ask for the name but returns the greeting directly with the correct username. The conversation is saved to this name.
**Navel** first must learn a new face and therefore asks for the name the first time.

### Limitations of facial recognition

Face recognition is not 100% reliable. This is because recognition depends, among other things, on the lighting conditions and the orientation of the head, which always vary.
If facial recognition has not recognized the person, **Navel** will continue to ask for the name. Users should not be disappointed if they are not recognized by Navel. Please inform them that this is due to the different lighting conditions. Over time, **Navel** should recognize the face better even in different lighting conditions and head orientations.
We want to further improve the recognition rate in the future through additional measures. In future, **Navel** will also be able to start the dialog independently by greeting you by name.

### Tips on how to use facial recognition

For a good recognition rate, it is helpful to make eye contact with **Navel** for a second before starting the dialog with "Hello" or "Hello <name>".
When initializing for the very first time, it also helps to look at **Navel** for several seconds before greeting him and to turn your face slowly to the left and right, as if you were giving each other a kiss - but slowly.
If there are several people in **Navel's** field of vision, **Navel** only analyzes the face that it is currently looking at. The person **Navel** is supposed to be talking to should therefore be sitting in front of his face and not to the side. If **Navel** has made eye contact with the target person, the caregiver can also start the dialog from the side with a brief "hello" and **Navel** greets the target person by name. However, if the caregiver speaks to **Navel** from the side for longer, **Navel** will turn towards the caregiver and greet them by name.
If the person changes during the dialogue, the new person is not recognized by **Navel**. This is because facial analysis is currently only active at the start of a conversation. As before, the conversation is saved to the name that was greeted. If a different person is to be recognized, the dialog must first be ended and then restarted.

## Driving Function

### Activation and warnings

**Navel**'s driving function is deactivated upon delivery. This can be changed in Control Studio by an authorised person (godparent).

ATTENTION: Currently, it is still possible that obstacles (e.g. stairs, tables, platforms) and safety-relevant objects (such as walking aids or small animals) may not always be reliably detected. **Navel's** environment detection is continuously being developed. Regular software updates continuously improve detection performance.

ATTENTION. **Navel** may only be operated under the constant supervision of trained persons. Please read the safety instructions and check the environment according to the Safety Checklist [>>here<<] before starting.

### Voice control

In order for **Navel** to approach a person, there must be eye contact and the dialogue must be started with 'Hello <name>'. Then a voice command can set **Navel** in motion.

**Navel** uses its language model to process and respond to your voice commands. Therefore, he not only listens explicitly for the command word, but also for interpretations that convey the same meaning. For example, instead of 'Come here,' you can also say 'Would you please come here?'

### Voice commands

**Navel** can drive to you on request. To do this, use the following voice commands or interpretations of the meaning:

- 'Come here.'
  **Navel** will drive to the person he is looking at when the command *'COME HERE'* is given. The decisive factor for the target orientation is therefore the person with whom Navel has eye contact at that moment – not necessarily the person who gives the command.

- 'Stop.'
  **Navel** stops when you say *'STOP'*. He will then stop moving towards the person. You can then ask him to come again or continue the dialogue.

### Special behavioral characteristics

During the dialogue, **Navel**'s attention may shift – for example, if another person speaks more actively. In this case, Navel will make eye contact with that person and would drive towards them if a subsequent command is given.

### Dealing with obstacles

If **Navel** detects an obstacle, he will stop and wait until the obstacle has been removed. If he has to wait longer than 20 seconds, he will stop moving towards the person. You can then ask him to come again or continue the dialogue.

# Operating modes of Navel Research

**Navel** can be controlled in various ways in the **Navel Research** version. These are described in the online documentation: *doc.navelrobotics.com*.

