

Lely Discovery 90 SW

Mobile Barn Cleaner



Operator Manual

en-US - English Original

5.4006.8530.0 B





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List of Included Amendments

Issue Date (yyyy/mm)	Revision	Chapter(s)	Remarks
2021/03	B	All	<p>Added: Intended use information (see Intended Use on page 1-1).</p> <p>Added: General safety information (see General Safety on page 2-2).</p> <p>Changed: Layout and figures</p> <p>Added/changed: Signal icons and safety messages according to the ANSI standard</p> <p>Hardware changes: Connection of scraper assembly (see Replace the Manure Scraper on page 6-15) PCB box (see Switch On the Machine on page 5-3)</p> <p>Removed procedure: Tighten the drive chains</p> <p>Added: EG declaration; Disposal instructions</p>
2015/03	A	All	<p>iOS functionality added</p> <p>Hardware changes are incorporated</p>
2014/06	-	All	<p>Bluetooth operation added</p> <p>Pause button added</p> <p>Operator manual separated</p>
2012/11		All	<p>Full revision of the manual</p> <p>Hardware changes are incorporated</p>
2011/02			Initial issue

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Preface

Manual Contents

This manual contains the information necessary to operate the Lely Discovery 90 SW Mobile Barn Cleaner. The information in this manual is for operators.



Study and understand this information thoroughly before you operate the machine. Failure to do so could result in damage to equipment or personal injury. Please consult your local Lely service provider if you do not understand the information in this manual, or if you need additional information. Store this manual in a safe place for future reference.

All information in this manual has been compiled with care. Lely shall not be liable for errors or faults in this manual. The recommendations are meant to serve as guidelines. All instructions, pictures and specifications in this manual are based on the latest information that was available at the time of publication. Your machine may comprise improvements, features or options that are not covered in this manual.

Applicability

The table below shows the type numbers of the machine for which this manual is applicable.

Model designation

Model	Type number
Lely Discovery 90 SW Mobile Barn Cleaner	5.4006.0020.1

Software version

The description, operation and procedures in this manual are based on the software version:

- ADS3840 PCB: DISSv04.08.XX or higher.
- ADS3641 PCB: 1.2.41 or higher.
- Lely Control app Android: 1.2.23 or higher.
- Lely Control app iOS: 1.0.0 or higher.

Standard Torque Loading of Parts

All the nuts, bolts and screws used on the machine are torque tightened to standard torque loadings applicable to the construction materials used.

If a part has a non-standard torque loading, it is specified in the applicable part of the manual.

Registration

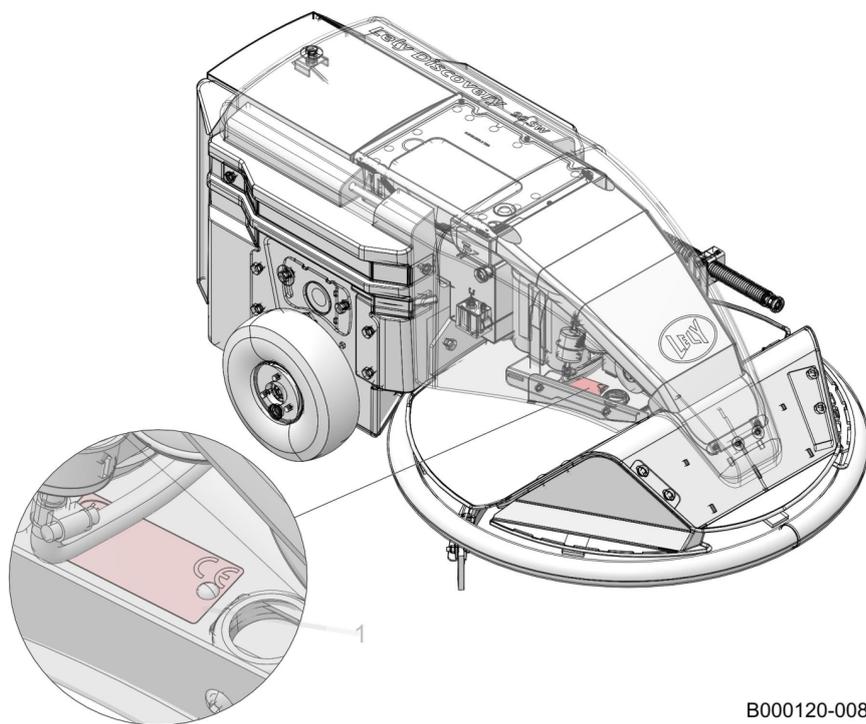
The type and serial number plate is attached to the upper side of the frame of the machine, under the red cover. Always include the type and serial number of your machine when you contact your local Lely service provider or order spare parts.

	LELY INDUSTRIES NV 3147 PB MAASSLUIS THE NETHERLANDS		
	<input type="checkbox"/> Type		
	Ser.Nr.		kg
	V	Hz	VA

Figure 1. Type and serial number plate

We suggest that you complete the table below with the type and serial numbers of your machine. This makes sure that you can easily find the information.

Type number	
Serial number	



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Figure 2. Location of type and serial number plate

Personnel Requirements



Risk of accident from insufficiently qualified personnel. Unqualified personnel working on or in the danger zone of the machine can be the cause of serious injuries and considerable damage to material.

- ***All activities must only be carried out by qualified personnel.***
 - ***Keep unqualified personnel away from the danger zones.***
 - ***Only persons who can be expected to carry out their job reliably are authorized as personnel. Persons whose reactions are impaired, e.g. by drugs, alcohol medications are not authorized to work with the machine***
-

Maintenance Authorization



Risk of accident from uncertified technicians. Uncertified technicians doing maintenance on the machine can be the cause of serious injuries and considerable damage to material. Only technicians certified by Lely Industries are authorized to do maintenance on the machine, except for the maintenance done by the operator as indicated in the operator manual. If people who are not certified by Lely Industries do maintenance on the machine, the warranty on the machine becomes invalid.

Technician Training

All the technicians certified by Lely Industries have completed an approved training program, and passed written and practical examinations during and at the end of the training program. The training is given by Lely International or a specialist from the LSO and includes troubleshooting and corrective maintenance of the machine

During training, a trainee is permitted to work for up to a maximum of six months under close supervision of a certified technician. A trainee can do work on the machine only in the presence of a certified technician.

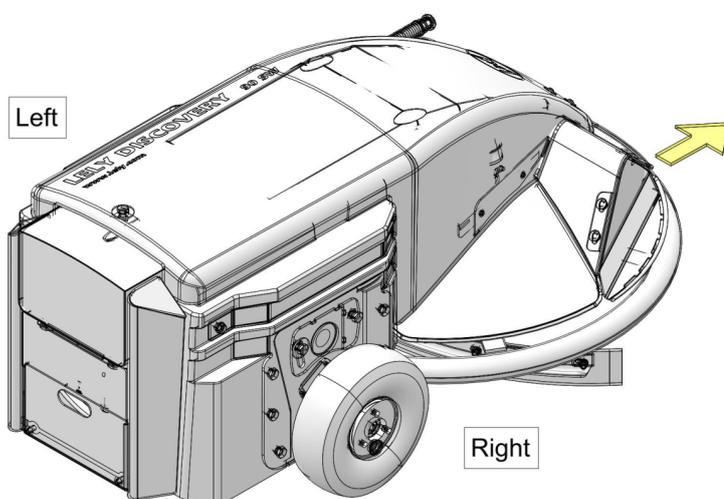
Contact Number Local Service Provider

We suggest you write the telephone number and email address of your local service provider contact in the table below. This makes sure you can easily find the information.

Telephone number	
email address	

Left, Right, Rear and Front

The positions left, right, rear and front in this manual refer to the machine, as seen in the driving direction.



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1 Lely Discovery

1.1 The Lely Discovery 90 SW Mobile Barn Cleaner

The Lely Discovery 90 SW Mobile Barn Cleaner is a battery-driven vehicle that cleans the floor of a barn. A nozzle sprays water on the floor before a manure scraper on the bottom of the machine which pushes the manure through the openings of the slatted floor.

The farmer (operator) uses the Lely Control app on the smartphone to program the route for the Discovery. Routes can be programmed flexibly. The farmer has the option to do more intensive cleaning of some areas of the barn during certain hours of the day.

The information in this manual is for operators. The operator uses the information to program and operate the Discovery. The operator also uses the information to do maintenance.

The operator must read the operating instructions for daily operation and for the setup of routes and time paths. He must read the test and adjustment section for the setup and for testing the machine and routes. He must also read the maintenance and troubleshooting sections for preventive and basic corrective maintenance instructions.

The operator should refer to the description and the operation section for background information. The operator must also read and understand the safety instructions in section 'Safety'.

1.2 Intended Use

The Lely Discovery 90 SW Mobile Barn Cleaner is designed as an autonomous driving machine to clean the slatted floor of a barn (= proper use). A manure scraper on the bottom of the machine pushes the manure through the openings of the slatted floor. Usage going beyond that does not constitute proper use. The manufacturer is not liable for damage resulting from improper use; the operator only bears the risk.

The Discovery manure robot is intended to operate efficient and safe between cows within an enclosed space on the stable floor. The implemented safety measures are designed for this application only. Leaving this designated, enclosed space (e.g. crossing the feed alley to get from one designated space to another) is not an intended use and therefore not allowed.

Application of the Discovery manure robot in any way other than the intended use is dangerous and can cause serious injuries or death.

Usage going beyond the above does not constitute proper use. The manufacturer is not liable for damage resulting from improper use; the operator only bears the risk.

Intended uses also implies that the instructions and rules prescribed by the manufacturer are observed.



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2 Safety

2.1 Introduction

The Discovery 90 SW is an automated machine. Therefore it is of the utmost importance to obey all safety instructions.

2.2 Signal Icons

Note the use of the signal words DANGER, WARNING and CAUTION with the safety messages. The signal word for each message uses the following guidelines:



Danger
Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Warning
Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Caution
Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



Notice
Is used to address practices not related to physical injury e.g. property damage.



Tip
Indicates information that may help the reader, but not hazard related.

2.3 Safety Instructions

YOU are responsible for the SAFE operation and maintenance of your machine. YOU must make sure that you and anyone else who is going to operate, maintain or work in the vicinity of the machine knows all the related SAFETY information in this manual.

YOU are the key to safety. Good safety practices protect you and the people around you. Make these practices a working part of your safety program. Make sure that EVERYONE who operates, maintains or works near the machine obeys the safety precautions. Do not risk injury or death by ignoring good safety practices.

- Owners must train operators before they operate the machine. This training must be repeated at least annually.
- The operator must read, understand and obey all safety and operating instructions in the manual.
- A person who has not read and understood all safety and operating instructions is not permitted to operate the machine.
- Do not modify the equipment in any way. Unauthorized modification may impair the function and/or safety and could affect the life of the equipment and persons.
- Only use approved spare parts and make sure that they are only installed by authorized technicians.

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The hazards in the operating zone and working area pose a risk of fatal injury to unauthorized persons.

Unauthorized persons who do not satisfy the requirements described herein are not aware of the hazards in the work area. Unauthorized persons are therefore at risk of serious or fatal injury.

- ***Keep unauthorized persons away from the operating zone and work area.***
- ***If in doubt, approach unauthorized persons and ask them to leave the operating zone and work area.***
- ***Stop work as long as unauthorized persons are within the operating zone and work area.***

2.3.1 General Safety

- When locking up cows in the feed fence (e.g. for clawcare) on a location where the machine can drive during a route or by accident, the machine must be switched off or taken out of operation to prevent serious injury of cows! Locked up cows can not get away when the machine approaches.



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- Make sure the fencing that prevents the machine from leaving the manure alley is in place and not damaged or modified.
- No calfs are allowed in the area where the machine is active.
- Separate pregnant cows timely to prevent cows from calving in the regular barn. The Discovery can be dangerous for newborn calves (injuries and/or pushed into the manure pit).
- When the water filling station is connected to the drinking water system, a header tank must be installed between the drinking water system and the water filling station to prevent pollution of potable water by backflow of water with bacterial contamination.
- Read and understand the manual and all safety signs before you connect power supplies to operate, maintain or adjust the machine.
- Only trained persons are permitted to operate the machine.
- Make sure you know where the pause button of the machine is located for quick access.
- A first-aid kit must be available near the machine. Store in a highly visible place.
- A carbon dioxide or foam fire extinguisher must be available near the machine. Store in a highly visible place.
- Install all protective covers and guards before you operate the machine.
- When the buzzer is defect, make sure it is being repaired as soon as possible.
- When a part on the machine is broken or missing that may cause a hazardous situation, take the machine out of operation. Make sure the part is repaired before you put the machine into operation again.
- Wear the correct protective clothing and equipment.
- Disconnect and isolate the electrical power supply and wait for all moving parts to stop before you clean or do maintenance on the machine.
- Know the emergency medical center number for your area.
- Contact your nearest Lely service provider if you have any questions.
- Review safety related items with all operators frequently (annually).

2.3.2 Electrical Safety

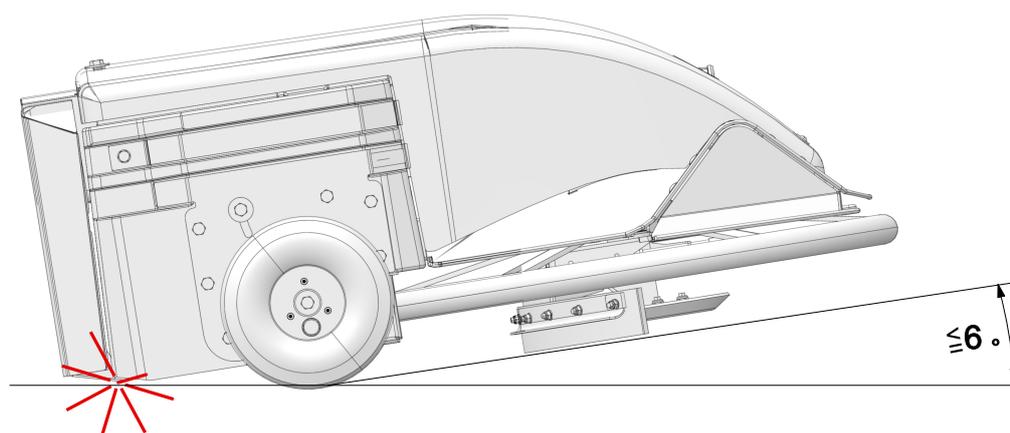
- Only an authorized electrician must install the electrical power supply for the charging station of the machine.
- Make sure the electrical grounding of the electrical system and all parts of the charging station of the machine meet the local rules and regulations.
- Replace any damaged electrical lines, conduits, switches and components immediately.
- Switch the power OFF with the OFF button on the ADS3840 PCB before you start to work on the system.
- Pull the plug from the socket before you start to work on the charging station.

2.3.3 Operating Safety

WARNING

***Unexpected movement of vehicle.
Risk of personal injury.
Make sure the machine is in your line of sight. Remote operation of the smartphone or tablet by remote desktop software (such as, but not limited by, Teamviewer) is strictly forbidden to avoid dangerous situations.***

- Read and understand this manual and all safety signs before you connect power supplies to operate, maintain or adjust the machine.
- Only trained persons are permitted to operate the machine.
- Make sure all covers are installed before you operate the machine.
- Keep hands, feet, hair and clothing away from all moving parts.
- Keep away from all areas with high voltage.
- Keep unauthorized persons, especially small children away from the machine at all times.
- Always be alert for unexpected movement of the cow. Cows can transmit large forces to parts of the machine.
- Contact your nearest Lely service provider if you have any questions.
- Review safety related items with all operators frequently (annually).
- Make sure the slope of the floor is 6 degrees maximum (10.5 cm per 100 cm).



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Figure 3. Maximum slope

2.3.4 Maintenance Safety

- Read and understand this manual and all safety signs before you connect power supplies to operate, maintain or adjust the machine.
- Block the cow traffic before you do maintenance. Always be alert for unexpected movement of the cow.
- Only trained persons are permitted to do corrective maintenance on the machine.
- Disconnect and isolate the electrical power supply to the charging station before you do maintenance on it.
- Switch OFF all timed actions before you do maintenance on the machine or clean it.
- Keep tools and metal parts away from the battery.
- Do NOT use water to clean the body of the machine.
- Use water and a brush to clean the manure scraper or the ultrasonic sensor of the machine; refer to the maintenance instructions.
- Install all covers after you finished the maintenance.



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3 Specifications

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Specifications Vehicle	
Dimensions and Weight.	<ul style="list-style-type: none"> • Length: 1362 mm (53.60 in). • Width: 860 mm (33.86 in). • Height: 575 mm (22.64 in). • Weight: 340 kg (750 lb). • Sensing ring height: 102 mm (4.02 in).
Battery.	<ul style="list-style-type: none"> • Number of batteries: 1. • Nominal voltage: 12 V. • Capacity: 55 Ah. • Charging time: 6 hours maximum. • Spare capacity: 120 min. • Weight 19.5 kg (42.9 lb).
Driving speed.	10.8 to 18 m/min (display: 180 - 300 mm/sec)
Routes.	<ul style="list-style-type: none"> • Max. number of different programmable routes: 16. • Max. number of actions per route: 125. • Max. number of time-route combinations per time path: 48 • Max. duration of a time path: 24 hours
Drive on thresholds and level differences.	< 10 mm (0.4 in).
Cleaning capacity.	Max. cleaning capacity: 918 m ² /h at 18 m/min.
Navigation sensors.	<ul style="list-style-type: none"> • Detection of the driving direction: Gyroscope. • Distance measurement to wall: Ultrasonic sensor. • Travelled distance: Measured via encoders on the motors.
Drive mechanism.	2 electric motors, each motor driving one wheel.
Water system.	<ul style="list-style-type: none"> • Total water tank capacity: 30 l (7.9 gal). • Total water output via nozzles: Max. 1 l/min (0.26 gal/min).
Average power consumption.	0.05 kWh.
Noise emission in accordance with EN-ISO 4871 Emission sound pressure level (LpA).	< 70 dB.
Floor.	Suited for all level slatted floors.
Drive on slopes.	< 6° (10.5 cm per 100 cm).



Specifications Charging station	
Dimensions and weight.	<ul style="list-style-type: none"> • Width: 380 mm (15.0 in). • Depth: 220 mm (8.7 in). • Height: 1650 - 2050 mm (65.0 - 80.7 in). • Weight(excluding floor column): 40 kg (88 lb).
Floor column (optional) dimensions and weight.	<ul style="list-style-type: none"> • Width: 370 mm (14.6 in). • Depth: 100 mm (3.9 in). • Height: 2100 mm (82.7 in). • Weight: 44 kg (97 lbs).
Electrical properties battery charger (grey).	<ul style="list-style-type: none"> • Type: Impulse 'L' . • Input voltage: 230 VAC (50 Hz) or 110 VAC (60 Hz). • Nominal output voltage: 12 VDC. • Max. charge current: 20 A. • Max. power: 295 W.
Electrical properties battery charger (blue).	<ul style="list-style-type: none"> • Type: Impulse 'II L' . • Input voltage: 220 - 240 VAC (50–60 Hz). • Nominal output voltage: 12 VDC. • Max. charge current: 20 A. • Max. power: 400 W.

Specifications Water Filling Station	
Dimensions and weight Water filling station:	<ul style="list-style-type: none"> • Width: 406 mm (16.0 in).. • Height: 282 mm (11.1 in). • Depth: 231 mm (9.1 in). • Weight: 11 kg (24.3 lb).
Dimensions and weight Header tank (optional):	<ul style="list-style-type: none"> • Width: 330 mm (13.0 in). • Height: 210 mm (8.3 in). • Depth: 200 mm (7.9 in). • Weight: 6 kg (13.2 lb); completely filled: 14 kg (31 lb). • Hose pilar thread: 1/2 in BSP. • Tube connection diameter: 13 mm (0.5 in).

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Specifications Water Filling Station	
Water Requirements.	<ul style="list-style-type: none"> • Max. water inlet pressure filling station: 5 bar (73 psi). • Max. water inlet pressure header tank: 3 bar (43.5 psi). • Min. required water flow for filling the machine: 2.3 l/min (0.61 gal/min). • Use potable water to prevent blockage of the nozzle or the water pump.
Hygiene protection.	The header tank meets the standard 'NEN-EN 1717:2000 en' which deals with the means to be used to prevent the pollution of potable water inside premises and the general requirements of protection devices to avoid pollution by backflow.

Requirements Smartphone	
Android.	<ul style="list-style-type: none"> • Android 4.0.3 or higher. • Screen resolution 480 x 800 (or higher). • Processor: 1 GHz (or higher). • Bluetooth version 2.1, (or higher) + EDR. • Compliance with 1999/5/EC european directive for Radio and Telecommunications Terminal Equipment. • At least 10 MB free storage.
iOS.	<ul style="list-style-type: none"> • iPhone 4 or higher. • iOS 7 or higher (iOS 8 is recommended). • iPhone must have at least 10 MB free storage.
Updates.	<ul style="list-style-type: none"> • For software updates a WiFi or 3G network must be available.