# Troubleshooting

| Malfunction | Possible causes and measures |
|---|---|
| The red LED flashes several times after switching on and **Navel** does not start. | Start-up was prevented for safety reasons.<br>⇨ Count how often the LED flashes in quick succession. Read the chapter "LED displays " to find out what each number means and what action is required. |
| **Navel** cannot be switched on. The LEDs remain off. | The battery is empty.<br>⇨ Carry **Navel** by the handle to the charger. Charge the battery. |
| **Navel** has fallen over and can no longer be switched on. | For safety reasons, the electronics were switched off when it fell over.<br>⇨ Stand **Navel** upright on his wheels. To do this, lift it by the handle on the back or, if necessary, with both hands on the torso. Switch **Navel** on using the control button. |
| **Navel** stops while driving and does not continue. | The sensors may have detected an obstacle or abyss. **Navel** tries to avoid these and stops if this is not possible.<br>⇨ Remove obstacles if necessary.<br>⇨ Keep enough distance from **Navel** so that he can continue driving.<br>⇨ If necessary, carry **Navel** by the carrying handle to a different location without any gaps or obstacles. |
| **Navel** has "got stuck" in a corner. | With the help of sensors, **Navel** avoids getting too close to other objects. It may not be able to get out of tight corners on its own.<br>⇨ Lift **Navel** by the carrying handle to a free position. |
| **Navel** doesn't understand what a person is saying. | There may be no Internet connection.<br>⇨ Use the Navel Control Studio to check whether **Navel** has an Internet connection. If not, please contact your local IT service.<br>The ambient noise may be too high.<br>⇨ Ensure a quieter environment and test again whether **Navel** now recognizes speech.<br>The pronunciation may be too unclear or the dialect used may be too strong for **Navel** to decipher.<br>⇨ Try to speak as clearly as possible at a normal volume and without dialect.<br>The microphones may be covered by the cap.<br>⇨ Move the cap up to the edge of the face so that the microphones are no longer covered.<br>It is possible that **Navel** does not understand what was meant.<br>⇨ Use simple, clear wording such as clear "yes" or "no" statements. |
| **Navel** does not recognize people. | The person may be standing against the light so that the camera is dazzled by the light and does not recognize the dark face.<br>⇨ Move to another location and speak to **Navel** again.<br>The camera may be covered by the cap.<br>⇨ Move the cap up to the edge of the face so that the camera is no longer covered. |

| | |
|---|---|
| An arm has fallen off or come loose. | For safety reasons, the arms are attached with a clip.<br>⇨ Clip the arm back onto the shoulder joint. Pay attention to the correct orientation of the arms. This is best done after switching on **Navel**, when the arms should be pointing straight down. |
| **Navel** shows very unusual or incorrect behavior | The behavior may have been triggered by a fault in the software or electronics.<br>⇨ Switch off **Navel** using the control button. Wait three minutes. Then switch it on again.<br>⇨ If the malfunction persists, contact navel robotics support |
| The Navel Control Studio is not accessible via the browser | **Navel** may not be switched on or fully booted. You can only access the Navel Control Studio when it is booted up.<br>If the connection via cable fails, temporarily disconnect your PC from other networks, e.g. WLAN, and try again.<br>The IP address at which **Navel** can be accessed is often determined by your IT infrastructure and may also be reassigned. If necessary, ask the responsible office for the current IP address. |

# Maintenance

Navel components require no regular maintenance. They are subject to natural ageing. For example, the charging capacity of the rechargeable batteries decreases, so that the running time is reduced. This does not represent a safety risk. If required, navel robotics support offers the replacement of individual components such as batteries or displays.

## Updates

Updates are provided for the Navel software. These can be installed manually. You will find an update button in the Navel Control Studio under the "System" tab. The current software version is displayed above the button.
Please note: The Navel Control Studio can only be accessed when Navel is switched on and booted up. Security-related settings can be configured there. Access is strictly limited to authorized users.

How to carry out an update:

1. Switch on Navel and start it up
2. Start the Navel Control Studio via the browser (connection via WLAN or LAN)
3. Select the "System" tab
4. Click on the update button (a circle symbol rotates on the button during the update)
5. Then wait another 3 minutes until Navel has processed everything
6. Navel is ready for use again and the new software version is displayed above the button

## Cleaning

Navel is not waterproof. It may only be cleaned with slightly damp cloths. Do not use any chemical or abrasive liquids or aerosols to prevent damage to the plastic parts.

Do not spray any liquid or chemical cleaning agents on Navel and avoid introducing moisture into openings. Before cleaning Navel:

- Make sure that Navel is switched off and the charging cable is disconnected. Note that the batteries inside are still live.
- Place Navel on a stable and hard surface and use a soft, slightly damp cloth.

Remove any dust from the housing openings. Do not reach into the housing with your fingers or tools. Clean camera lenses carefully without applying much pressure.

Use water or alcohol-free, mild cleaning agents. Soiling can be removed with a mild soap and a soft cloth. If disinfection is necessary, use oxidative disinfectants such as Ultrasol Oxy from Dr. Schumacher. These do not attack the plastics, but can lead to discoloration and should therefore be wiped off again after a short exposure time.

Before switching Navel on after cleaning, make sure that Navel is completely dry.

The hat is made of wool. The hat can be washed by hand at a maximum of 40° Celsius.

Check the Navel wheels once a quarter when they are switched off and clean them if necessary. The wheels can be turned by hand when switched off.

# Waste disposal

You must not dispose of **Navel** with household waste. **Navel** contains toxic lithium-ion batteries. To protect human health and the environment, we recommend that you dispose of your old device at an authorized collection point. Please observe the legal requirements.

You can also return **Navel** to navel robotics GmbH for disposal. It is best to use the original packaging for this. When shipping **Navel**, please observe the national regulations for the shipment of dangerous goods, particularly with regard to the lithium-ion batteries contained in the package. Damaged lithium-ion batteries must not be shipped.

# EU Declaration of Conformity Navel Care

The manufacturer

navel robotics GmbH
Agnes-Pockels-Bogen 1
80992 Munich

hereby declares under its sole responsibility that the product:
Designation: Navel Care
Identification number: N5
Year of construction: 2025
complies with all relevant provisions of applicable law (hereinafter), including any amendments thereto in force at the date of the declaration.

The following legal provisions were applied:
Directive 2006/42/EC (Machinery Directive)
Directive 2014/30/EU (EMC Directive)
Directive 2014/53/EU (Radio Equipment Directive)
Directive 2011/65/EU (RoHS Directive)

The protection targets of the following other legal regulations were met:
Directive 2014/35/EU (Low Voltage Directive)

The following harmonized standards were applied:

| Standard | Title |
|---|---|
| EN ISO 12100:2010 | Safety of machinery - General principles for design - Risk assessment and risk reduction |
| EN ISO 13482:2014 | Robots and robotic devices - Safety requirements for personal assistance robots |
| EN ISO 13849-1:2015 | Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design |
| EN ISO 13849-2:2012 | Safety of machinery - Safety-related parts of control systems - Part 2: Validation |
| EN 61000-6-1:2019 | Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments |
| EN 61000-6-3:2019 | Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission from equipment in residential environments |
| EN 62311:2020 | Assessment of electrical and electronic equipment with regard to limitations of exposure of persons to electromagnetic fields (0 Hz to 300 GHz) |
| EN IEC 63000:2018 | Technical documentation for the assessment of electrical and electronic equipment with regard to the restriction of hazardous substances |

The following additional technical standards were applied:

| Standard | Title |
|---|---|
| EN 62368-1:2020 + A11:2020 | Audio/video, information and communication technology equipment - Part 1: Safety requirements |

# EU Declaration of Conformity Navel Research

The manufacturer

navel robotics GmbH
Agnes-Pockels-Bogen 1
80992 Munich

CE

hereby declares under its sole responsibility that the product:

Designation: Navel Research
Identification number: N5
Year of construction: 2025

complies with all relevant provisions of applicable law (hereinafter), including any amendments thereto in force at the date of the declaration.

The following legal provisions were applied:
Directive 2006/42/EC (Machinery Directive)
Directive 2014/30/EU (EMC Directive)
Directive 2014/53/EU (Radio Equipment Directive)
Directive 2011/65/EU (RoHS Directive)

The protection targets of the following other legal regulations were met:
Directive 2014/35/EU (Low Voltage Directive)

The following harmonized standards were applied:

| Standard | Title |
|---|---|
| EN ISO 12100:2010 | Safety of machinery - General principles for design - Risk assessment and risk reduction |
| EN ISO 13482:2014 | Robots and robotic devices - Safety requirements for personal assistance robots |
| EN 61000-6-1:2019 | Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments |
| EN 61000-6-3:2019 | Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission from equipment in residential environments |
| EN 62311:2020 | Assessment of electrical and electronic equipment with regard to limitations of exposure of persons to electromagnetic fields (0 Hz to 300 GHz) |
| EN IEC 63000:2018 | Technical documentation for the assessment of electrical and electronic equipment with regard to the restriction of hazardous substances |