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3.1 Dimensions

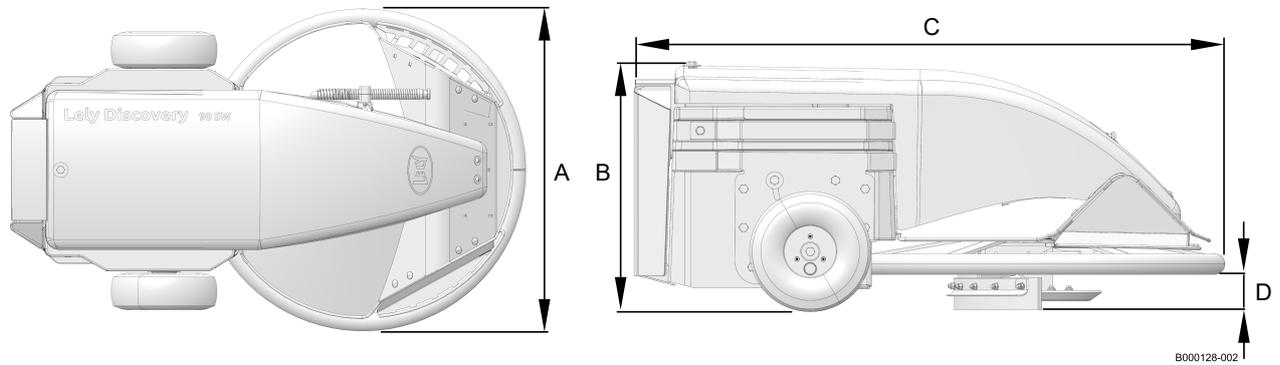
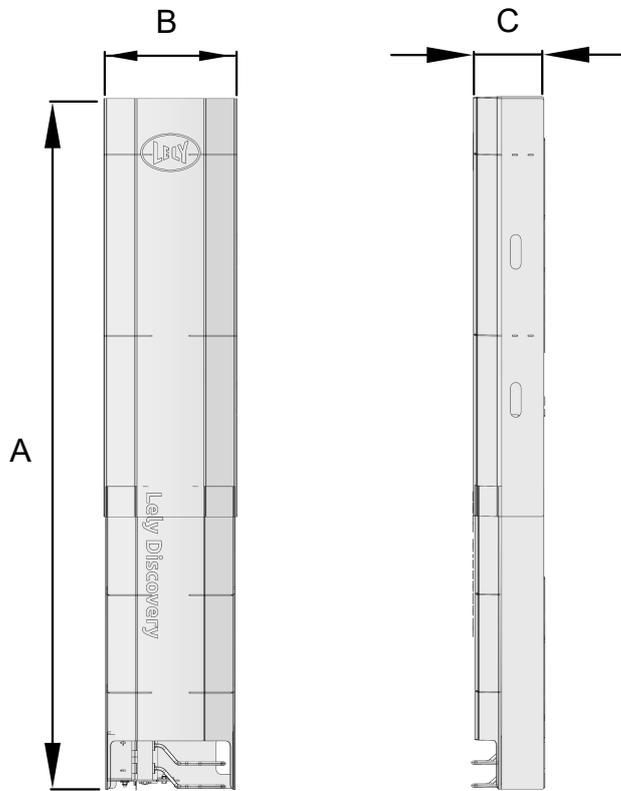


Figure 4. Machine dimensions

KEY:
 A: 860 mm (33.86 in)
 B: 575 mm (22.64 in)
 C: 1362 mm (53.6 in)
 D: 102 mm (4.02 in)

5.4006.8530.0 B



B000128-004

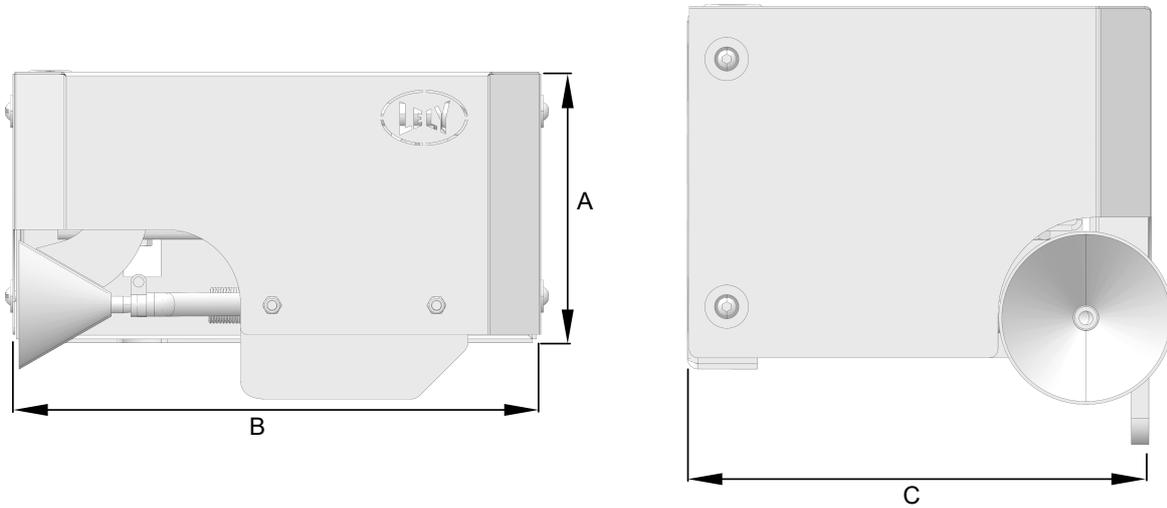
Figure 5. Dimension charging station

KEY:

A: 1650 - 2050 mm (65.0 - 80.7 in.)

B: 380 mm (15.0 in.)

C: 220 mm (8.7 in.)

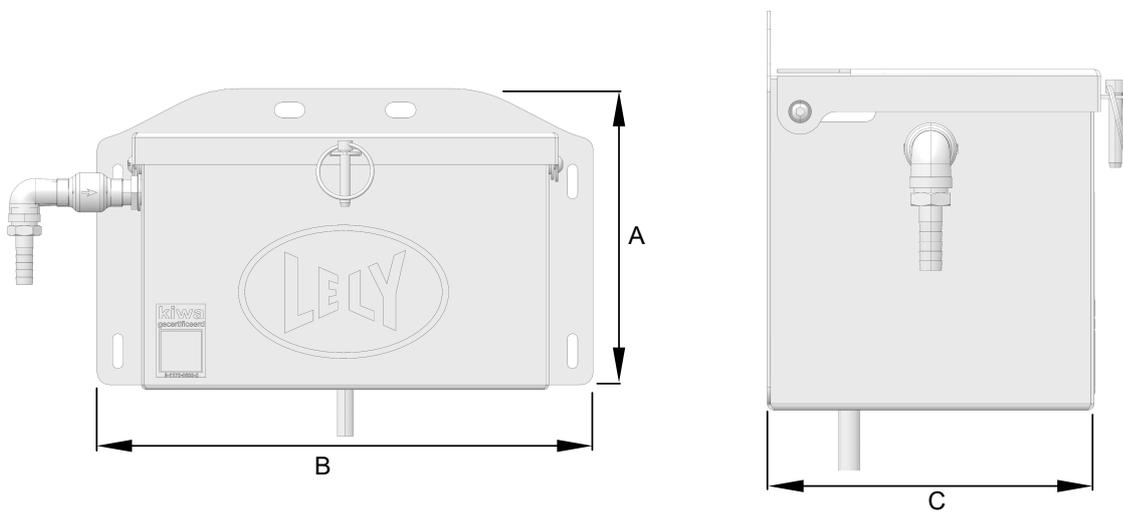


B000128-006

Figure 6. Dimensions water filling station

KEY:
 A: 28.2 cm (11.1 in)
 B: 23.1 cm (9.01 in)
 C: 10.6 cm (4.17 in)

5.4006.8530.0 B



B000128-008

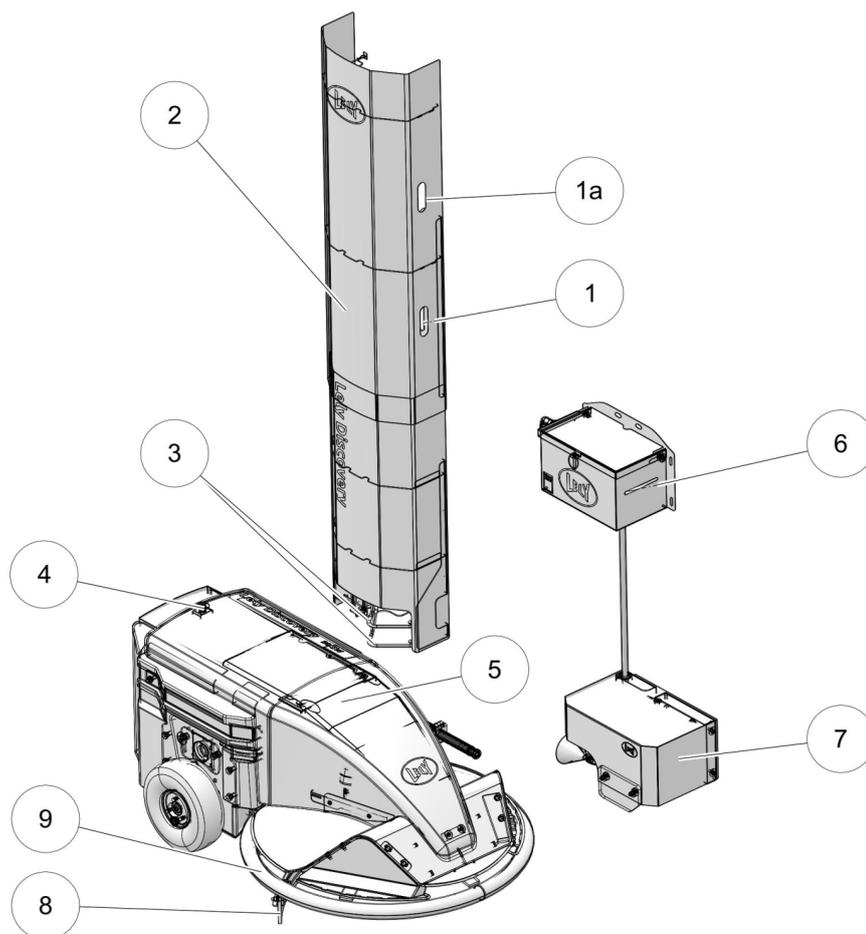
Figure 7. Header tank (optional)

KEY:
 A: Height
 B: Width
 C: Depth

4 Description and Operation

4.1 Introduction

This chapter describes the parts of the machine. It also explains how the parts work together to clean the barn floor.

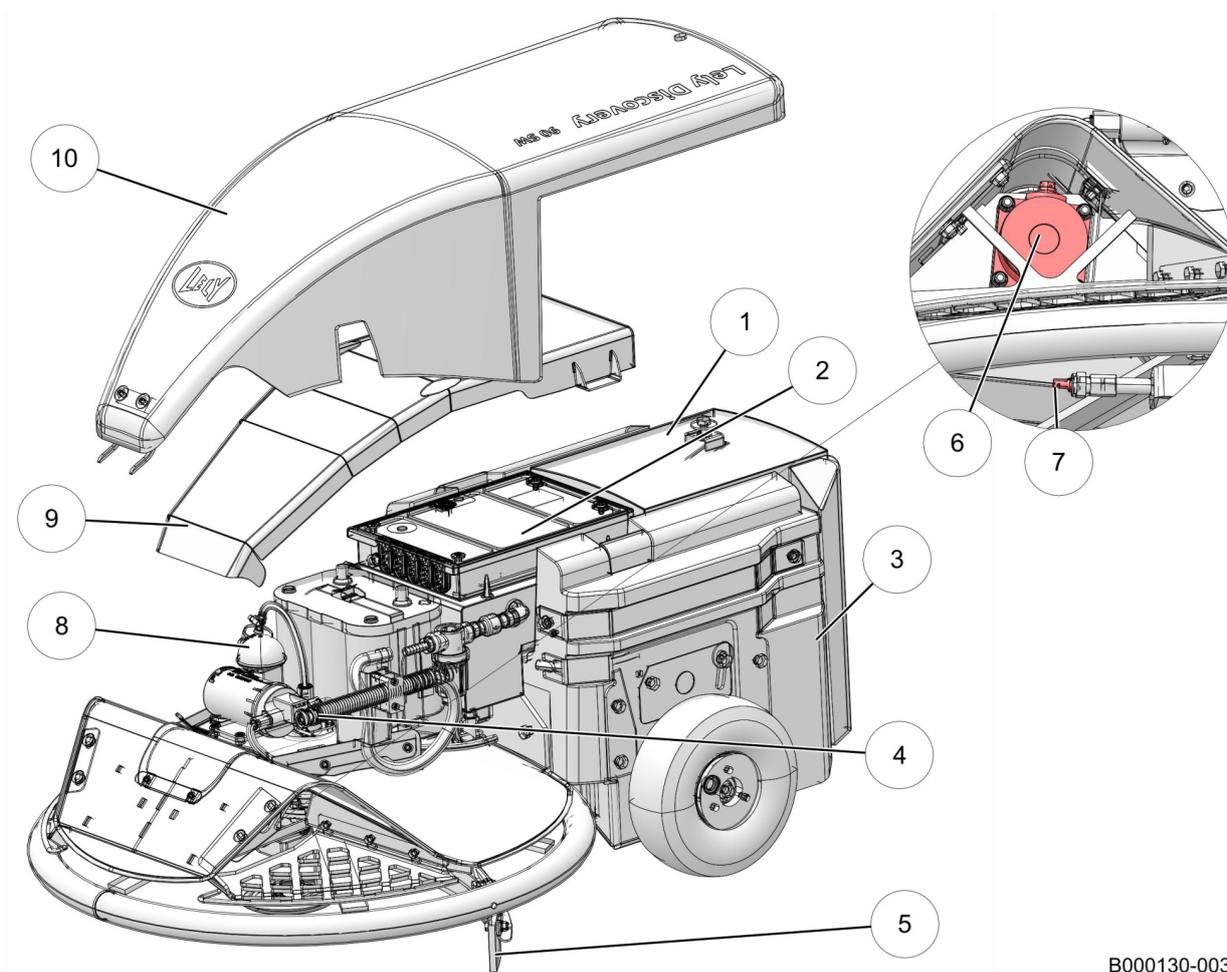


5.4006.8530.0 B

B000129-001

Figure 8. Main components Lely Discovery 90 SW Mobile Barn Cleaner

KEY: 1. or 1a. View hole for indicator LEDs - 2. Charging station - 3. Charging electrodes - 4. Discovery vehicle - 5. Upper cover - 6. Header tank (optional) - 7. Water filling station - 8. Manure scraper - 9. Sensing wheel



B000130-003

5.4006.8530.0 B

Figure 9. Main components Vehicle

KEY: 1. Water tank - 2. PCB box - 3. Concrete block/frame - 4. Water inlet - 5. Manure scraper - 6. Ultrasonic sensor - 7. Water sprayer - 8. Bluetooth antenna - 9. Lower cover - 10. Upper cover

4.2 Component Description

4.2.1 Discovery Mobile Barn Cleaner 90 SW Vehicle

The machine has the following mechanisms and systems:

- Cleaning mechanism.
- Driving mechanism.
- Power system.
- Control system.

4.2.1.1 Covers

The machine has a red upper cover (10) (see figure 9 on page 4-2) with a bolt to fasten it on the back side. At the front side of the machine a rotatable bracket holds the cover. Underneath the red upper cover, the lower cover (9) gives extra protection to the main components of the machine.

4.2.1.2 Cleaning System

A manure scraper (5) (see figure 9 on page 4-2) installed underneath the machine pushes the manure through the openings of the slatted floor.

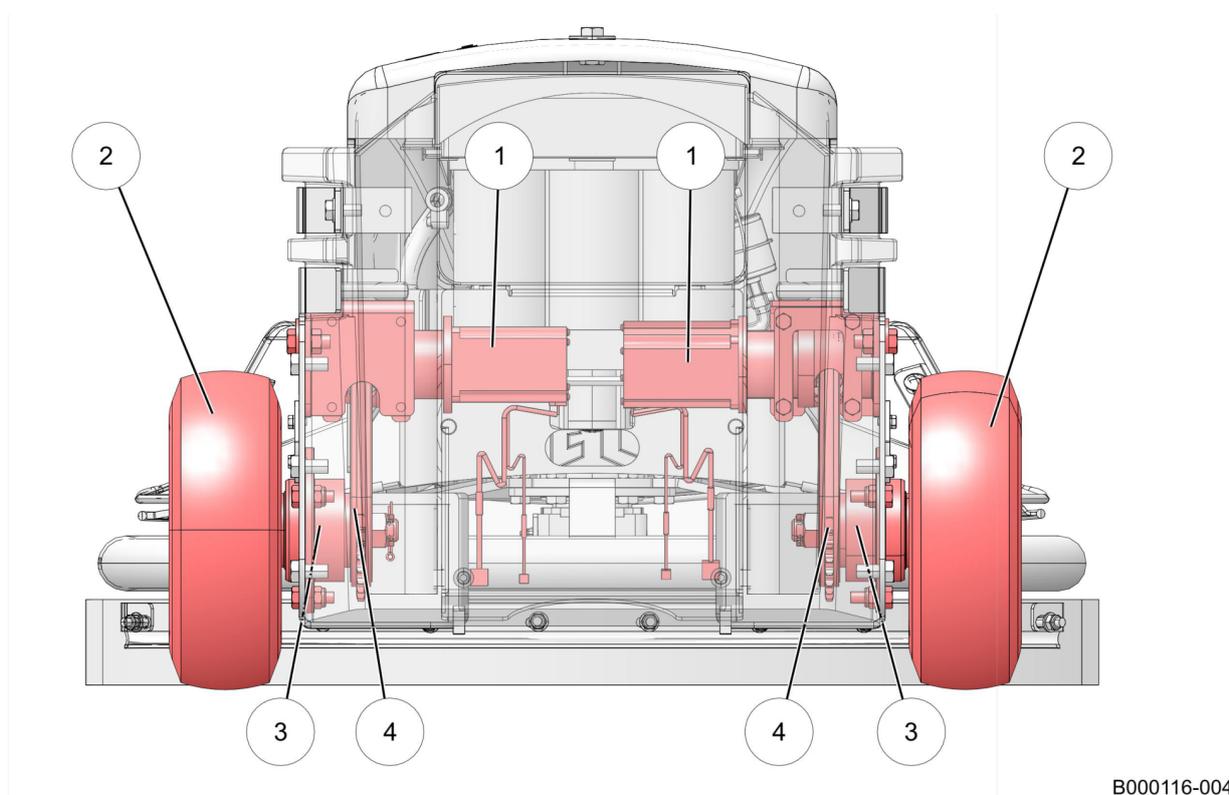
4.2.1.3 Driving Mechanism

The driving mechanism has the following parts:

- Two drive motors.
- Two chains.
- Two chain wheels.
- Two wheels.

The motors, one on the left side and one on the right side, drive the wheels via chains.

5.4006.8530.0 B



B000116-004

Figure 10. Driving mechanism

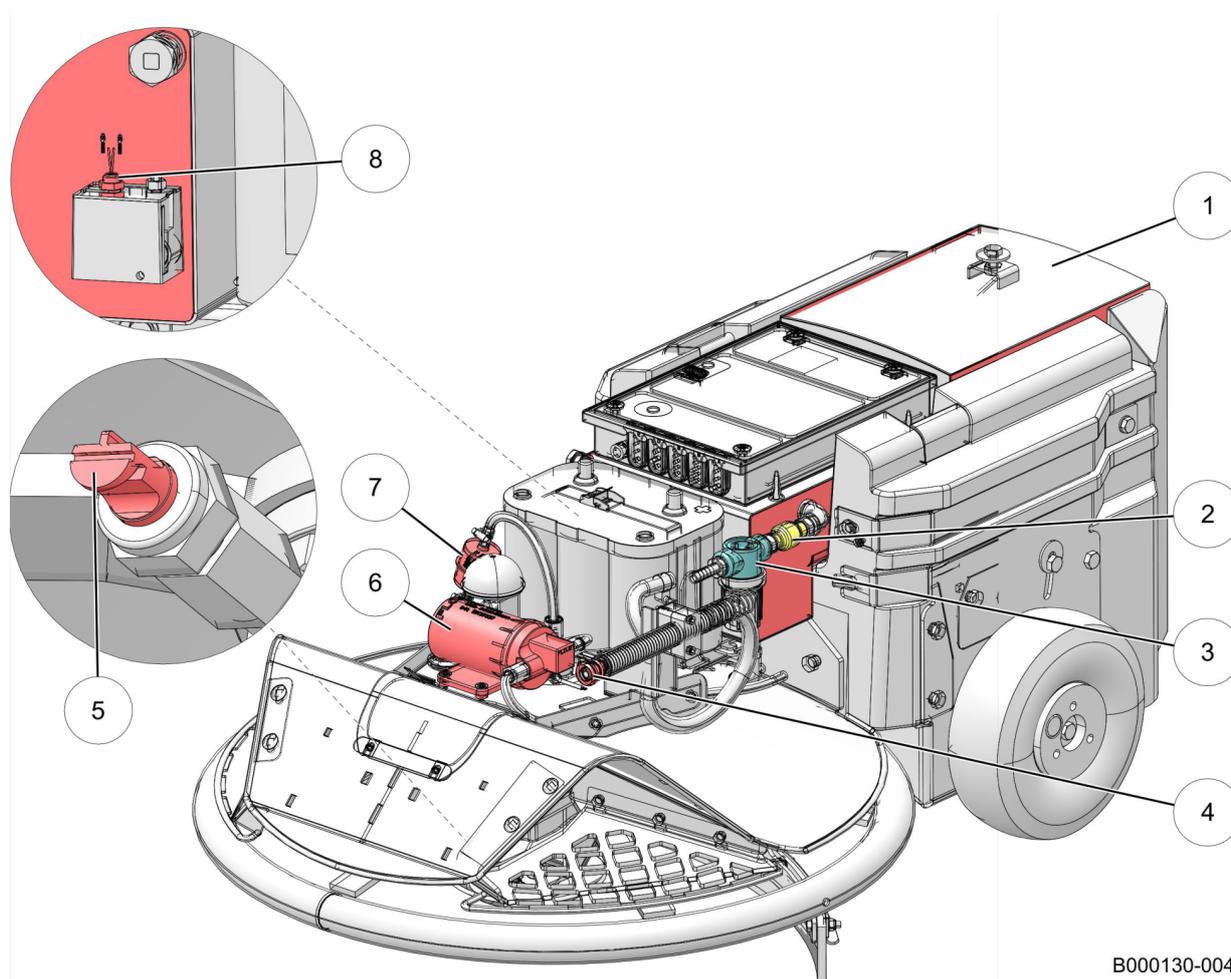
KEY: 1. Motor - 2. Wheel - 3. Wheel bearing - 4. Chain

4.2.1.4 Water Supply System

The nozzle on the front sprays water on the manure to soften the manure. The water supply system has:

- Water inlet.
- Water filter.
- Water tank.
- Pump, pumps the water from the water tank to the nozzle. Switched on only during a route.
- Nozzle.

The water tank is balanced installed on the concrete block and has a capacity of 30 liter, enough for one route.



5.4006.8530.0 B

B000130-004

Figure 11. Water supply

KEY: 1. Water tank - 2. Non return valve - 3. Water filter (inlet) - 4. Water inlet - 5. Water spray nozzle - 6. Water pump - 7. Water filter (outlet) - 8. Water sensor

4.2.1.5 Power System

The machine is battery-operated and after each route it returns to the charging station, which is installed at a convenient point in the barn. The charging station also functions as the starting point of each route.

The power system stores and distributes the electrical power for the driving mechanism and the ADS 3840 PCB. The power supply is a single rechargeable 12V battery. Charging takes place at the charging station. The power system has the following primary parts:

- Battery.
- Charging strips.
- On/Off switch.
- ADS 3840 PCB.

4.2.1.6 Control System

The control system has the following parts:

- ADS 3840 PCB, to control the operation of the machine.
- Encoders on the drive motors to measure the driven distance.
- Ultrasonic sensor to measure the distance to wall or fence.
- Gyroscope to measure angle differences to keep the right direction.

The water sensor detects when the water tank is full. The temperature sensor measures the temperature in the barn for frost protection.

Encoders

Each drive motor has an encoder that counts the rotation of the motor shaft. This information is used to calculate the position of the vehicle. The encoders send outputs to the ADS 3840 PCB.

Ultrasonic Sensor

The ultrasonic sensor makes sure the machine follows the wall or fence at a pre-determined distance.

A foam ring is adhered on the sensor to minimize reflections and to focus the reflected beam.

The sensor gets inputs from and sends outputs to the ADS 3840 PCB.

Gyroscope

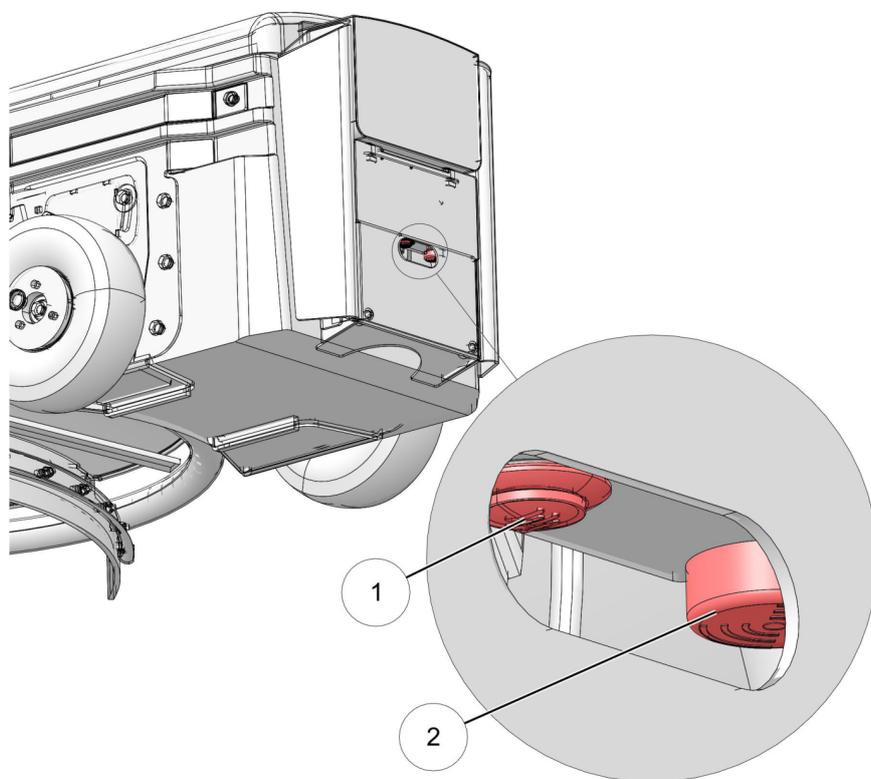
The gyroscope measures the turning angle. This information is used to find the correct direction. The gyroscope is essential for driving a route when there is no wall that can be followed.

The gyroscope is combined with the ADS 3840 PCB. The gyroscope is not a spare part.

Water Sensor

The water sensor is installed next to the battery on the water tank and detects when the tank is completely filled.

Pause Button



B000116-002

5.4006.8530.0 B

Figure 12. Pause button and acoustic warning device

KEY: 1. Pause button - 2. Acoustic warning device

A pause button (1) (see figure 12 on page 4-6) is installed on the machine. The light in the pause button is on when the button is pushed. When the pause button is pushed while the machine is in operation, the machine goes into pause mode:

- The machine stops.
- The operational sound of the machine is turned off.
- The user interface on the smartphone displays a question to resume or cancel the route.

When the pause button or the button in the Lely Control app is pushed shortly while the machine is in pause mode, the machine goes back into work mode:

- The machine goes back into operation.
- The LED light in the pause button turns off.
- The operational sound of the machine is turned on.

The pause button can be operated remotely with the Lely Control app on the smartphone.

If an alarm occurs, the LED in the pause button blinks. The alarm must be confirmed with the Lely Control app on the smartphone.

Status of the machine	LED status of the pause button
Start up	Blink
Out of operation. Lely Control app in main tab menu Work	On
Out of operation. Lely Control app in other menu	Blink
Machine paused	On
Machine in normal operation	Off
Alarm	Blink

Acoustic Warning Device

An acoustic warning device alerts persons and cows when the vehicle starts to move, moves or when an alarm occurs.

The beep lengths and beep frequencies of the acoustic warning device are:

Operational state of the machine	Beep frequency acoustic warning device
Normal operation	Once per 2 seconds (default)
An alarm occurred	3 short beeps every minute

The acoustic warning device is installed on the machine.

Lely Control app



5.4006.8530.0 B

The Lely Control app controls and monitors the machine and communicates with the management software. The Lely Control app is available in the Google play store (Android) and the Apple app store (iOS).

The user interface of the Lely Control app displays nine buttons that enable the user to give commands and change values in the machine. The user interface also shows reports and alarms.

The Lely Control app communicates via bluetooth with the software on the ADS 3840 PCB.

The user interface has the following buttons:

-  Execute the command on the display above the applicable soft button.
-  starts or stops an action.
-  Moves the selector up one item or increases a value by one.
-  Moves the selector down one item or decreases a value by one.
-  Opens the selected function or the next menu screen.
-  returns to the previous screen.
-  Reduces the speed of the vehicle.

Acoustic signal

The Lely Control app gives an acoustic signal when:

- The machine is in normal operation.
- Settings are saved.
- The calibration of the gyroscope is finished.
- Backup is finished (create / restore).
- Programming a route.

4.2.2 Charging Station

The machine normally starts and ends at the charging station. The machine recharges itself at the charging station. The battery charger electrodes are at the front near the bottom of the charging station.

The machine can be left permanently connected to the charging station. This keeps the battery in good condition. The ADS3840 PCB continuously examines the voltage of the battery. It is not possible to overcharge the battery.

The charging station has a 20 A electronic battery charger.

The charging station can be installed in the barn in two ways:

- Wall-mounted.
- Floor-mounted.

If it is not possible to install the charging station to the wall, an optional floor column can be supplied.

Battery Charger (Blue)

The 20 A electronic battery charger has two indicator LEDs on the upper right side. The LEDs are visible through the opening in the red cover. The meaning of the LEDs are:

Status	Charging LED (orange)	Power LED (green)
Mains connected	OFF	ON
Recharging (>1A)	ON	ON

Battery Charger (Grey)

The 20 A electronic battery charger has two indicator LEDs on the upper right side. The LEDs are visible through the opening in the red cover. The meaning of the LEDs are:

Status	Charging LED (orange)	Power LED (green)
Mains connected	OFF	ON
Recharging (>1A)	ON	ON
Error	blinking	blinking

4.2.3 Water Filling Station

The machine refills itself at the water filling station (7) (see figure 8 on page 4-1). The water filling station has:

- Mechanically operated shut-off valve
- Water outlet

When the water filling station is connected to the drinking water system, a header tank must be installed between the drinking water system and the water filling station to prevent the pollution of potable water by backflow of water with bacterial contamination (see Hygiene protection in Specifications (See page 3-1)).

The header tank supplies water with a constant pressure (0.2 bar) to the water filling station. The water station is installed next to the charging station on the wall. The header tank is installed 2 m above the floor

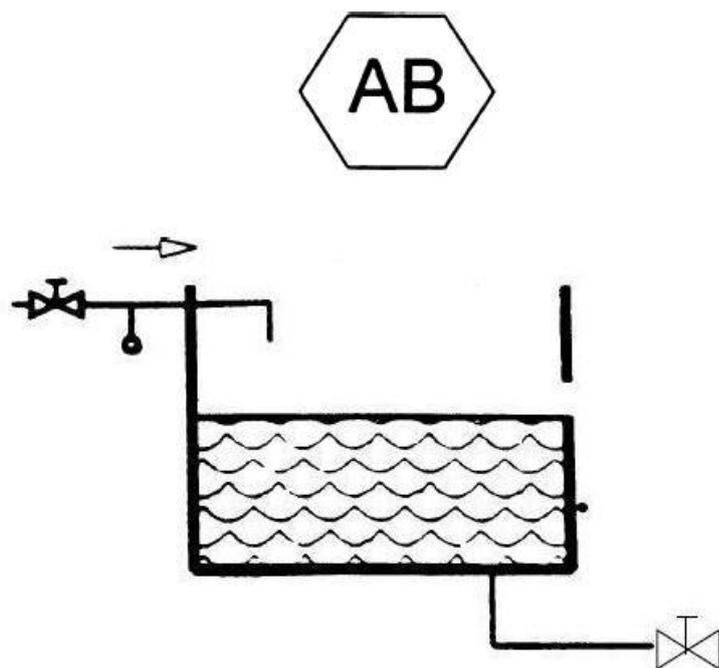


Figure 13. Symbolic representation of the header tank

4.3 User Interface

The machine is operated with a smartphone with an Android or iOS operating system. The smartphone communicates with the software via bluetooth. The main menu on the smart phone has the following items:

- **Work**
- **Routes**
- **Test**
- **Settings**
- **Alarms**
- **Service**

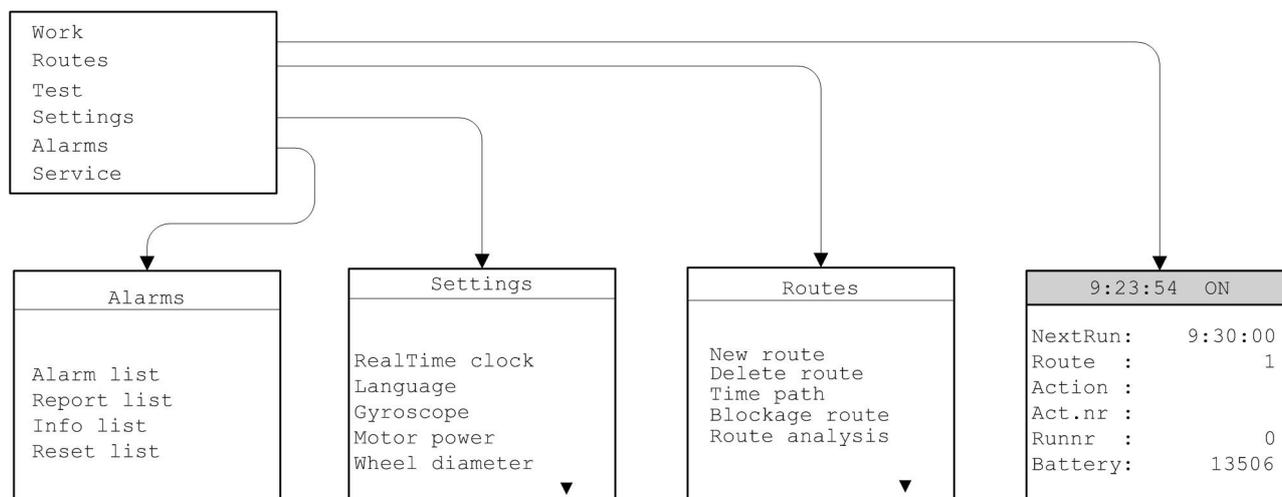


Figure 14. The Lely Control app menu structure

Buttons

- or to select a menu item.
- to confirm an action.
- to go to the previous menu.

4.3.1 Work

The menu **Work** is used for daily operation of the machine. You can operate the machine in automatic mode using a time path and in manual mode.

The menu **Work** has the following submenus:

- **On/Off** (to switch the time path **On** or **Off**).
- **MANUAL ROUTE** (to manually start a selected route).
- **MANUAL DRIVING** (to manually drive the machine).
- **MANUAL CHARGER** (to drive the machine to the charging station, following the wall).

The button must be used to open the next menu, to open the previous menu. A black dot on the right side of the screen indicates the level. The highest level (**On/Off**) has for instance a dot on the upper side, the lowest level (**MANUAL CHARGER**) a dot on the lower side.

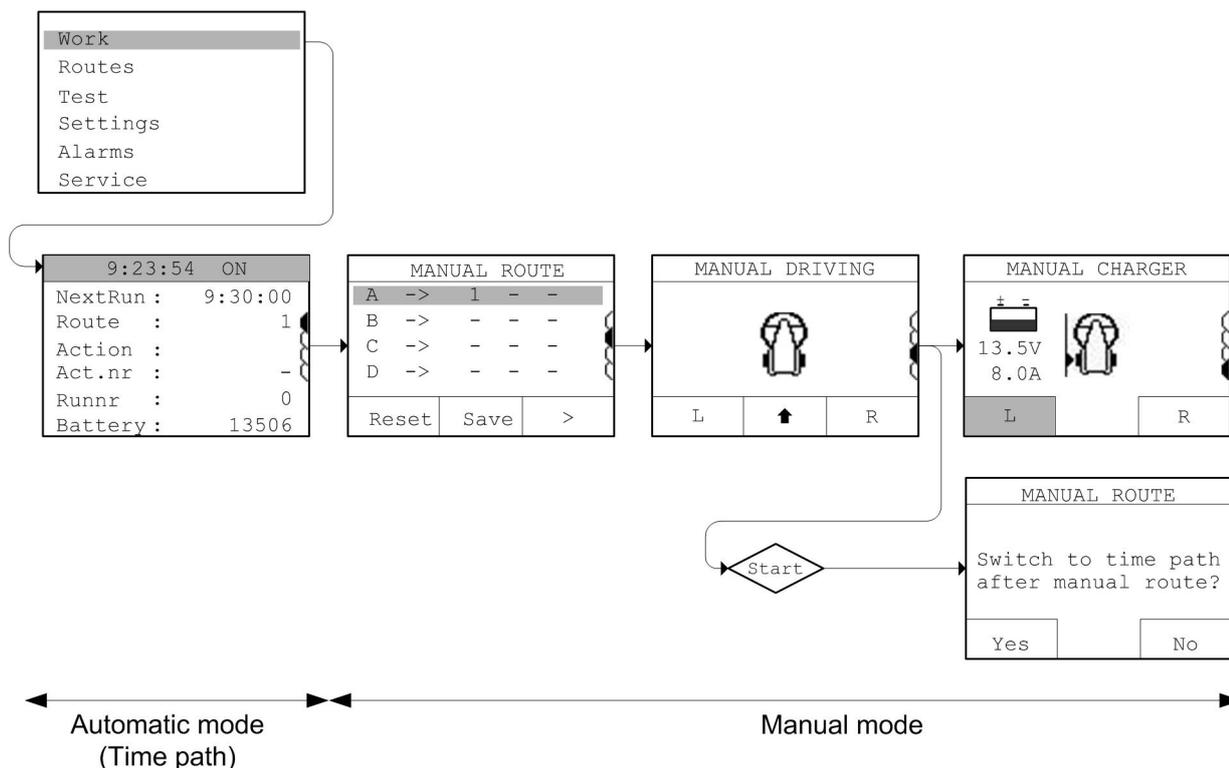


Figure 15. Menu **Work**

The level is indicated by a tab with a black dot on the right side of a display. There are four levels:

- Menu **Work**, indicated by the upper dot.
- **MANUAL ROUTE**, indicated by the second dot.
- **MANUAL DRIVING**, indicated by the third dot.
- **MANUAL CHARGER**, indicated by the fourth dot.

4.3.1.1 Time Path ON/OFF



If the time path is switched **On**, the upper pane is greyed out (see the following figure).

Display	Description
<pre> 9:23:54 ON NextRun: 9:30:00 Route : 1 Action : Act.nr : - Runnr : 0 Battery: 13506 </pre>	<ul style="list-style-type: none"> • Start or stop timed actions which are set in a time pat (see Time Path on page 4-20). • Display the status: <ul style="list-style-type: none"> • Actual time. • On or Off. • NextRun: start of the next route. • Route: route number. • Action: action description (visible during route). • Act.nr: sequence number for the action in this route. • Runnr: run number. • Battery: battery voltage.
<pre> 9:23:54 OFF NextRun: 9:30:00 Route : 1 Action : Act.nr : - Runnr : 0 Battery: 13506 </pre>	

Buttons

-  to start or stop timed actions.
-  to go to the next menu.
-  to go to the previous menu.



With the pause button (1) (see figure 12 on page 4-6) on the machine you can also start or stop timed actions.

4.3.1.2 Manual Route



Driving manual route is only possible when the time path is switched **Off**.

Display	Description
<pre> MANUAL ROUTE A -> 1 - - B -> 2 3 4 C -> - - - D -> - - - Reset Save > </pre>	<ul style="list-style-type: none"> • Let the vehicle drive a series of maximum 3 subsequent routes.

Buttons

- to start or stop the action.
- to go to the previous menu.
- to go to the next menu.
- Soft button **Reset** to clear the selected line.
- Soft button **Save** to save the set routes.
- Soft button **>** to select the first, second or third route in the series.

4.3.1.3 Manual Driving



Manual driving is only possible when the time path is switched **Off**.

Display	Description
	<ul style="list-style-type: none"> • Move the vehicle manually (see Manually drive the Machine on page 5-6).

Buttons

- to start or stop the action.
- to go to the next menu.
- to go to the previous menu.
- Soft button **L** to select the left motor. The vehicle turns right when you start the manual drive action with the button .
- Soft button **↑** to select the drive direction.
- Soft button **R** to select the right motor. The vehicle turns left when you start the manual drive action with the button .

Select both motors **L** and **R** to drive straight.

4.3.1.4 Manual Charger



Driving manually to the charger is only possible when the time path is switched **Off**.

Display	Description
	<ul style="list-style-type: none"> Let the vehicle automatically drive to the charging station, following the wall (starting within 1 m from the charging station). The values on the display indicate the battery voltage and the charge current.

Buttons

- to start or stop the action.
- to go to the next menu.
- to go to the previous menu.
- Soft buttons **L** and **R** to select the position of the charging station.

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4.3.2 Routes

The menu **Routes** is used for programming routes or for test and adjustments.

Buttons

- or to select a menu item.
- to confirm an action.
- to go to the previous menu.

4.3.2.1 New Route

New Route

A new route is built from the following actions:

- Fill water**
- Wall flw L** or **Wall flw R**.
- Straight**.
- Turn L** ←- or **Turn R** ->.
- Ultrasound L**.

- **Ultrasound R** (option).
- **Charger**.
- **Waiting time**.

A route has a maximum of 125 actions.

Water Filling

Drive from the charging station to the water filling station. After water filling the machine drives back (adjustable) before it is ready for the next action.

The display shows the following information:

Display	Description
	<ul style="list-style-type: none"> • Actionr: sequence number for the action in this route. • BackDst: the distance the machine drives back after filling (default 0.5 m (19 in))

Wall Follow L

Tracking along a wall on the left. The motor on the left side runs at 99% and the right motor runs at 100%. The sensing wheel is pushed to the wall.

The display shows the following information:

Display	Description
<pre> Follow wall L Actionr : 0 RunDst : 0 Speed1 : 0 Speed2 : 0 MAN </pre>	<ul style="list-style-type: none"> • Actionr: sequence number for the action in this route. • RunDst: distance travelled in mm. • Speed1: left wheel speed in mm/s. • Speed2: right wheel speed in mm/s.

Buttons

- to start or stop the action.
- to reduce speed when approaching a bump point.
- Soft button **MAN** to adjust the position of the vehicle to get a good start position (direction).



The same description applies for following a wall on the right side.

Straight

Drive straight forward, only with the use of the gyroscope to correct the position of the machine.

The display shows the following information:

Display	Description
<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Straight</p> <p>Actionr : 0</p> <p>RunDst : 0</p> <p>Gyro : 0.0</p> <p>Speed : 0</p> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> ↑ MAN </div> </div>	<ul style="list-style-type: none"> • Actionr: Sequence number for the action in this route. • RunDst: Distance traveled in mm. • Gyro: Angle value in gyroscope. • Speed: Wheel speed in mm/s.

Buttons

- to start or stop.
- to reduce speed when approaching a bump point.
- Soft button to change the direction.
- Soft button **MAN** to adjust the position of the vehicle to get a good start position (direction).

Turn Right or Left

Turn → or ← Turn

Turn right or left. You can choose from 12 standard turns to both right and left. The chosen turn can be adjusted according to the specific situation. The standard curves are:

Display	Description
<div style="border: 1px solid black; padding: 5px;"> <p>1-4 Turn --></p> <div style="display: flex; justify-content: space-around;"> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> X X X </div> </div>	<ul style="list-style-type: none"> • Turn right 60 degrees gradually, following wall, maximum cleaning. • Turn right 90 degrees. • Turn right 180 degrees, stop in adjacent lane 80 cm (31 in) to the right.
<div style="border: 1px solid black; padding: 5px;"> <p>2-4 Turn --></p> <div style="display: flex; justify-content: space-around;"> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> X X X </div> </div>	<ul style="list-style-type: none"> • Turn right 5 degrees. • Turn right 25 degrees. • Turn right 180 degrees, stop in adjacent lane 40 cm (16 in) to the right (clean 50 cm (20 in) from previous lane).
<div style="border: 1px solid black; padding: 5px;"> <p>3-4 Turn --></p> <div style="display: flex; justify-content: space-around;"> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> X X X </div> </div>	<ul style="list-style-type: none"> • Turn right 45 degrees. • Turn right 60 degrees. • Turn right 180 degrees, stop in the adjacent lane 20 cm (8 in) to the right (clean 70 cm (28 in) from the previous lane).
<div style="border: 1px solid black; padding: 5px;"> <p>4-4 Turn --></p> <div style="display: flex; justify-content: space-around;"> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> X X X </div> </div>	<ul style="list-style-type: none"> • Make a sharp right turn, maximum cleaning in the corner. • Turn right 90 degrees. • Turn right 180 degrees.

Display	Description
<div style="border: 1px solid black; padding: 5px;"> <p>1-4 <-- Turn</p> <p style="text-align: center;">-90</p> <p style="text-align: center;">X X X</p> </div>	<ul style="list-style-type: none"> • Turn left 60 degrees gradually, following wall, maximum cleaning. • Turn left 90 degrees. • Turn left 180 degrees, stop in adjacent lane 80 cm (31 in) to the left.
<div style="border: 1px solid black; padding: 5px;"> <p>2-4 <-- Turn</p> <p style="text-align: center;">-5 -25</p> <p style="text-align: center;">X X X</p> </div>	<ul style="list-style-type: none"> • Turn left 5 degrees. • Turn left 25 degrees. • Turn left 180 degrees, stop in adjacent lane 40 cm (16 in) to the left (clean 50 cm (20 in) from previous lane).
<div style="border: 1px solid black; padding: 5px;"> <p>3-4 <-- Turn</p> <p style="text-align: center;">-45 -60</p> <p style="text-align: center;">X X X</p> </div>	<ul style="list-style-type: none"> • Turn left 90 degrees, no wall following. • Turn 180 degrees. • Turn left 180 degrees, stop in adjacent lane 20 cm (8 in) to the left (clean 70 cm (28 in) from the previous lane).
<div style="border: 1px solid black; padding: 5px;"> <p>4-4 <-- Turn</p> <p style="text-align: center;">-90 -90</p> <p style="text-align: center;">X X X</p> </div>	<ul style="list-style-type: none"> • Make a sharp left turn, maximum cleaning in the corner. • Turn left 90 degrees. • Turn left 180 degrees.