The following additional technical standards were applied:

| Standard | Title |
|---|---|
| EN 62368-1:2020 + A11:2020 | Audio/video, information and communication technology equipment - Part 1: Safety requirements |

# Software Components

| | |
|---|---|
| Operating system | Linux |
| Computer vision (10fps) | Face recognition<br>Face identification<br>Facial expression recognition<br>Gaze direction recognition<br>Head orientation recognition |
| Sound processing | Sound localization |
| Speech processing | STT: via cloud service (e.g., Microsoft)<br>TTS: Acapela (30 languages)<br>Dialog manager: LLM-based (e.g., GPT) |
| Navigation | Socially aware proxemics |
| GUI | Navel Control Studio |

# Hardware Components

| | |
|---|---|
| SoC | NVIDIA® Jetson AGX Xavier™<br>15 GB for user data |
| Cameras | Head: 80° 720P 60 fps global shutter<br>Body: 160° 720P 60 fps global shutter |
| Microphones | 3D array consisting of 7 microphones |
| 3D sensors | Intel® RealSense™ Depth Module D430<br>2x Lidar sensors<br>3x Sonar sensors |
| Displays | 3x Circular displays<br>3x 3D lenses |
| Motors | Head: 3x Quiet gimbal motors<br>Drive: 2x 65 W motors<br>Shoulder: 2x Servo motors<br>Tilt: 2x Linear motors |
| Speakers | 2x 4 W broadband speakers |

# Technical data

| | |
|---|---|
| Weight | Approx. 8.6 kg |
| Dimensions | H 72 cm x W 30 cm x D 25 cm |
| Cap size | Head circumference 44 cm, cap height 13 cm |
| Power supply | 230 V, 50 Hz |
| Power consumption | Charger outputs up to 3 A at 16.8 V |
| Battery capacity | 295.2 Wh in four batteries of 73.8 Wh each |
| Battery life | 6 to 8 hours |
| Battery charging time | 8 to 10 hours |
| Working temperature range | 0°C to 30°C |
| Working humidity range | < 80% |
| Noise emission | ≤ 85dB |
| Floor | Firm, even, flat, dry, clean |
| Max. sill | 10mm |
| Max. Speed | 0.5 m/s |
| Lidar sensors: | Laser class 1 (IEC 60825)<br>Light source: VCSEL<br>Wavelength: 905 nm ± 10 nm<br>FOP: 2° (theoretical) |
| IR projector: | Laser class 1 (IEC 60825-1:2007 Edition 2, IEC 60825-1:2014 Edition 3)<br>Light source: VCSEL<br>Wavelength: 850nm ± 10 nm nominal @ 20°C<br>Optical power: max. 440mW<br>FOP: 64°±3° (horizontal), 41°±3° (vertical) |
| LAN socket: | RJ45 socket (standard Ethernet, 10/100/1000 Base-T) |
| WLAN module: | Intel AC-8265 / Intel AX200NGW<br>IEEE 802.11a/b/g/n/ac / IEEE 802.11a/n/ac/ax<br>Compliant with 2014/53/EU<br>Approved for indoor use in the EU.<br>2400 - 2483 MHz: 100mW<br>5150 - 5725 MHz: 200mW<br>5725 - 5875 MHz: 25mW |

CE

| | | | | | | |
|---|---|---|---|---|---|---|
| AT | BE | BG | CH | CY | CZ | DE |
| DK | EE | EL | ES | FI | FR | HR |
| HU | IE | IS | IT | LI | LT | LU |
| LV | MT | NL | PL | PT | RO | SE |
| SI | SK | TR | UK | | | |

# Contact information of the manufacturer

If you have any questions, please contact

navel robotics GmbH
F4.10 / Support
Agnes-Pockels-Bogen 1
80992 Munich
Germany

+49 89 87769826
support@navelrobotics.com
www.navelrobotics.com

# Notes

Default IP address (cable): 169.254.254.1

IP address (cable): _____

IP address (WLAN): _____

_____

_____

_____

_____

_____

_____

_____

_____