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Adjust the Turn

After selecting an option, the variables of the turn can be adjusted. The display shows the following information:

Display	Description
<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Turn</p> <p>Actionnr : 2</p> <p>Turn : 90 <</p> <p>Radius : 300</p> <p>Back : 0</p> <div style="border: 1px solid black; width: 40px; height: 20px; margin: 5px auto; text-align: center; line-height: 20px;"><</div> </div>	<ul style="list-style-type: none"> • Actionr: Sequence number for the action in this route. • Turn: Angle of the turn, positive value (+) = turn right, negative value (-) = turn left. • Radius: The radius of the turn the vehicle will make: 0 = on the spot, 300 = about one of the drive wheels For instance: a turn of 180 degrees with a radius of 0 is used to clean the same lane again. A turn of 180 degrees with a radius of 300 is used to clean the next lane. • BACK: The distance (in mm.) the vehicle first goes back before making the turn (needed if the vehicle is near an obstacle).

Buttons

- Soft button to select the variable you want to modify.
- Push or to adjust the value of the selected variable.

- to start or stop.
- Soft button **MAN** to adjust the position of the vehicle.

The same description applies for turning to the left.

Ultrasound L

Tracking along a wall or fence on the left at a certain distance (200 cm, 78.7 in max.). The ultrasonic sensor is used to measure the distance to the wall.

Default the ultrasonic sensor is installed on the left. If the sensor is installed on the right, the menu is **Ultrasound R** or if a sensor is installed on both sides, the menu is **Ultrasound L+R**.

The display shows the following information:

Display	Description
	<ul style="list-style-type: none"> • Actionnr: Sequence number for the action in this route. • RunDst : Covered distance (mm). • UltraDst: Actual distance to the wall (mm) (2000 mm, 78.7 in max). • ULTRADST: Adjustable distance to the wall (mm).

Buttons

- or to adjust the value of the selected variable.
- to start or stop.
- Soft button **MAN** to adjust the position of the vehicle.

Charger

Drive the vehicle back to the charging station. The machine finds the charging station independently (default = on the left), within a distance of 1.5 - 3 m (5 -10 ft.) (see Go to the Charging Station on page 5-26). The vehicles nose must point approximately into the direction of the charging station.

The display shows the following information:

Display	Description
	<ul style="list-style-type: none"> • Actionnr: sequence number for the action in this route. • RunDst: Covered distance (mm). • Charger: not applicable.

Buttons

- Soft button **L** to modify the position of the charging station.
- Soft button **MAN** to adjust the position of the vehicle.
- to start or stop.

Waiting Time

Wait an adjustable time before continuing with the next action in a route (see Waiting Time on page 5-26). This action is used in a route through a waiting area. The vehicle stops before entering the area to give cows time to move out.

The display shows the following information:

Display	Description
	<ul style="list-style-type: none"> • Actionnr: Sequence number for the action in this route. • Time: (min): Waiting time (min).

Buttons

- or to modify the value of the selected variable.
- to start or stop.
- Soft button **Save** to save the setting.

4.3.2.2 Delete Route

This menu is used to delete an existing route (see Delete a Route on page 5-28).

The display shows the following information:

Display	Description
	<ul style="list-style-type: none"> • List of set routes.

Buttons

- or to select a route.
- to confirm.

4.3.2.3 Time Path

It is useful to combine routes into a time path. If the time path is switched ON, the machine drives the set routes automatically at the set times each day (see Set a Time Path on page 5-29). A time path lasts maximum 24 hours. A time path has 48 time-route combinations maximum. A maximum of 16 different routes can be programmed. The time-route combinations of the time path are sorted automatically in time order.

The display shows the following information:

Display	Description																		
<table border="1"> <thead> <tr> <th>TIME</th> <th>ROUTE</th> <th></th> </tr> </thead> <tbody> <tr> <td>07:00</td> <td>01</td> <td>On</td> </tr> <tr> <td>09:15</td> <td>03</td> <td>Off</td> </tr> <tr> <td>13:15</td> <td>01</td> <td>On</td> </tr> <tr> <td>16:15</td> <td>04</td> <td>On</td> </tr> <tr> <td>Del</td> <td>New</td> <td>></td> </tr> </tbody> </table>	TIME	ROUTE		07:00	01	On	09:15	03	Off	13:15	01	On	16:15	04	On	Del	New	>	<ul style="list-style-type: none"> Time path; start times of set routes.
TIME	ROUTE																		
07:00	01	On																	
09:15	03	Off																	
13:15	01	On																	
16:15	04	On																	
Del	New	>																	

Buttons

- or to select a route in the time path.
- Soft button **Del** to delete a route from the time path.
- Soft button **New** to add a new route to the time path.
- Soft button **>** to select the next variable.

4.3.2.4 Blockage Route

This menu is used to temporary block one or more routes. If you do not want the vehicle to drive in a particular part of the barn, block the routes that go through that part. Blocked routes will be skipped from the time path.

This option can be used if a part of the barn is reconstructed or if a cow is calving.

4.3.2.5 Route Analysis

The menu **Route analysis** has the following options:

- **Fail. problty.**
- **Failure analys.**

Fail. problty gives a quick overview of the reliability per route. **Failure analys** gives detailed information and shows per route the action numbers that have a high risk of failure. It also gives an indication of the fault (see Analyse the Reliability of a Route on page 7-3).

Failure Probability per Route

The display **Fail. problty** displays for each route, numbered from 1 - 16, the probability of a failure on a scale from 0 - 5. In the next figure route 1 has a low risk and route 4 a very high risk.

1-2 Failures/route								
5								
3								
1								
	1	2	3	4	5	6	7	8

If a route has a failure probability of more than 2, the risk of failures is too high. This could be due to a number of factors like:

- Few bump points.
- Many so called 'short actions', like **Straight**, **Turn L ←** or **Turn R →** without 'long actions' in between to enable the machine to correct itself.
- Obstacles.

Buttons

-  to open the next screen.
-  to go one level up.

Failure Analysis

The display Failure analysis has 3 tables:

- The table Failure analysis displays per fault category (A - H) the action numbers that cause a risk.
- The second table displays the percentage of actions in a route that have bump points (must be more than 20%) and the percentage short actions versus long actions (must be less than 50%).
- The third table displays explanations.

Table 1. display Failure analysis

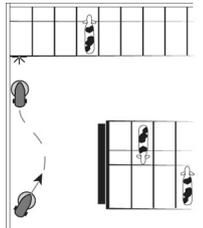
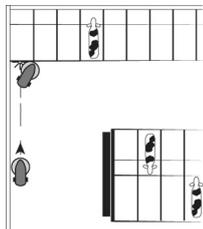
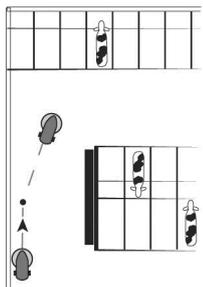
	Display text	Explanation	
A	Bend in action.	Very unreliable route due to a combination of factors (B-H).	
B	Start-Resetc. angle.	Angle of more than 20 degrees between the start and the reset point. This could be due to an angled start point.	
C	Resetc.-End angle.	Angle of more than 15 degrees between the reset point and the end point. The vehicle goes in the wrong direction before it reaches the end point. This could be due to an obstacle.	
D	Angle betw. Actions.	Vehicle has unexpectedly turned after saving an action, causing the next action to start in a different direction.	

Table 1 display Failure analysis (cont'd.)

	Display text	Explanation	
E	Drift/bend action.	Vehicle is forced to make a bend during an action (wall follow or ultrasound drive) less than 1.5 m (4.9 ft.) after the start of the action.	
F	Drift/angled start.	Vehicle starts angled due to, for instance angled ending of the previous action.	
G	Angled ending.	Vehicle ends action angled (>10 degrees) due to for instance a collision with a cow leg.	
H	Straight > 5 m.	Deviation caused by driving straight for more than 5 m (15.4 ft).	

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4.3.2.6 Speed Route

This menu is used to set the speed for a route.

The maximum speed is 300 mm/sec. which is approximately 18 m/min.

During programming, the speed is 300 mm/sec., during operation the speed is default 180 mm /sec. (10.8 m/min). You can adjust the speed for each particular route.

4.3.2.7 Speed Action

This menu is used to set the speed for an action during a route (see Set the Speed for a Particular Action on page 5-35), for example driving slowly when passing the feed fence or a waiting area.

4.3.2.8 Beepfreq Route

This menu is used to set the beep frequency during the driving. The default frequency is every 2 seconds. The frequency can be set for each route separately. The display displays the value per second, so 0.5 equals one beep per two seconds. When the value is set to zero, the beep is switched **Off**.



Switch the beep **On** if the route passes a feed fence or a waiting area. The cows present in the area are alerted and can move out of the way.

4.3.2.9 Copy Route

The menu **Copy route** is used to copy a route. The copied route can be modified to make a new route.

4.3.2.10 Modify Route

The menu **Modify route** is used to modify parts of an existing route. Since a route is built of many actions, changing one action influences the rest of the route. Therefore modification is restricted to:

- Modify the run distance.
- Modify the angle of a turn.
- Add waiting time.

Examples

If the machine slips during action (3) (see figure 16 on page 4-25), the vehicle will not reach the wall during the next action (4). Instead of following the wall, it will then hit the manger on the cross wall. In that case the run distance of action 3 (**Straight**) should be increased.

If, after following a wall, a crosswalk must be passed, the machine must first make a small turn to the left (2). Otherwise the vehicle will hit the cross wall on the other side of the crosswalk. If it turns out that, despite the turn, the vehicle hits the wall, the angle of the turn must be increased.

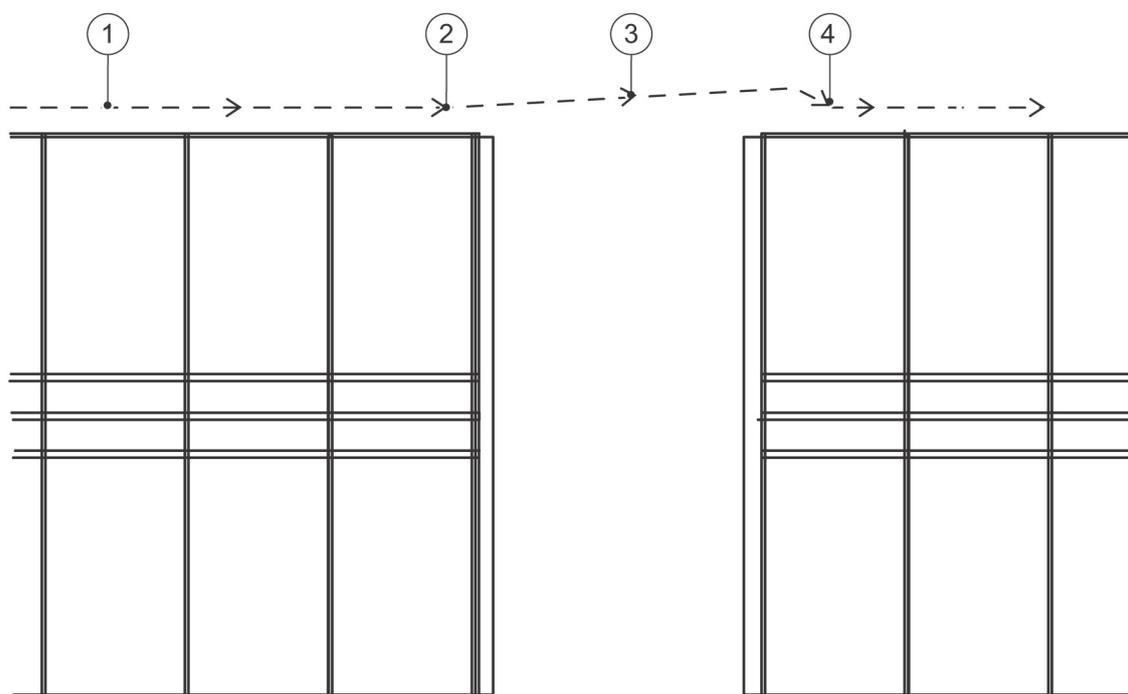


Figure 16. To pass a crosswalk

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4.3.2.11 Wheel Correction

If the wheels become worn, the diameter and thus the covered distance per rotation decreases. As a result the driving distance in a route decreases.

The menu **Wheel corr.** is used to correct the wheel diameter in the software and thus the driving distance (see Wheel Diameter on page 4-26).

4.3.2.12 Backup Route

This menu is used to make a backup with the Lely Control app on the smartphone or to restore the information on the ADS3840 PCB.

4.3.2.13 Sprinkler Route

The menu **Sprinkle route** is used to set the water sprinkler **On** or **Off** per route.

4.3.3 Test

The menu **Test** is used to do functional tests of components and actions.

4.3.4 Settings

4.3.4.1 RealTime clock

This menu is used to set the date and time of the machine. The correct date setting is also important to search for alert reports on a date.

Date 02-09-20 (dd/mm/yy).

Time 16:53:31 (hh/mm/ss).

4.3.4.2 Language

This menu is used to modify the language of the user interface.

4.3.4.3 Gyroscope

This menu is used to recalibrate the gyroscope. The machine must not be moved during the calibration.

4.3.4.4 Motor Power

The motor power must be high enough to overcome an unevenness or a slope. Otherwise it must not be too high, because the control system uses the current value to detect an obstacle.

The motor power can be set to:

- Average.
- Low.

NOTICE

Do not modify the motor power without the consent of your local Lely service provider.

4.3.4.5 Wheel Diameter

Specifies the diameter of the wheels. The default diameter is 250 mm.

NOTICE

Do not modify this setting when the wheel diameter is not changed. This affects the route accuracy.

4.3.4.6 Beep Length

This menu is used to set the duration of the beep. The default length is 200 mSec. This setting is for all routes. When the value is set to zero, the beep is switched OFF.

4.3.4.7 Reset Report

This menu resets the service information data.

4.3.4.8 Fill Water

The menu **Fill water** is used to:

Set the **Push Power Fill** (default 15.5 A). The power the machine exerts on the water filling station must be high enough to open the water valve without causing damage.

Set the **Pumpcurrent** (default 1000 mA). The pump must stop when the water tank is empty. When the pump current drops below the set value, the pump stops.

Set the water fill function (**Water in use**) On or Off. When this setting is off, the machine does not stop at the water filling station when it starts a route. This setting can be used to clean the barn without the use of water, for example during periods of frost. When the setting is off, the machine skips a visit to the water filling station and continues the route immediately.

4.3.5 Alarms

The machine monitors itself continuously and informs you about the situation. The machine generates alarms and reports.

Alarm list

The alarm list gives a summary of the alarms received. This list stores up to 250 alarms. Once 250 alarms are stored, the next alarm overwrites the oldest alarm of the list (see Alarm List on page 8-3).

Report list

The report list gives a summary of the generated reports (see Report List on page 8-11).

Info list

The list gives technical details. It is used by the service technician (see Information Report List on page 8-13).

Reset list

To delete all alarm, report and info information.

4.3.6 Service

The menu **Service** has the following sub menus:

- **Hour counter** to display the hours in use since the last counter reset.
- **Version** to display the software version.
- **Installation 1** (password protected).
- **Installation 2** (password protected).

- **Tests service** (password protected).

4.3.7 Test Route

The test procedure **Test route** is used to test a selected route.

4.4 Operation

4.4.1 Routes, Actions, Manual Routes and Time Paths

Actions Make a Route

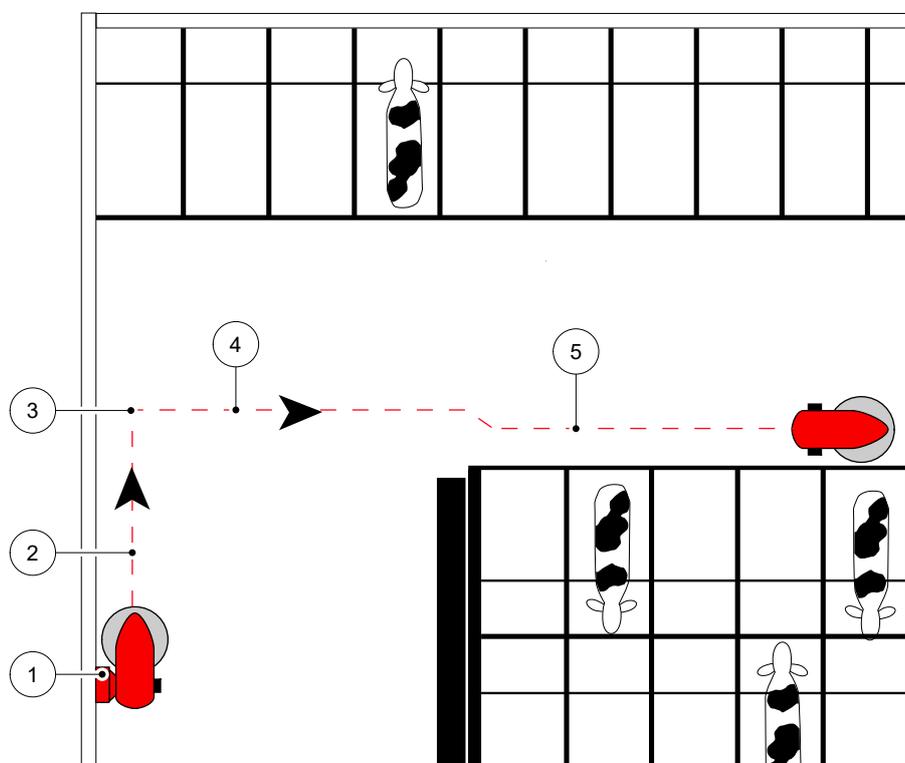
The machine drives through a barn along a programmed route. A route is build up of actions like **Wall flw L** or **Turn R →**. A route in most cases starts, and always ends at the charging station (see figure 17 on page 4-29).

Automatic Cleaning with a Time Path

The machine cleans the barn each day automatically on the same time if a time path is set and switched **On** (see Time Path on page 4-20).

Manual Cleaning with Manual Routes

It is useful to enable **MANUAL ROUTE**. You then can clean a part of the barn whenever you want or test a route. It is also useful to program routes from different points in the barn back to the charging station for instance to pick up a lost vehicle.



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Figure 17. Actions make a route

KEY: 1. Charging station - 2. Wall flw L - 3. Turn R -> - 4. Straight - 5. Wall flw R

4.4.2 Control System

The control system keeps the vehicle on the right track.

4.4.2.1 Driving Distance

The encoders on the drive motor measure the number of rotations of the motor shafts. This value is used to calculate the travelled distance. If, due to slip, the actual driving distance is less than calculated, it can only be corrected if the action ends at a bump point (a collision point with a wall). If an expected bump point is not reached, the machine continues driving for a limited distance.

The driving distance is corrected in the software, so the next time the machine drives a bit further. On the other hand, if a bump point is reached earlier than expected, it is also corrected. These corrections are deleted when you reset the ADS3840 PCB.

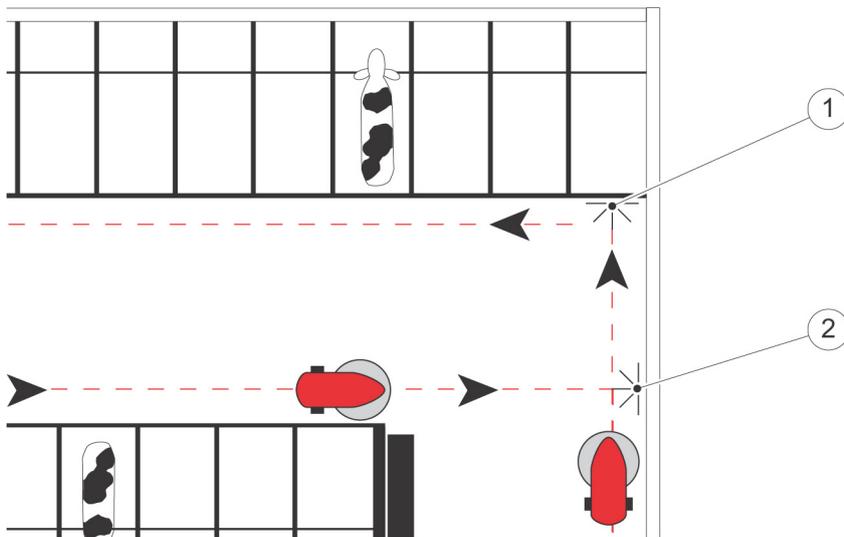


Figure 18. Bump points to correct the driving distance

KEY: 1. Bump point - 2. Bump point

4.4.2.2 Speed

The number of revolutions of the motors are also used to calculate the speed. The speed can be set for a route or for an action in a route.

4.4.2.3 Distance to a Wall

The ultrasonic sensor sends a pulsed ultrasound wave at an object and then measures the time for the sound echo to return.

4.4.2.4 Direction

At the start of a route, the angle with the wall is 0 degrees. During the route the gyroscope calculates each deviation from a straight line. This information is used to control the direction of the vehicle. This is especially important during so called 'short actions', when there is no contact with the wall.

Short actions

Short actions are:

- **Straight.**
- **Turn L ←.**
- **Turn R →.**

Due to a combination of factors like skidding, obstacles or drift from gyroscope, the calculated angle with the wall may differ from the actual angle. This can cause the vehicle to drive in the wrong direction. This is no problem if the control system is able to correct itself during a 'long action'.

Long actions

Direct wall contact with the sensing wheel or indirect wall contact with the ultrasonic sensor are used to keep the machine in the correct direction. This is the case during:

- **Fill water**
- **Wall flw L.**
- **Wall flw R.**
- **Ultrasound L** (or **Ultrasound R** or **Ultrasound L+R**).
- **Charger**

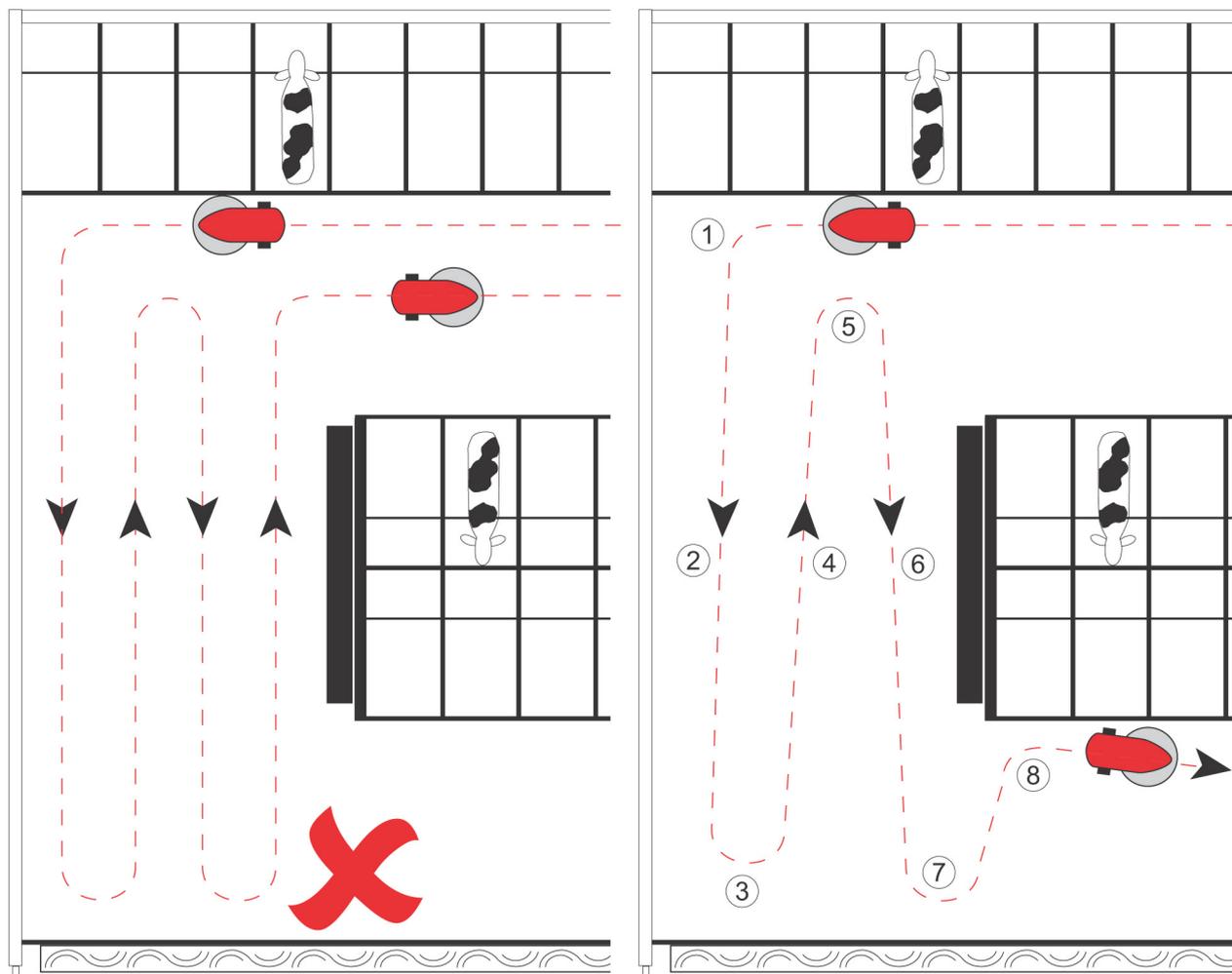
If these actions continue for more than 10 m (33 ft) they are called 'long actions' because then the vehicle passes the 'reset point' (between 3 to 10 m (9.8 - 33 ft)). At that point the angle is reset to 0 degrees and a beep is sound.

'Long actions' compensate for the deviations caused by 'short actions'. It is therefore very important to program a subsequent 'long action' after a succession of 'short actions'.

In a situation with a succession of 'short actions' (**Straight**, **Turn L ←** and **Turn R →**) the vehicle can get lost, due to an accumulation of errors (see figure 19 on page 4-32).

The risk of deviating from the programmed route can be minimized when (see figure 20 on page 4-33):

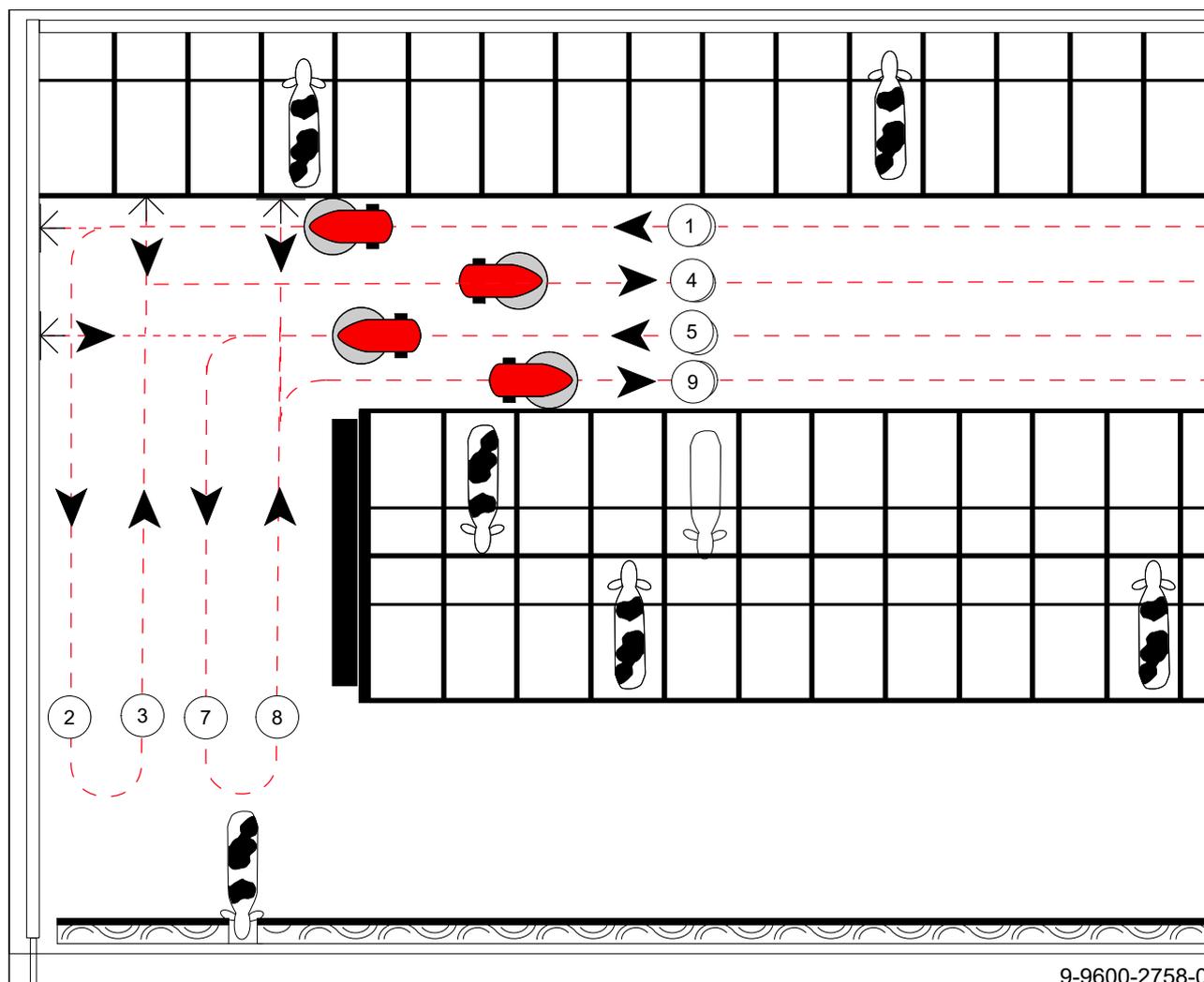
- The machine has contact with the wall, barn or feed fence, either direct (**Wall flw L** or **Wall flw R**) or indirect (**Ultrasound L**).
- Bump points enable the control system to compare the travelled distance with its own information.
- 'Short actions' are mixed with 'Long actions' to correct the direction.



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Figure 19. Example situation of short routes resulting in errors; left side: programmed route, right side: resulting route

Number	Explanation
1	The vehicle doesn't reach the wall, due to skidding. There is no bump point to correct this error.
3, 5, 7	Due to deviations in the gyroscope (drift) and/or skidding the turns are less than 180 degrees.
2, 4, 6	The errors are not corrected while driving straight.
8	The vehicle bumps the cubicle, tries to go on and eventually gets lost.



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Figure 20. Alternation of short and long actions

Number	Explanation
1	The vehicle follows the cubicles on the right side until the wall (bump point).
2	The vehicle follows the wall on the right side up to a certain distance from where cows are eating, followed by Turn L ←- .
3	The vehicle follows the wall on the left side (Ultrasound L), until the cubicles (bump point).
4	The vehicle drives back and follows the cubicles on the left side (Ultrasound L).
5	The vehicle follows the cubicles on the left side with Ultrasound L followed by Straight until the wall (bump point).
6	The vehicle drives back followed by Turn L ←- .
7	The vehicle drives Straight up to a certain distance from where cows are eating followed by Turn L ←- .

Number	Explanation
8	The vehicle drives Straight until the start of the cubicles on the right, then Wall flw R , followed by Straight until the bump point.
9	The vehicle drives back followed by Wall flw R .

4.4.2.5 Obstacles

If the machine unexpectedly comes across an obstacle, for example the leg of a cow or a pile of manure, the machine acts as follows:

- it reverses and tries again (up to 3 times)
- it reverses and makes a 45 degrees turn to the left or right, depending on the previous action (left or right wall tracking/ultrasonic). If it succeeds in passing the obstacle, it returns to the original route and continues to finish the route.

4.4.3 Power and Water Supply

At the end of a route, the machine drives to the charging station. It stays there until the start of the next route.

Each time the machine starts a route, it first drives to the water filling station (1) (see figure 21 on page 4-35). The water inlet tube enters the funnel shaped water supply tube and opens the mechanically operated shut-off valve. The vehicle stops automatically. The water enters the water tank via a water filter.

When the tank is full, it overflows through the water sensor. The water sensor detects the flow and makes sure the machine drives back (2) from the water filling station and thereby stops the water filling process.

After that, the machine turns to the right (3), drives alongside the water filling station (4) and (5) and continues its route (6).

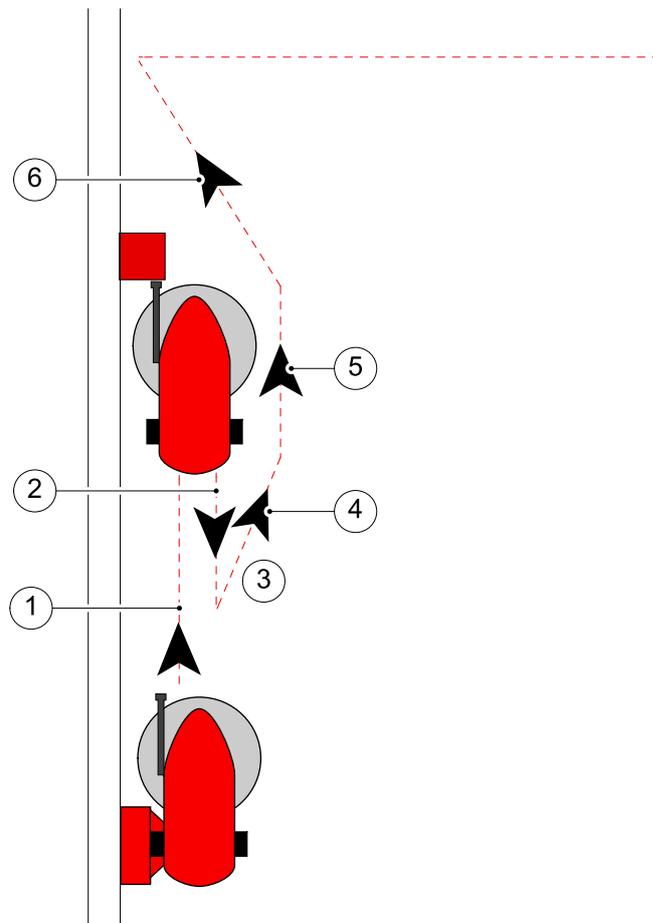


Figure 21. Start of a route

4.4.4 Cleaning

The nozzle sprays water just in front of the manure scraper to soften the manure. The manure scraper pushes the manure over the slatted floor until it falls through the gaps.



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5 Operating Instructions

5.1 Install or update the Lely Control App on your Smartphone

1. On an Android smartphone go to the Google play store, on an iPhone go to the Apple app store.
2. Download the Lely Control app.
3. Install the app.
4. Wait until the software is correctly installed.
5. The first time you start to control the machine with the software on the Android smartphone, you must enter a password. Ask your local Lely service provider for the password.
6. The first time you start to control the machine with the software on the iPhone:
 1. You must pair the machine in the bluetooth list of devices on the iPhone and enter the password 0000.
 2. Check in the list of Bluetooth devices if the machine is connected, tap once to connect if it is not connected.

In case of problems with connection to your iPhone see the troubleshoot table (see Troubleshooting Table iPhone on page 8-18).



If there is new software available, a notification is displayed on the icon of the Google play / Apple app store.

5.2 Rename the Machine on the Smartphone

NOTICE

The device name of the machine that is displayed on the smartphone can only be modified by a certified Lely technician.

5.3 Set the Farmer Password

NOTICE

The farmer password must be set by a certified Lely technician.

NOTICE

It is recommended to use the same password for all smartphone controlled machines on a farm.

5.4 Remove or install the Covers

Preparation

1. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
2. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).

Removal

1. Loosen the bolt (1) on the upper side of the upper cover (3).
2. Rotate (A) the upper cover (3) towards the front side of the vehicle to remove the upper cover from the chassis (4).
3. Only if necessary, remove (B) the lower cover (6) from the vehicle.

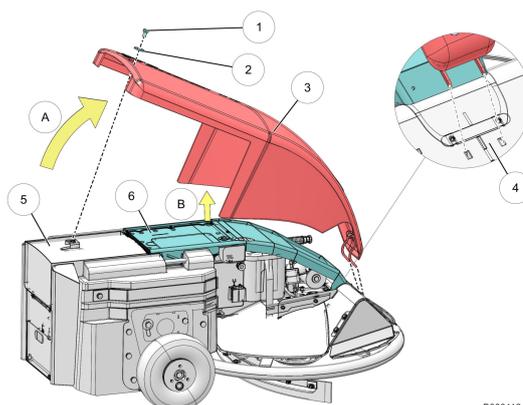


Figure 22. Remove or install the covers

KEY: 1. Bolt - 2. Washer - 3. Upper cover - 4. Frame - 5. Water tank - 6. Lower cover

Installation

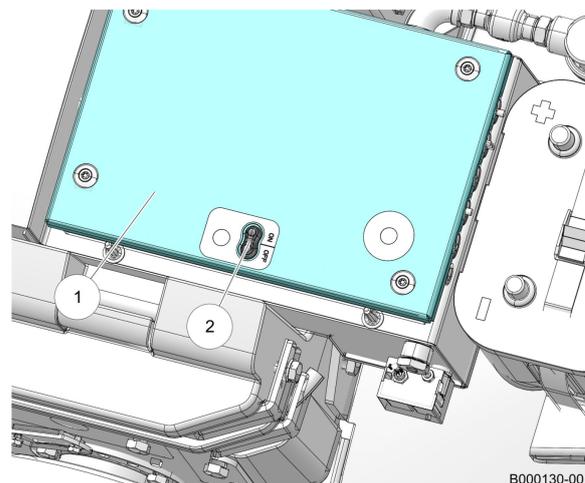
1. Reinstall the lower cover (6).
2. Put the bracket of the upper cover in the slot at the front side of the of the machine (4).
3. Lower the upper cover (3) at the rear side.
4. Install the bolt of the upper cover (1).

Close-up

1. Manually drive the machine to the charging station (see Manually drive the Machine on page 5-6).
2. Start the time path to put the machine into operation (see Start or Stop the Time Path on page 5-32).

5.5 Switch Off the Machine

1. Make sure the machine is not connected to the charger, if necessary drive the machine away from the charger (see Manually drive the Machine on page 5-6).
2. Remove the upper and lower cover (see Remove or install the Covers on page 5-2).
3. On the PCB box, push the button [OFF] (2) to switch off the power.
4. Install the covers (see Remove or install the Covers on page 5-2).



KEY: 1. PCB box - 2. On/Off button

5.6 Switch On the Machine



WARNING

***Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.***

1. Remove the upper and lower cover (see Remove or install the Covers on page 5-2).

2. On the PCB box, push the button [On] (2) to switch on the power.
3. Install the covers.

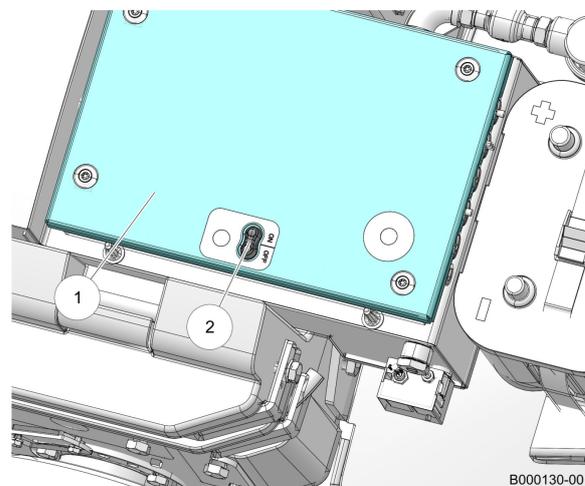


Figure 23. ON switch

KEY: 1. PCB box - 2. On/Off button

5.7 Start the Lely Control Application

WARNING

***Unexpected movement of vehicle.
Risk of personal injury.
Make sure the machine is in your line of sight. Remote operation of the smartphone or tablet by remote desktop software (such as, but not limited by, Teamviewer) is strictly forbidden to avoid dangerous situations.***

NOTICE

Make sure you are in the vicinity of the machine when you want to connect the phone to the machine. If the distance is too big, it will not appear in the list on the smartphone display.

NOTICE

The device name of the machine that is displayed on the smartphone can only be modified by a certified Lely technician.

NOTICE

Sometimes the phone must be paired with the machine before you can do the procedure below.

NOTICE

The machine can not be connected to more than 1 smartphone simultaneously.

On the smartphone:

1. Start the Lely Control app.
2. If bluetooth was not in operation the following question (or similar) appears: **The application tries to switch on bluetooth, continue?**
3. Push **Yes**.
4. Push the line **Search for devices**. The devices near the smartphone will be found. If one or more devices are not found, repeat this step.
5. Push the line with the machine you want to operate. A connection will be made with the selected machine. A green light is displayed in the title when the connection is made. The smartphone shows a set of control buttons and a display that can be used to operate the software. If the smartphone loses connection the green light turns red. Move towards the machine and make the connection again.
6. Push .
7. If the machine was switched off, calibrate the gyroscope (see Calibrate the Gyroscope on page 8-19).

The buttons have the following function:

-  Execute the command on the display above the applicable soft button.
-  Starts or stops on action.
-  Moves the selector up one item or increases a value by one.
-  Moves the selector down one item or decreases a value by one.
-  Opens the selected function or the next menu screen.
-  Returns to the previous screen.
-  Reduces the speed of the vehicle.

5.8 Manually drive the Machine

1. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
2. Push twice to select the menu **MANUAL DRIVING**.
3. The message **SAFETY WARNING. Manual operation is permitted only with a clear overview of the vehicle. Confirm?** appears on the smartphone display.
4. Confirm if you have a clear view on the machine.
5. In the menu **MANUAL DRIVING** Push:
 - **L** to select the left motor. The vehicle turns right when it is manually driven, or
 - **R** to select the right motor. The vehicle turns left when it is manually driven, or
 - **L and R** (both motors) to go straight forward or backward.
6. Push to change the direction, if necessary.
7. Push to start, hold it.
8. Release to stop.

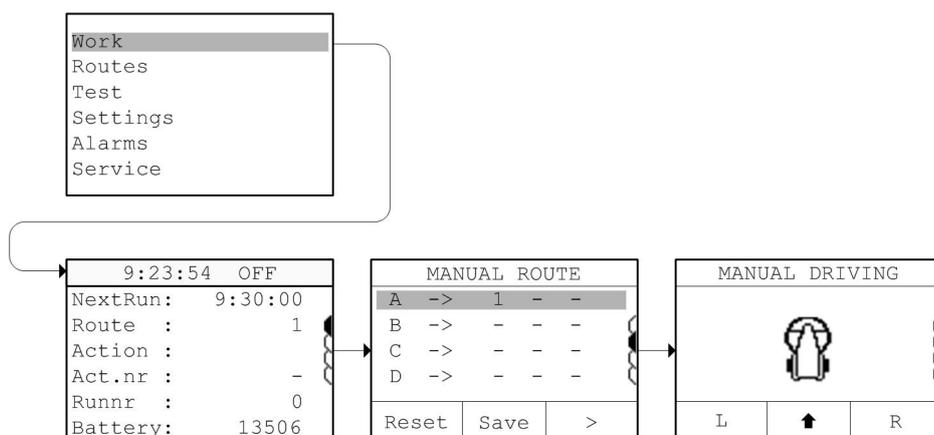


Figure 24. Manual driving

5.9 Drive the Machine to the Charging Station

1. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
2. Manually drive the machine to the charging station and stop at a distance of 1.5 - 3 m (5 -10 ft) before the charging station (see Manually drive the Machine on page 5-6).
3. Make sure the vehicle is positioned parallel to the wall and towards the charger. The machine will use 'Wall follow' to drive to the charging station until it connects to the charger.
4. Push to select the menu **MANUAL CHARGER**.

5. In the menu **MANUAL CHARGER** push:
 - **L** if the charging station is on the left side.
 - **R** if the charging station is on the right side.
6. Push to start.

NOTICE

The machine approaches the charging station and stops by itself.

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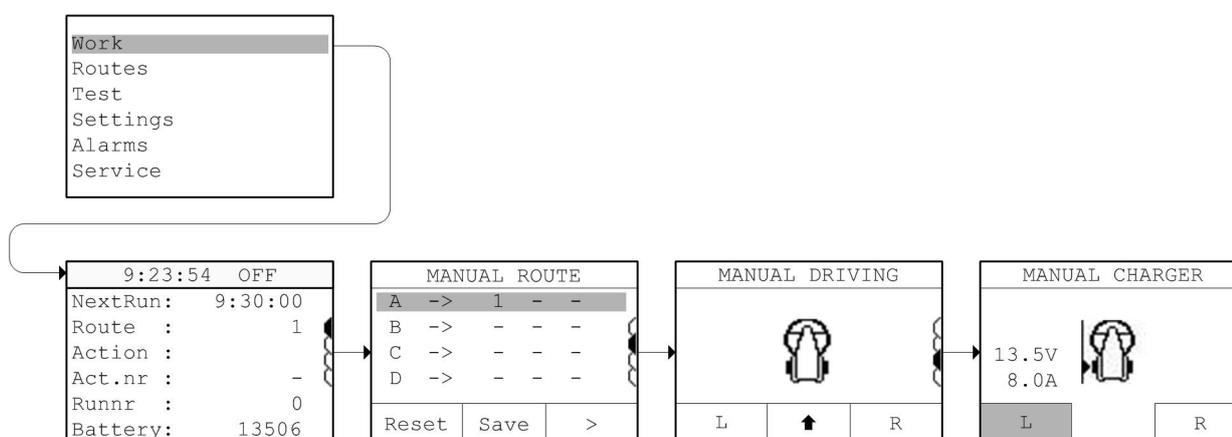


Figure 25. Manual charger

5.10 Switch ON or OFF the Water Filling Function (OFF during Wintertime)

Switch OFF the water fill function

The water filling function must be switched Off and the header tank (if present) and the water tank must be drained before the environmental temperature drops below freezing point. Lely Industries N.V. will not take any liability for damage due to frost.

1. If a header tank is present: Switch off the water supply to the header tank.
If no header tank is present: Switch off the water supply to the water filling station.
2. Push against the water outlet of the water filling station until the tank is empty, and if present also the header tank must be empty.
3. Let the machine drive routes while spraying water until the water tank in the machine is empty.
4. Set the water fill function **Off** (see Set the Water Fill Settings on page 7-3).

Switch ON the water fill function

1. Switch on the water supply to the header tank (if present) or to the water filling station.
2. Set the water fill function **On** (see Set the Water Fill Settings on page 7-3).

5.11 Prepare for Route Programming

5.11.1 Requirements for a good Route

NOTICE

Be aware of the intended use before programming the Discovery (See chapter Intended Use).

Make it possible for the machine to correct itself

- Include as many bump points as possible in all directions. If, due to slipping, the bump point is not reached in time, the machine continues until the bump point is reached. This improves the reliability of the route.
- Be aware that actions like **Turn** and **Straight** may cause inaccurate results. Make sure the vehicle cannot get stuck after making a turn or driving straight. Program a 'long action' (wall contact: **Wall follow** or **Ultrasound**) after a 'short action' (no wall contact: **Turn** or **Straight**) (see Direction on page 4-30).
- If the vehicle follows the wall or cubicle row (**Wall follow** or **Ultrasound**) and if there is a bend, stop the vehicle, program a turn and go on to follow the wall (see To follow a Bend in a Wall on page 5-18).

Make it easy for yourself

- Program routes from different positions in the barn back to the charging station. This will enable you to easily return the vehicle back to the charging station in case it gets lost.
- Make a backup after programming a route.

Adapt the route or settings to the herd

- The beep can be modified separate for each route. If the beep length is set to 0, the beep is switched **Off**. If a warning signal is given, the cows have time to move out of the way. However, the sound may equally well disturb other cows (see which settings suit your herd best).
- Set the speed to a lower level for parts of the route or the whole route if the cows are disturbed (see Set the Speed for a Particular Action on page 5-35).

Only spray water when needed

The water tank capacity is 30 L (7.9 gal), which is enough for approximately 30 minutes of spraying. As a result the machine must return to the water filling station (and the charging station) for a refill.

5.11.2 Example Routes, Barn with Milking Robot

In the example situation, the barn is divided into 3 areas. The time path has different routes to clean each area:

Route 1

The area behind the cubicles is most extensively polluted (see figure 26 on page 5-9). It should be cleaned each hour at least.

Route 2

The walking alley should be cleaned 4 to 6 times a day (see figure 27 on page 5-10). Because the area behind the cubicles should be cleaned often, the route combines cleaning the walking area and the area behind the cubicles. It is useful to clean the walking area just before you enter the stall, for instance at 7:00, 12:00, 17:00 and 22:00 hour.

Route 3

The area between the cubicles and the feeding fence should be cleaned no more than 2 times a day, preferably at night (see figure 28 on page 5-10). Cows should not be disturbed when eating.

Time path based on these routes

To keep the battery healthy, the driving time must be less than 40% of the total time (so charging time is 60% or more of the total time). If the routes in these 3 examples take less then 24 minutes to drive, the time path can be set based on these 3 routes. To see how to set a time path: (see Set a Time Path on page 5-29) .

Also keep in mind that after ending the first route after midnight the machine will charge until the batteries are completely full. Routes with a start time during this charging period are skipped and will not be driven. A full charge cycle can take between half an hour and 3 hours.

Time	Route	Time	Route
00:00	3	12:00	3
01:00	1	13:00	1
02:00	1	14:00	1
03:00	1	15:00	1
04:00	2	16:00	2
05:00	1	17:00	1
06:00	1	18:00	1
07:00	1	19:00	1
08:00	2	20:00	2
09:00	1	21:00	1
10:00	1	22:00	1
11:00	1	23:00	1

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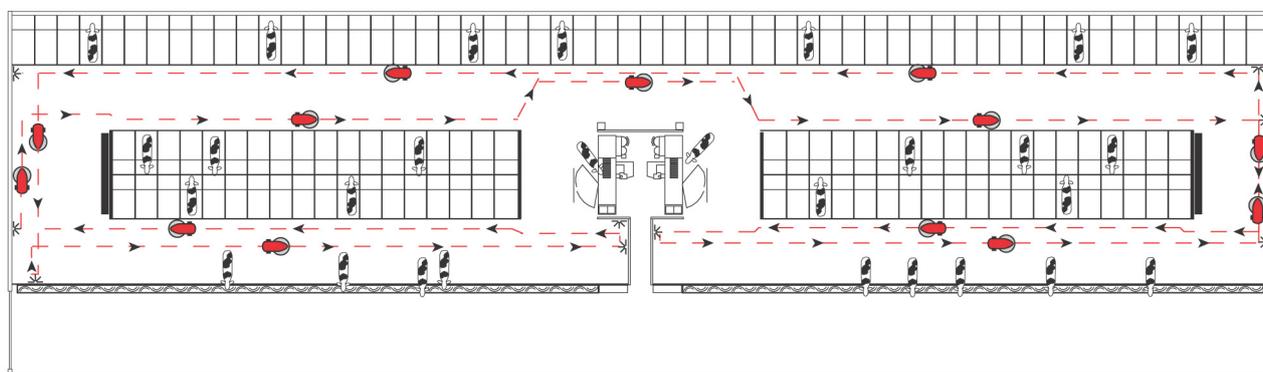


Figure 26. Route 1, clean all areas behind the cubicles each hour

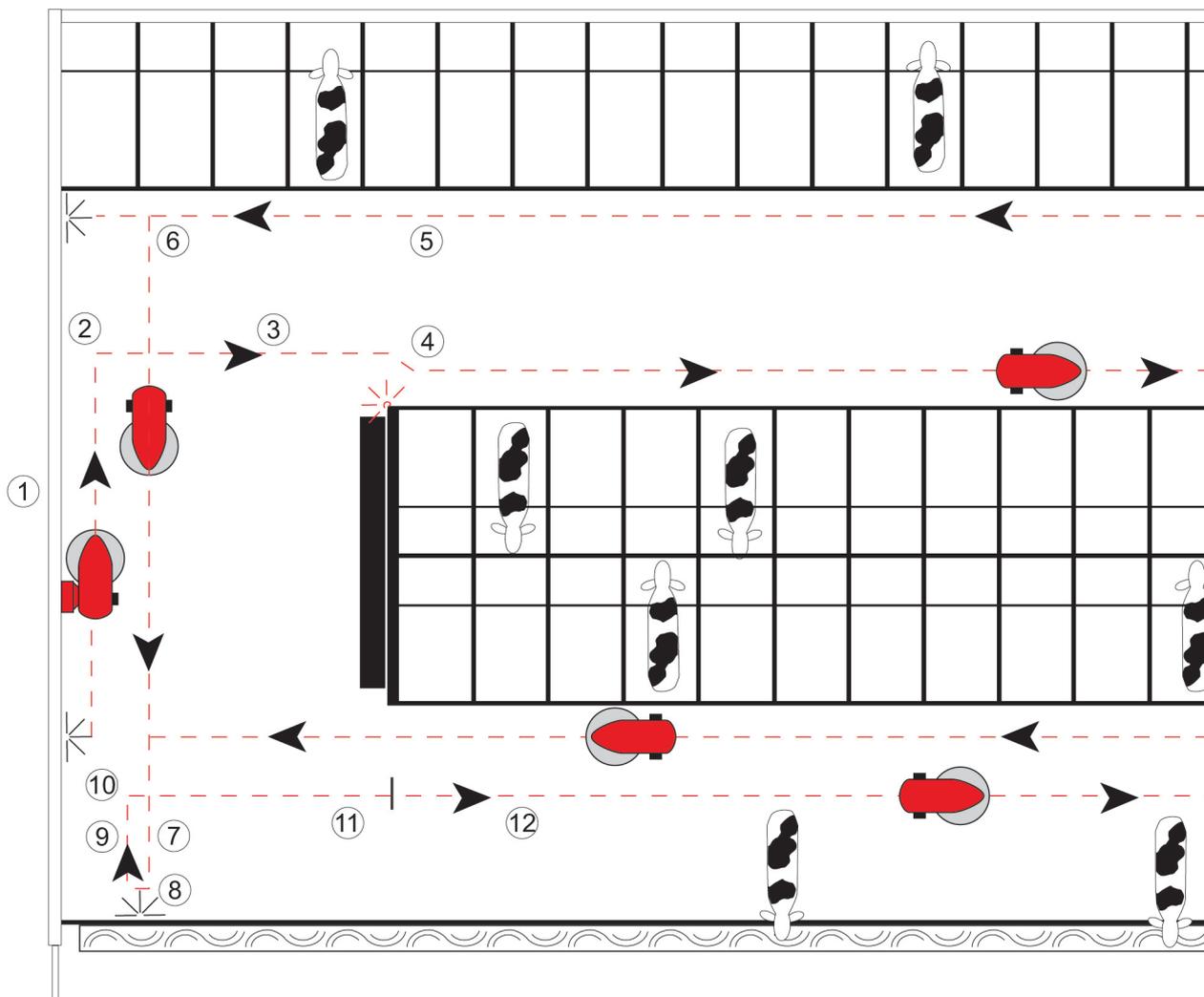
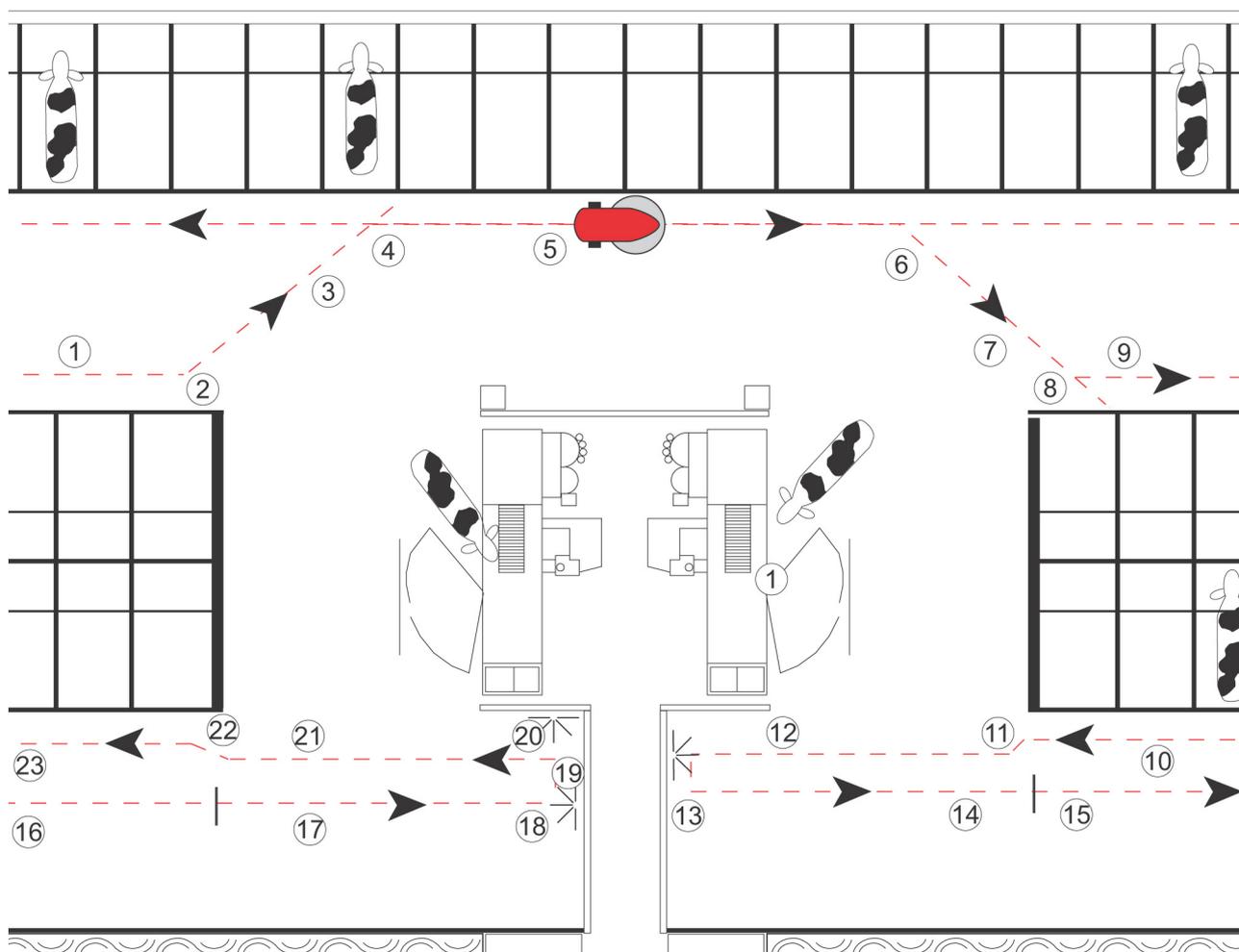


Figure 29. Example actions (left side)

Number	Action	Explanation
1	Wall flw L	Follow the wall is always the first action, necessary to leave the charging station.
2	Turn R → (90 degrees)	Standard turn. Make sure the vehicle will not hit the cubicle wall after action 3. Else modify the turn.
3	Straight	Driving straight is the only option because the distance to a wall is more than 2 meter.
4	Wall flw R	Vehicle will turn right until it hits the cubicle floor and will then follow the cubicle floor. Although it is easier to clean the left side first, this is not allowed because cows can get hurt, due to the opening for the ultrasonic sensor.
5	Wall flw R	Follow the cubicle floor until the wall (bump point).
6	Turn L ← (90 degrees, 1000 mm back)	Standard turn 90 degrees. Modify turn: back 1000 mm before turning.

Number	Action	Explanation
7	Straight	Drive straight until the wall (bump point).
8	Turn R → (180 degrees)	Standard turn R (180 degrees).
9	Straight	
10	Turn R → (90 degrees)	Standard turn 90 degrees, modify if the nose of vehicle doesn't point in the correct direction.
11	Straight	Straight until the first cubicle on the left side.
12	Ultrasound L	Ultrasound drive (1100 mm).

The following figure shows the actions of route 1 in the middle of the barn, the table below explains each action. Refer to the complete picture for an overview.

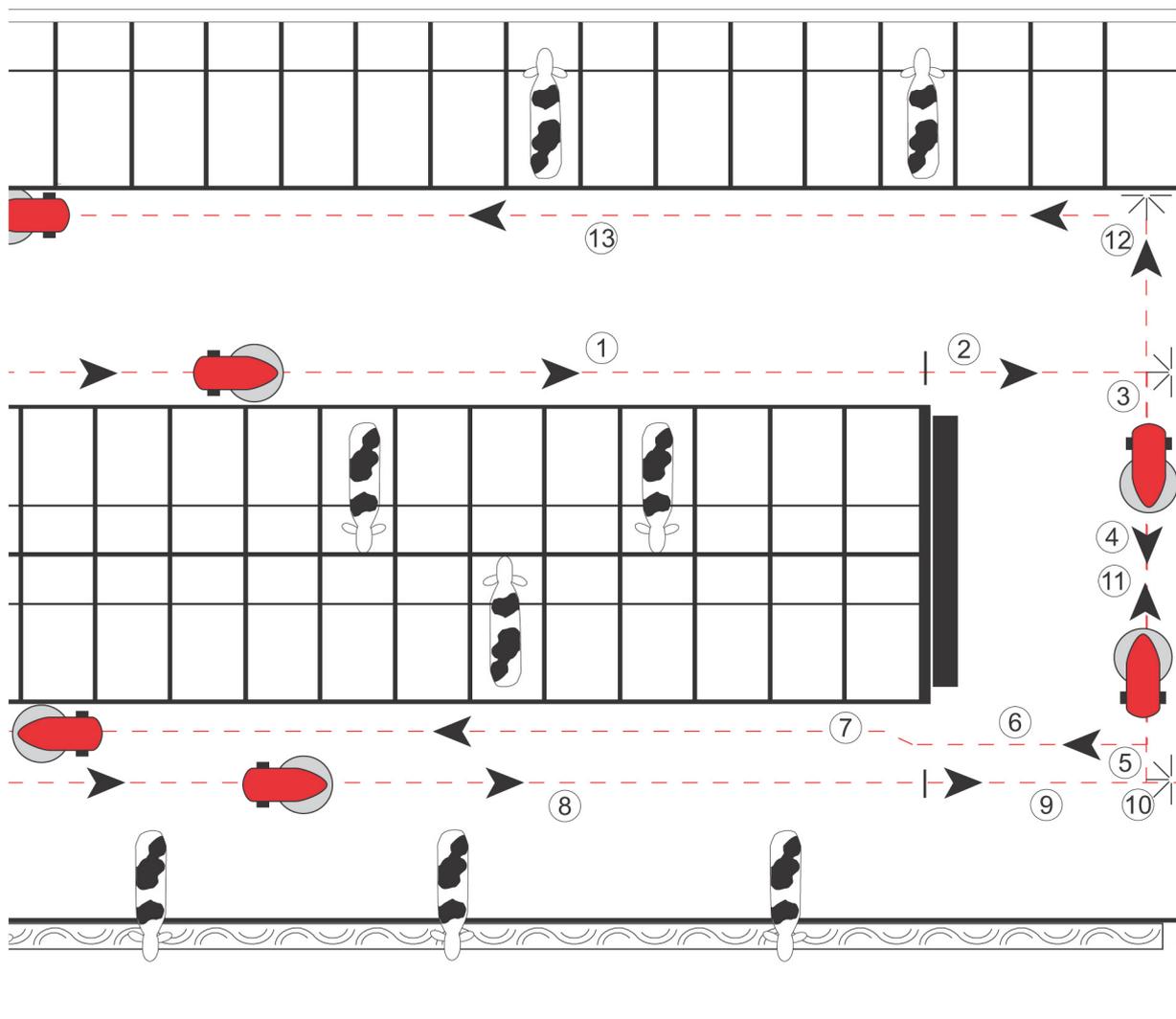


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Figure 30. Example routes (middle part)

Number	Action	Explanation
1	Wall flw R	Follow the cubicle floor until the end of the cubicle row.
2	Turn L ←- (45 degrees)	
3	Straight	Drive straight.
4	Turn R → (45 degrees)	
5	Wall flw L	Follow the cubicle floor
6	Turn R → (45 degrees)	
7	Straight	Drive straight
8	Turn L ←- (45 degrees)	
9	Wall flw R	
10	Wall flw R	
11	Turn L ←- (10 degrees) Straight Turn R → Turn R → (5 degrees)	Move to the left to prevent hitting the wall after crossing over.
12	Straight	Drive straight until bump point.
13	Turn L ←- - (180 degrees)	Standard turn, stop in adjacent lane.
14	Straight	
15	Ultrasound L	Ultrasound drive 1100 mm.
16	Ultrasound L	Ultrasound drive 1100 mm.
17	Straight	Drive straight until bump point.
18	Turn L ←- (90 degrees)	
19	Wall flw R	Follow wall until bump point.
20	Turn L ←-	Standard turn, back 500 mm.
21	Straight	Drive straight until begin of cubicle row.
22	Turn R → (10 degrees)	
23	Wall flw R	

The following figure shows the actions of route 1 on the right side of the barn, the table below explains each action. Refer to the complete picture for an overview.



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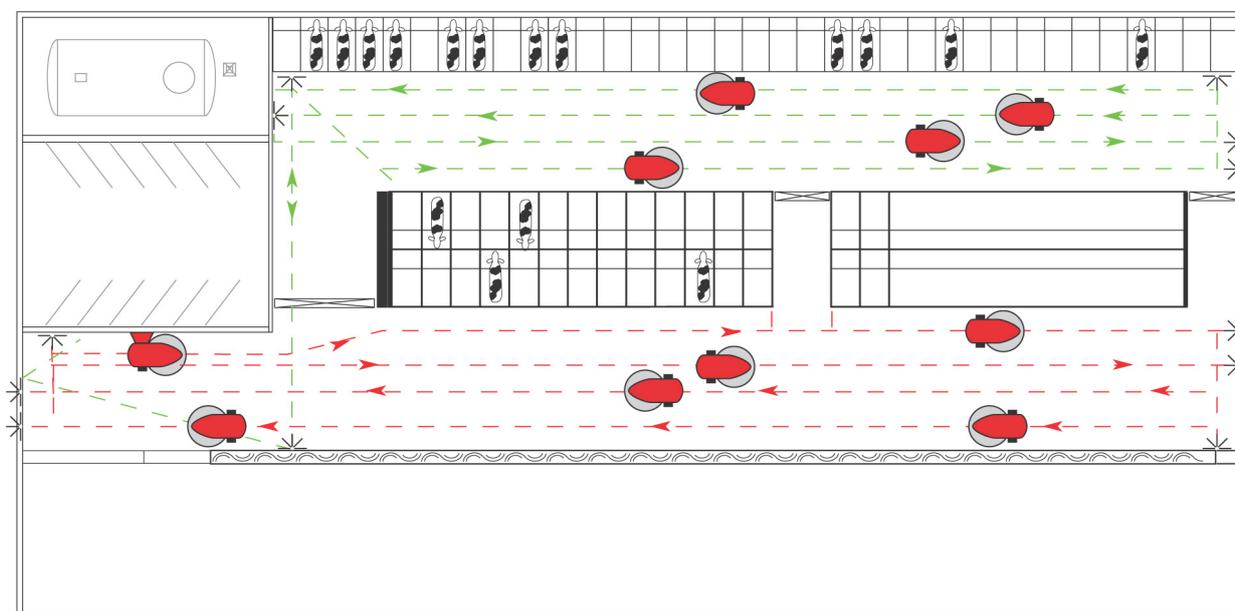
Figure 31. Example actions (right side)

Number	Action	Explanation
1	Wall flw R	Follow the wall until the end of the cubicle row.
2	Straight	Drive straight until bump point.
3	Turn R → (90 degrees)	
4	Wall flw L	
5	Turn R → (90 degrees)	
6	Straight	Drive straight until start of a cubicle row.
7	Wall flw R	
8	Ultrasound L	Ultrasound drive 1100 mm until end of the cubicle row.
9	Straight	Drive straight until bump point
10	Turn L ← (90 degrees)	
11	Wall flw R	Follow the wall until bump point

Number	Action	Explanation
12	Turn L ← (90 degrees)	
13	Wall flw R	

5.11.3 Example Route, Barn with Milking Parlour

In a barn with a milking parlour the situation is different from a barn with a milking robot. There is no free cow traffic to the milking parlour. If the cows are milked, a half of the barn is closed and can be cleaned.



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Figure 32. Example route, barn with milking parlour

5.11.4 To pass a Crosswalk

If the machine passes a crosswalk between two cubicle rows, the direction must be corrected to avoid hitting the opposite cubicles. The next figure and the corresponding table with actions show how to do this.

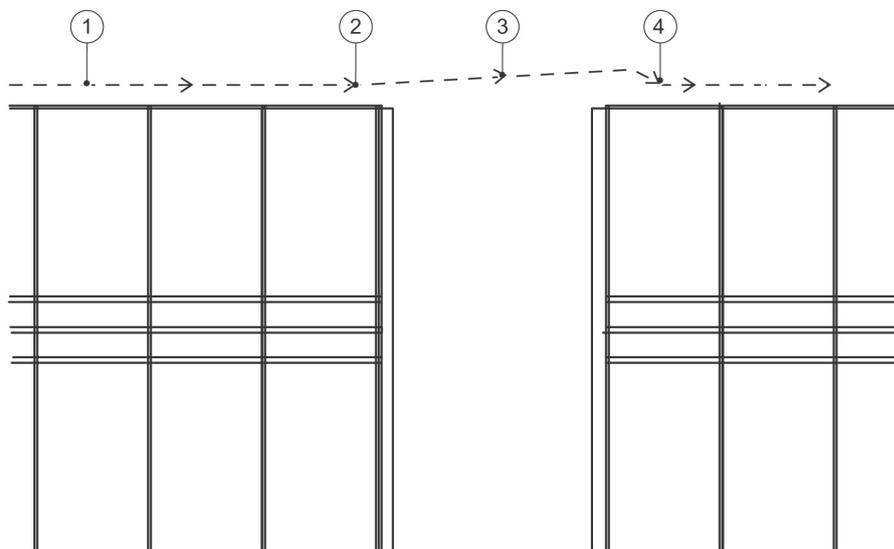


Figure 33. To pass a crosswalk

Number	Action	Explanation
1	Wall flw R	Follow the cubicles row, stop at the end.
2	Turn L ←	Turn left, 5 degrees.
3	Straight	Drive straight until middle of the next cubicle.
4	Wall flw R	Follow the wall, the machine automatically turns to the cubicles.

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5.11.5 To make a Turn

Turn to clean the next (adjacent) lane

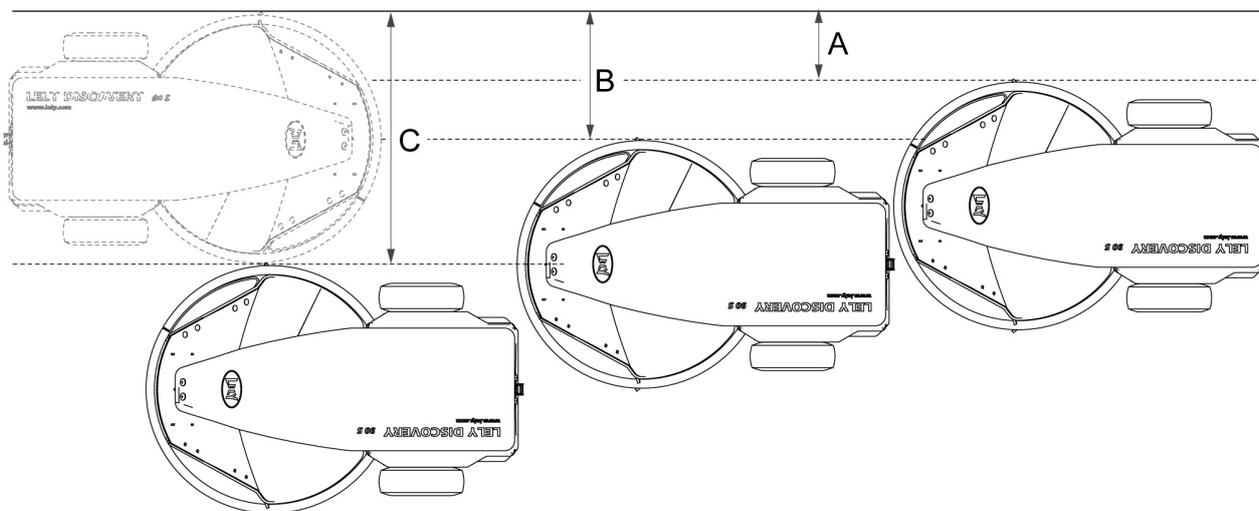
When the machine approaches a wall and must be turned 180 degrees to clean the next lane, it must:

- Hit the wall (bump point).
- Drive back to enable turning.
- Turn 180 degrees with a certain radius.

You can choose from 4 standard turns, both left and right each with a different radius:

- Go back, turn 180 degrees, stop in the next lane 80 cm (31 in) to the right or left (to clean the next lane).
- Go back, turn 180 degrees, stop in the next lane 40 cm (16 in.) to the right or left (to clean the next lane and also half of the former lane).
- Go back, turn 180 degrees, stop in the next lane 20 cm (8 in.) to the right or left (to clean the next lane and also three quarter of the former lane).
- Go back, turn 180 degrees, stop in the same lane (to clean the same lane again).

The next figure shows the options.



KEY: A: 20 cm (8 in) B: 40 cm (16 in) C: 80 cm (31 in)
--

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5.11.6 To approach the Charging Station from the opposite Direction

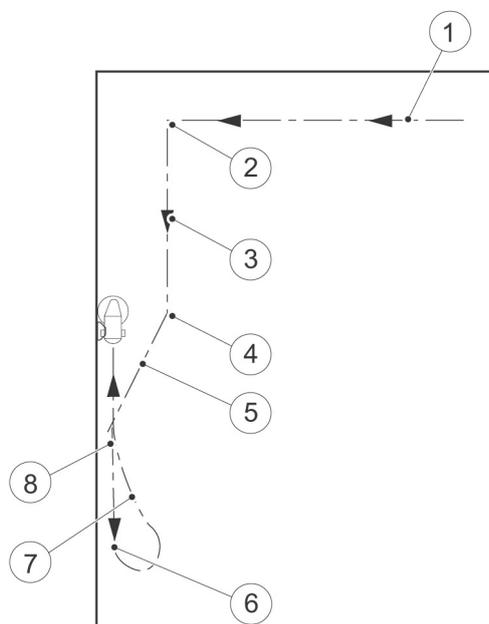


Figure 34. Approach the charging station

Number	Action	Explanation
1	Wall flw R	Follow the wall on the right side.
2	Turn L ←	Turn left.
3	Straight	Drive straight.

Number	Action	Explanation
4	Turn R →	Turn right 20 degrees.
5	Wall flw R	Follow the wall on the right side.
6	Turn L ←	Turn L 180 degrees.
7	Wall flw L	Follow the wall until 1.5 - 3 m (5 - 10 ft.) from the charging station.
8	Charger	Go to the charging station.

5.11.7 To follow a Bend in a Wall

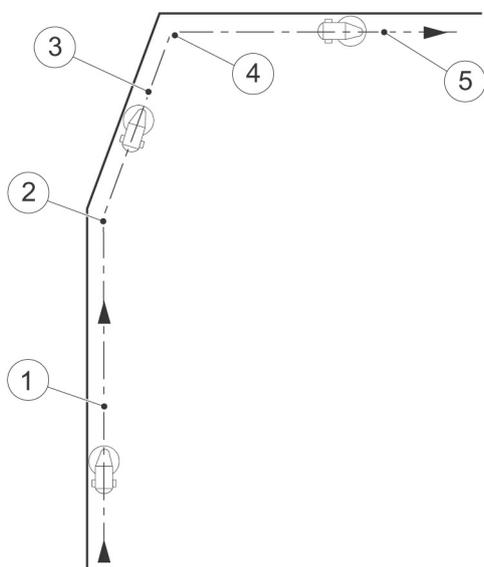


Figure 35. Follow a bend in a wall

Number	Action	Explanation
1	Wall flw L	Wall follow.
2	START/STOP	Stop the wall follow action.
3	Wall flw L	Wall follow (no turn action needed because the angle < 20 degrees).
4	Turn R →	Turn right, nose in drive direction.
5	Wall flw L	Wall follow.

5.12 Route Programming

5.12.1 Program a new Route

NOTICE

Be aware of the intended use before programming the Discovery (See chapter Intended Use).

Preparation

1. Make sure you understand the requirements for setting up a good route .
2. Plan the route on a piece of paper.
3. .
4. Stop the time path to take the machine out of operation .

Program

1. In the main menu of the Lely Control app, select **Routes** and push .
2. Select the menu **New route** and push .



If the machine is not connected to the charging station, you can push soft button  **CHARGE** to drive the machine to the charging station .

3. The message **SAFETY WARNING. Manual operation is permitted only with a clear overview of the vehicle. Confirm?** appears on the smartphone display.
4. Confirm if you have a clear view on the machine.
5. Push soft button  **START**.
6. Read the messages on the display and push  (2x).
7. Program the first action (**Fill water**)

8. Program the actions in the route:
 - **Fill water**
 - **Wall flw L** .
 - **Wall flw R**.
 - **Straight**.
 - **Turn R →** .
 - **Turn L ←**.
 - **Ultrasound L** or **Ultrasound R** or **Ultrasound L+R** .
 - **Charger**.
9. If the machine has returned to the charging station within 1-3 m (3.2 - 9.8 ft), go to the charging station, else repeat step 6 .
10. Push soft button  **EXIT**.
11. Push soft button  **Yes** to save the new route.

Close-up

1. Test the route .
2. Make a backup of the route .

5.12.1.1 Follow a Wall (Left or Right)

NOTICE

Try to avoid to move past cows on the left side, they may get hurt due to the opening for the ultrasonic sensor (see figure 36 on page 5-21).

NOTICE

If the angle between the machine and the wall is more than 30 degrees, you must program a '**Turn**' action first before you program a '**Follow wall**' action (see figure 36 on page 5-21).

1. If the wall is:
 - On the left side, select the menu **Wall flw L** and push .
 - On the right side, select the menu **Wall flw R** and push .
2. Push  to start.



Build in as many bump points as possible in all driving directions.

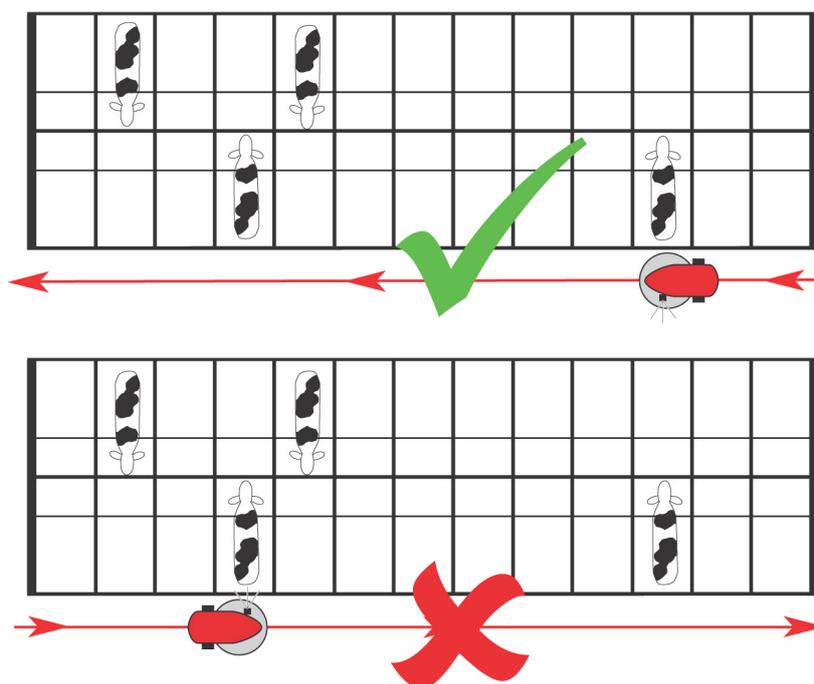
3. If the machine approaches a bump point (approx. 30 cm (12 in)):

1. Push  to smoothly reduce speed.
2. Push  to stop the machine immediately.

NOTICE

The display shows the status (**Manual stop** or **Bump stop**) and the travelled distance (in mm).

4. Push soft button  **Save**.



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Figure 36. Try to avoid to move past cows on the left side

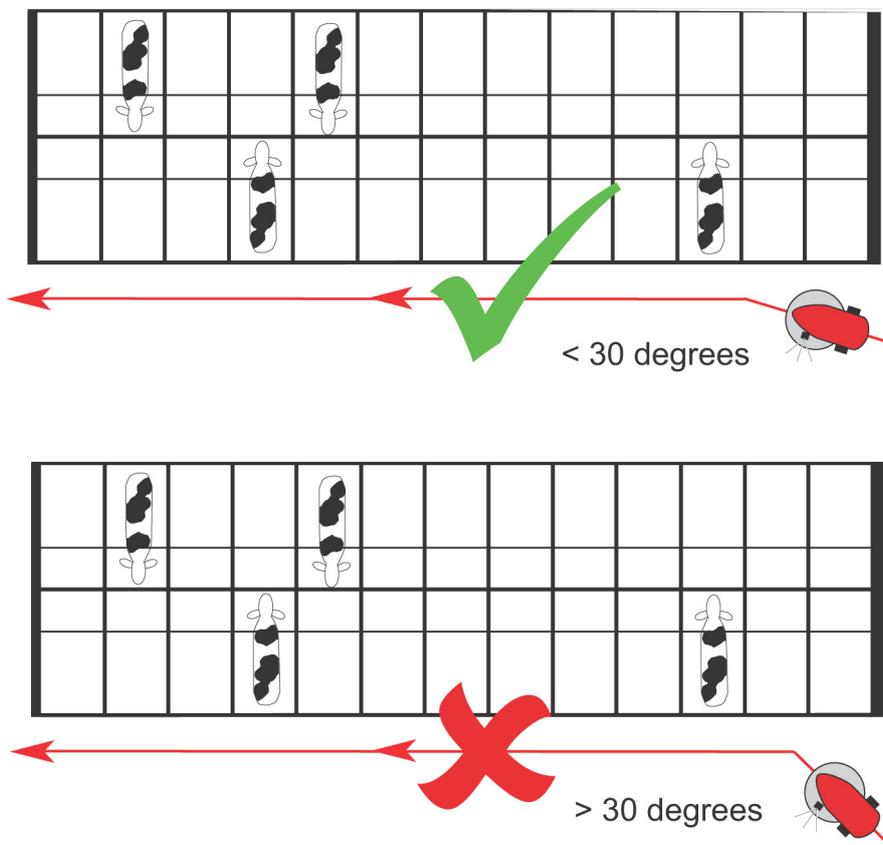


Figure 37. Never make an angled start (>30 degrees)

5.12.1.2 Go Straight

NOTICE

When moving straight forward, the deviation can be more than 10%. Take this into account when you set up a route. If possible, include a bump point after going straight.

NOTICE

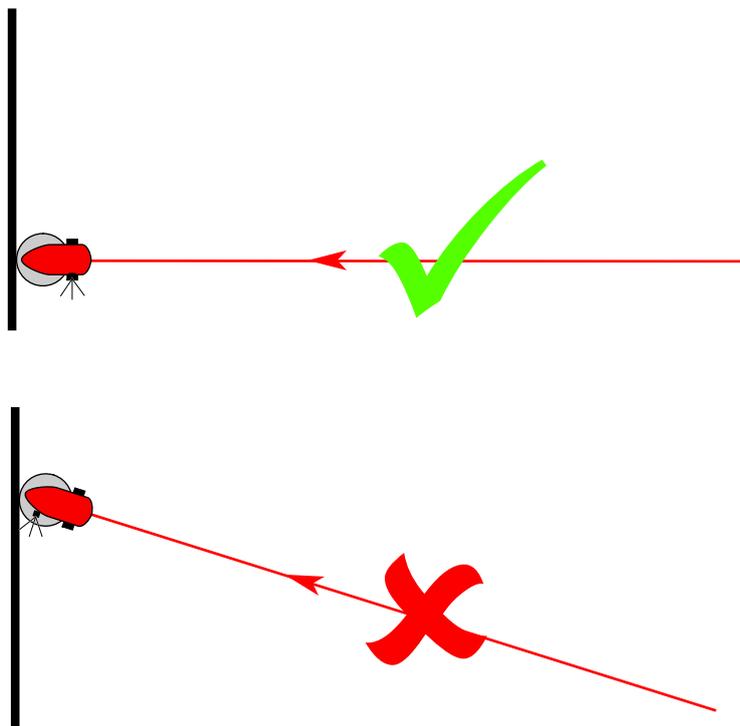
Before starting, make sure the machine points in the correct direction. Use the **Straight** option as little as possible. If it really is necessary, for example to get the machine through a doorway, make the distance travelled as short as possible. Once through the doorway, continue to follow a wall left or right, or **Ultrasound L**. This improves the accuracy of the route that is travelled.

1. Select **Straight** and push .
2. Push  to start.
3. If the vehicle approaches the wall from an angle:
 1. Push .
 2. Turn the vehicle to a right-angled position to the wall (see figure 38 on page 5-24).
 3. Resume driving **Straight**.
4. If the machine approaches a bump point (approx. 30 cm (12 in)), push  to smoothly reduce speed.
5. Push  to stop the machine immediately.



The display shows the status **Manual stop** or **Bump stop** and the travelled distance in mm.

6. Push soft button  **MAN** to modify the position.
 1. Push soft button  [↶] to turn left, or  [↷] to turn right.
 2. Push  to confirm and go one level up.
7. Push soft button  **Save**.



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Figure 38. Avoid angled bumping

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5.12.1.3 Turn Left or Right

1. If you want to turn left, select **Turn L ←** and push .
2. If you want to turn right, select **Turn R →** and push .
3. Read the message on the display and push .



You can choose from 12 standard turns (see Turn Right or Left on page 4-17) and modify the turn afterwards. Preferably do not make sharp turns in heavy polluted areas (less power).

4. Push  until the most appropriate standard turn is displayed, or push **Esc** to go to the previous display.
5. Select one of the standard turns with the appropriate soft button (see Turn Right or Left on page 4-17).
6. If you want to modify the turn angle, push  or  to select the angle.

7. If you want to drive back before making a turn:
 1. Push soft button  to select **Back**.
 2. Push  or  to select the reverse distance.
8. If you want to modify the radius of a turn:
 1. Push soft button  to select **Radius**.
 2. Push  or  to select the radius.
9. Push  to start.



If the made turn is not exactly as planned, modify the position (see the next step). This is above all important if the angle is 90 or 180 degrees left or right.

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10. Push soft button  **MAN** to modify the position.
 1. Push soft button  [] to turn left, or  [] to turn right.
 2. Push  to confirm and go one level up.
11. Push soft button  **Save**.

5.12.1.4 Follow a Wall or Fence on a Certain Distance (Ultrasound)

NOTICE

Do not program **Ultrasound L** when the wall is more than 2 meters away.

1. Select the menu **Ultrasound L** and push .
2. Read the actual distance to the wall (**UltraDst**) from the display.
3. Push  or  to select the required distance to the wall.
4. Push  to start.
5. If the machine approaches a bump point (approx. 30 cm (12 in)), push  to smoothly reduce speed.
6. Push  to stop the machine immediately.

NOTICE

The display shows the status (**Manual stop** or **Bump stop**) and the travelled distance (in mm).

7. Push soft button  **MAN** to modify the position.
 1. Push soft button  [↶] to turn left, or  [↷] to turn right.
 2. Push  **Esc** to confirm and go one level up.
8. Push soft button  **Save**.

5.12.1.5 Go to the Charging Station

1. Make sure the machine is within 1.5 - 3 m from the charging station, and points towards it (see Manually drive the Machine on page 5-6).
2. Select the menu **Charger**.
3. Push soft button  **MAN** to modify the position.
 1. Push soft button  [↶] to turn left, or  [↷] to turn right.
 2. Push  **Esc** to confirm and go one level up.
4. If the charging station is on the right, push soft button  **L**.
5. Push  to start.

NOTICE

The machine approaches the charging station and stops by itself.

5.12.1.6 Waiting Time

1. Select the menu **Waiting time**.
2. Push  or  to select the waiting time.
3. Push soft button  **Save**.

5.12.2 Copy a Route

1. Start the Lely Control Application (see page 5-4).
2. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
3. In the main menu of the Lely Control app, select **Routes** and push .
4. Select **Copy route** and push .
5. Select the route you want to copy and push .
6. Push soft button  **Yes** to confirm.

5.12.3 Modify a Route

1. Start the Lely Control Application (see page 5-4).
2. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
3. Test the route (see Test a Route on page 7-4).
4. In the main menu of the Lely Control app, select **Routes** and push .
5. Select **Modify route** and push .
6. Select **Modify route** and push .
7. Select the route you want to modify and push .
8. Read the message and make sure to understand it.
9. Select the action you want to modify and push .
10. If you want to add extra waiting time before the action:
 1. Select the action.
 2. Push soft button  **New**.
 3. Select **Waiting time** and push .
 4. Modify the waiting time with  or .
11. If you want to modify the driving distance or the turn:
 1. Select the action and push .
 2. Select the property you want to modify with soft button  **<**.
 3. Modify the value of the property with  or .

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12. Push **Esc** to confirm and go one level up.

13. Push soft button  **Yes** to confirm.

5.12.4 Reset a Modified Route to the Previous Version

1. Start the Lely Control Application (see page 5-4).
2. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
3. In the main menu of the Lely Control app, select **Routes** and push .
4. Select **Modify route** and push .
5. Select **Modify reset** and push .
6. Select the route you want to reset and push .
7. Push soft button  **Yes** to confirm.

5.12.5 Delete a Route

1. Start the Lely Control Application (see page 5-4).
2. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
3. In the main menu of the Lely Control app, select **Routes** and push .
4. Select **Delete route** and push .
5. Select the route you want to delete and push .
6. Push soft button  **Yes** to confirm.

5.12.6 Set or Delete a Manual Route



Set a manual route to manually drive (a set of) route(s) or to test a route (see Manual Route on page 4-13).

1. Start the Lely Control Application (see page 5-4).
2. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).

3. In the main menu of the Lely Control app, select **Work** and push
4. Push to select the menu **MANUAL ROUTE**.

Set a Series of Routes

1. In the menu **MANUAL ROUTE**, push to select the series of routes you want to set (A, B, C or D).
2. Push soft button to select the first route in the series.
3. Push or to select the route number.
4. Repeat step 2 and 3 to select the next route in the series (if applicable).
5. Push soft button twice.
6. Push **Save** to save the series of manual routes.

Delete a Manual Route

1. Push or to select the route you want to delete.
2. Push soft button **Reset**.

5.12.7 Set a Time Path

NOTICE

The machine must not drive more than 40% of the total time in a time path. It must spend minimum 60% of the total time charging at the charging station.



To quickly confirm a change while editing a route, push button . To cancel push button **Esc**.

1. Start the Lely Control Application (see page 5-4).
2. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
3. In the main menu of the Lely Control app, select **Routes** and push .
4. Select **Time path** and push .
 - Refer to the time path description (see Time Path on page 4-20).

5. Push soft button  **New**.
6. Push  to select the start time (hour) and push soft button .
7. Push  to select the start time (minutes) and push soft button .
8. Push  to select the route number and push soft button .
9. Push  to switch on/off water spraying.
10. Push soft button  to save the time-route combination. The timeroute combination is automatically switched on. To switch off the timeroute combination push .
11. If you want:
 - To add another time-route combination to the time path, push soft button  **New** and repeat steps 5 to 10
 - Confirm an go up one level, push .
12. Push soft button  **Yes** to save the new time path (see Time Path on page 4-20).

5.12.8 Make a Backup

NOTICE

Make a backup each time you changed a route or time path or when another smartphone is used. Backups are made on the smartphone.

Make sure to give each backup you make a unique name.

Make sure the phone has a proper connection with the machine and has enough storage space available for the backup file.

1. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
2. In the main menu of the Lely Control app, select **Routes** and push .
3. Select **Backup route** and push . The question **Backup or restore the current routes and settings?** appears on the display of the smartphone.
4. Push soft button  **Bckup**. The software asks if you want to make a backup on the smartphone.
5. Push soft button  **Yes**. The smartphone displays a progress bar of the backup process.

6. Enter the name for the backup file.
7. Push soft button  **OK**.
8. Wait until the process ends with a beep.

5.12.9 Copy a Backup file from the Smartphone to a PC

Android

1. Connect the smartphone to a usb port of the PC. Use the data cable of the smartphone to connect.
2. Use the PC to browse to the Lely backup folder on the smartphone.
3. Select the applicable backup file (.bkp).
4. Copy the backup file from the smartphone.
5. Paste the backup file to the pc.

iOS

1. Connect the iPhone to a usb port of the PC. Use the data cable of the iPhone to connect.
2. Open iTunes.
3. Select the iPhone in iTunes.
4. Go to the **apps** tab.
5. In the File Sharing tab, select the Lely Control app.
6. Select the applicable backup file (.bkp).
7. Click **Save to**.
8. Select the location on the PC where you want to save the backup file.

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5.12.10 Copy a Backup file from a PC to the Smartphone

Android

1. Connect the smartphone to a usb port of the PC. Use the data cable of the smartphone to connect.
2. Use the PC to browse to the location of the backup file (.bkp).
3. Copy the backup file from the PC.
4. Paste the backup file to the Lely backup folder on the smartphone.

iOS

1. Connect the iPhone to a usb port of the PC. Use the data cable of the iPhone to connect.
2. Open iTunes.
3. Select the iPhone in iTunes.
4. Go to the **apps** tab.
5. In the File Sharing tab, select the Lely Control app.
6. Select the applicable backup file (.bkp).
7. Click **Add**.

- Save the backup file in the Lely backup folder on the iPhone.

5.13 Start or Stop the Time Path



**Unexpected movement of vehicle.
Risk of personal injury.**
Make sure the machine is in your line of sight. Remote operation of the smartphone or tablet by remote desktop software (such as, but not limited by, Teamviewer) is strictly forbidden to avoid dangerous situations.

- Start the Lely Control Application (see page 5-4).
- In the main menu of the Lely Control app, select **Work** and push



If the pane on the upper side of the menu, that displays the actual time, is grayed out, the time path is **On**.

- Push or
- Push the pause button on the machine to pause/restart the time path of the machine.

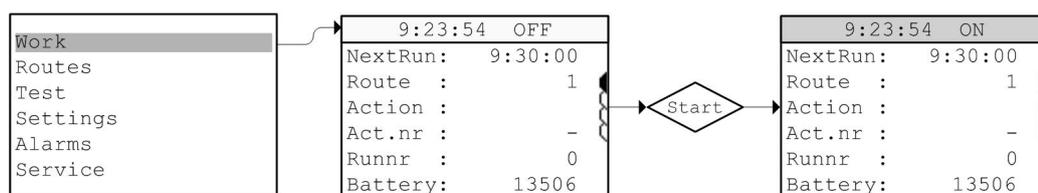


Figure 39. Start or stop the time path

5.14 Start, Stop or Pause a Manual Route



**Unexpected movement of vehicle.
Risk of personal injury.**
Make sure the machine is in your line of sight. Remote operation of the smartphone or tablet by remote desktop software (such as, but not limited by, Teamviewer) is strictly forbidden to avoid dangerous situations.

To Start a Manual Route

1. Stop the time path to take the machine out of operation Start or Stop the Time Path (see page 5-32).
2. In the main menu of the Lely Control app, select **Work** and push .
3. Push  to select the menu **MANUAL ROUTE**.
4. Push  to select the series of routes (A, B, C or D).
5. Push .
6. If you want to switch ON the time path after the manual route, push soft button  **Yes**, else push soft button  **No**.

To Pause or Stop a Manual Route

1. Push  or the pause button on the machine.
2. If you want to:
 - Stop the route immediately, push soft button  **Yes**.
 - Resume the route, push soft button  **No** or the pause button on the machine.
 - Pause,
 1. Push soft button  **Pause**.
 2. Push button  to select the number of minutes you want to pause.
 3. Push soft button  **OK**.

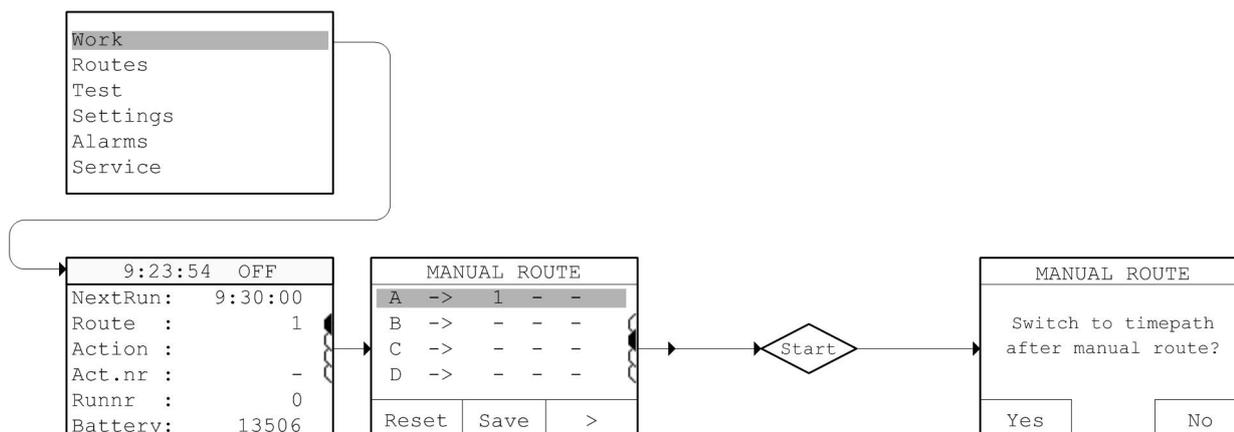


Figure 40. Start a manual route

5.15 Block a Route

NOTICE

Blocking a route has no effect on **MANUAL ROUTE** (see Start, Stop or Pause a Manual Route on page 5-33).

1. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
2. In the main menu of the Lely Control app, select **Routes** and push
3. Select **Blockage route** and push
4. Push to select the route that you want to block and push
5. Push to block the route (value 1) and push **Esc** to confirm and go one level up.

5.16 Set the Speed for a Route

1. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
2. In the main menu of the Lely Control app, select **Routes** and push
3. Select **Speed route** and push
4. Select the route you want to change and push
5. Push or to modify the speed.

6. Push  to confirm and go one level up.

5.17 Set the Speed for a Particular Action

1. Stop the time path to take the machine out of operationStart or Stop the Time Path (see page 5-32).
2. In the main menu of the Lely Control app, select **Routes** and push .
3. Select **Speed action** and push .
4. Select the route you want to change and push .
5. Select the action you want to change and push .
6. Push  or  to select the speed for that particular action.
7. Push  twice to confirm and go two levels up.
8. Push  **Yes** to save the modification.
9. Push  to confirm and go one level up.



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5.4006.8530.0 B

6 Maintenance

6.1 Introduction

This chapter contains the preventive maintenance schedule and the applicable preventive maintenance procedures for the Discovery. It also contains some basic corrective maintenance procedures.

6.2 Preventive Maintenance Schedule

The following table shows the preventive maintenance schedule for the machine. Preventive maintenance must obey local regulations, if applicable.

NOTICE

The frequencies of the tasks shown in the table are the minimum frequencies recommended.

Maintenance Tasks	Frequencies		
	Operating Weeks	Operating Months	Note
Clean the Charging Strips and the Charging Electrodes (see page 6-2).	1		
Clean the Water Inlet Filter (see page 6-4)	2		
Clean the Water Outlet Filter (see page 6-5)	2		
Clean the Nozzle (see page 6-8)		2	
Read the report list and do any indicated maintenance procedure (see Report List on page 8-11).	2		
Make sure the Battery is Charging (see page 7-5).		1	
Clean the Ultrasonic Sensor (see page 6-10).		1	
Replace the Manure Scraper (see page 6-15).		3 - 6	Replace if broken or cleaning insufficient.

6.3 Maintenance Procedures

6.3.1 Clean the Charging Strips and the Charging Electrodes

NOTICE

Make sure that after cleaning the charging electrodes slide over the middle of the charging strips when the machine parks.

Preparation

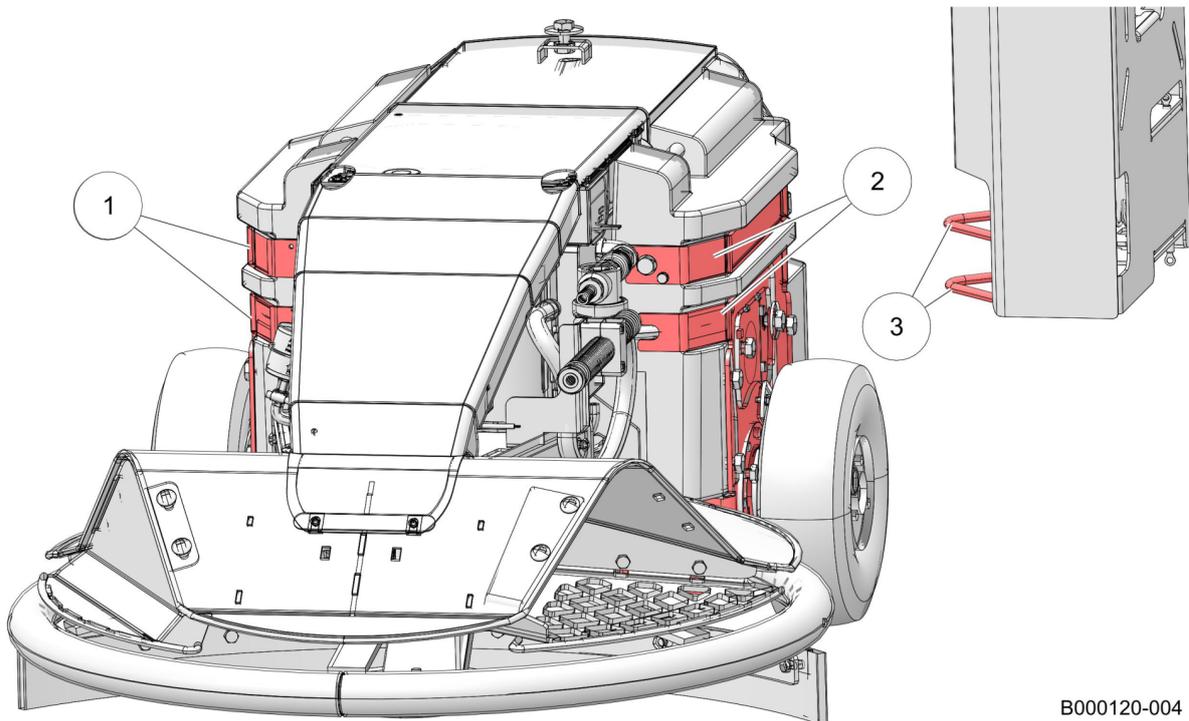
1. Disconnect the main power supply to the charging station.
2. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).
3. Switch Off the Machine (see page 5-3).

Clean

WARNING

*Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.*

1. Thoroughly clean the charging strips (1), (2) (see figure 41 on page 6-3) of the machine with sand paper or a steel brush.
2. Thoroughly clean both electrodes of the charging station (3) with sand paper.



B000120-004

Figure 41. Clean the charging strips and the charging electrodes

KEY: 1. Charging strips right (upper strip: + , lower strip: -) - 2. Charging strips left (upper strip: + , lower strip: -) - 3. Charging electrodes

Close-up

1. Connect the charging station to the main power supply.
2. Switch ON the machine (see Switch On the Machine on page 5-3).

NOTICE

During the calibration process you must not move the Discovery.

3. Push soft button  **Yes** to start the gyroscope calibration process.
4. Wait until a beep is heard (about 10 minutes) to confirm that the calibration is complete.
5. Drive the Machine to the Charging Station (see page 5-6)
6. Examine if the charging electrodes slide over the middle of the charging strips when you park the machine.
7. Start the timepath (see Start or Stop the Time Path on page 5-32) to put the machine into operation.

6.3.2 Clean the Water Inlet Filter

NOTICE

Make sure to reinstall the water inlet filter properly after cleaning to avoid water damage.

Make sure not to lose the rubber seal (2) that is installed inside the cap.

Preparation

1. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).

WARNING

**Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.**

2. Remove the upper cover (see Remove or install the Covers on page 5-2).

Clean

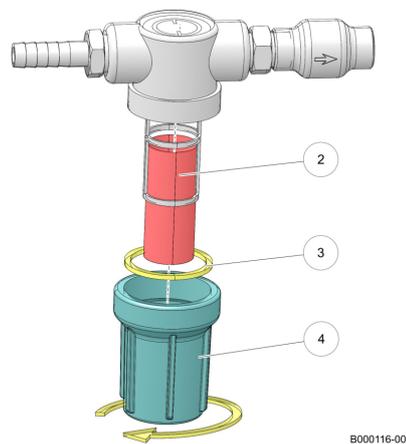
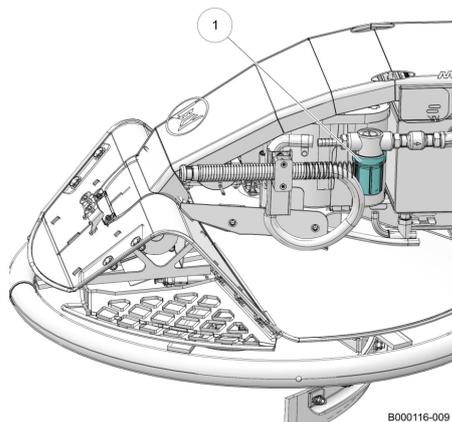


Figure 42. Clean the water inlet filter

KEY: 1. Water inlet filter - 2. Filter - 3. Seal - 4. Cap

1. Turn the cap (4) counter clockwise to remove it from the filter housing.
2. Remove the filter (2) from the filter housing.
3. Clean the filter and the cap.
4. Install the filter in the filter housing

5. Install the cap on the filter housing.

Close-up

1. Install the upper cover (see Remove or install the Covers on page 5-2).
2. Drive the Machine to the Charging Station (see page 5-6).
3. Start the time path (see Start or Stop the Time Path on page 5-32).

6.3.3 Clean the Water Outlet Filter

Preparation

1. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).



***Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.***

2. Remove the upper cover (see Remove or install the Covers on page 5-2).

Clean

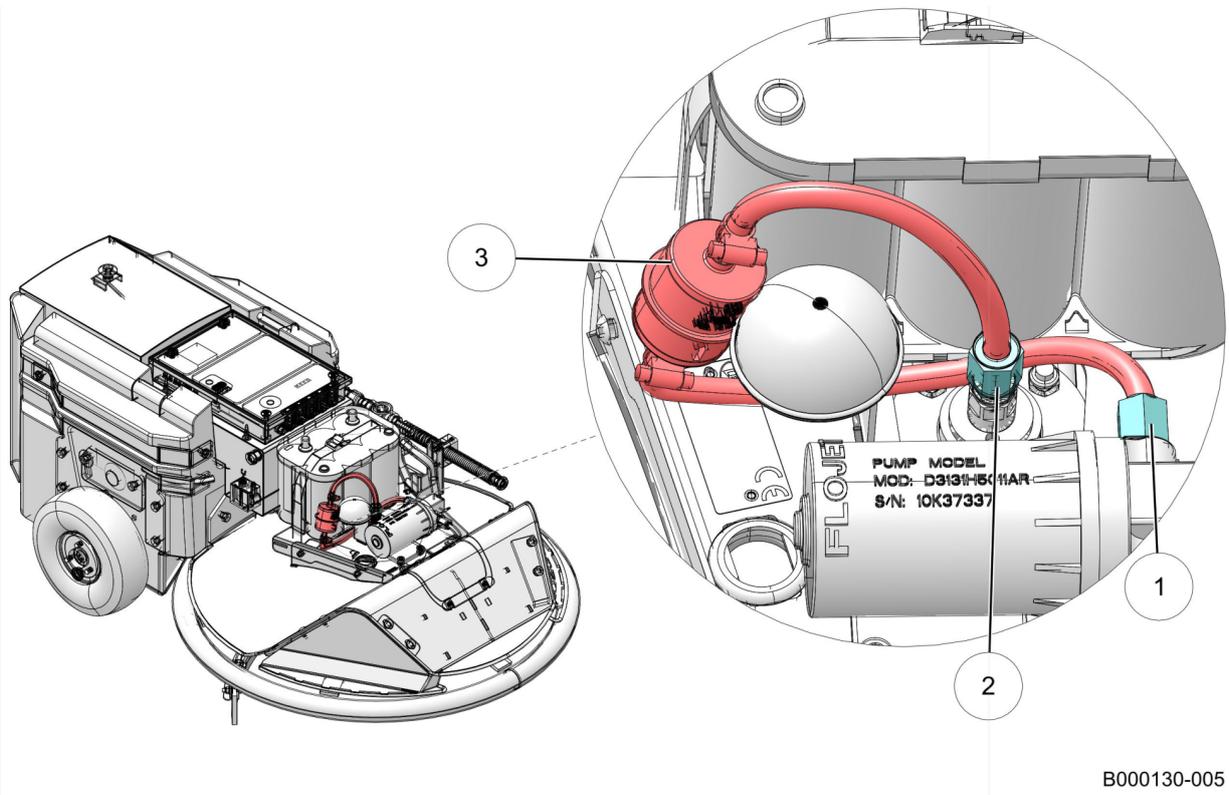


Figure 43. Clean the water outlet filter

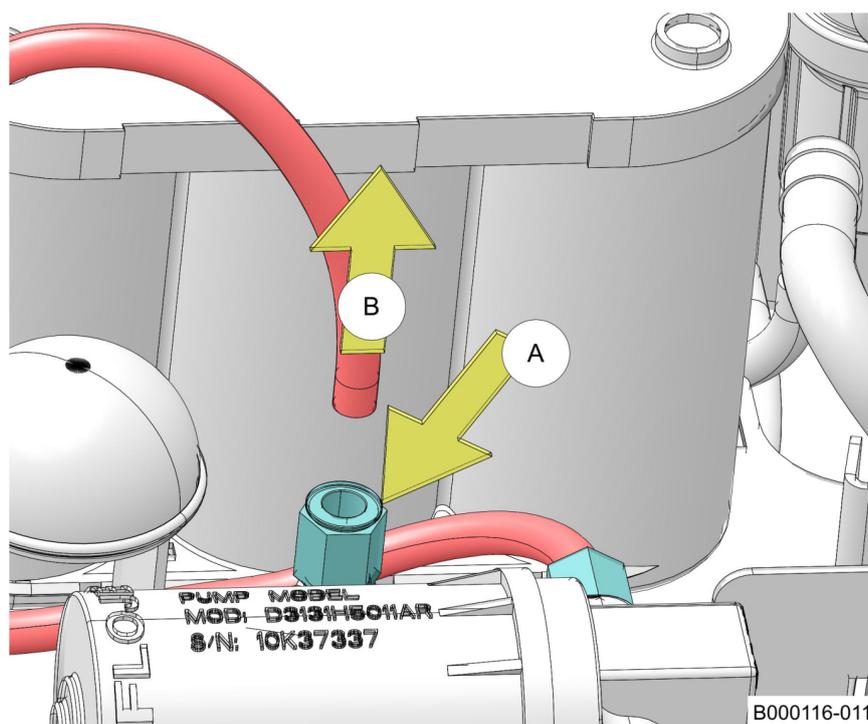
KEY: 1. Tube coupling from pump - 2. Tube coupling to spray nozzle - 3. Water outlet filter

5.4006.8530.0 B

1. Disconnect the filter tubes from the pump (1) (see figure 43 on page 6-6) and the throughput to the spray nozzle (2).

To release a tube:

1. Push the blue collar of the push-in fitting down (A).
2. Pull the tube out of the fitting (B).



5.4006.8530.0 B

Figure 44. Disconnect the filter tubes

2. Examine the flow direction of the filter (arrow).
3. Hold the tube-filter assembly under a water tap. Let water flow through the tube-filter assembly against the flow direction. If necessary, use warm water and a non-aggressive cleaning detergent.
4. Connect the tubes of the tube-filter assembly to the pump (1) and the throughput to the spray nozzle (2). Make sure the flow direction is correct (to the spray nozzle).

Close-up

1. Install the upper cover (see Remove or install the Covers on page 5-2).
2. Drive the Machine to the Charging Station (see page 5-6).
3. Start the time path (see Start or Stop the Time Path on page 5-32).

6.3.4 Clean the Nozzle

NOTICE

Avoid water running into the electronics and do not use water to remove manure from the sensing wheel and the manure scraper!

Preparation

1. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).
-

WARNING

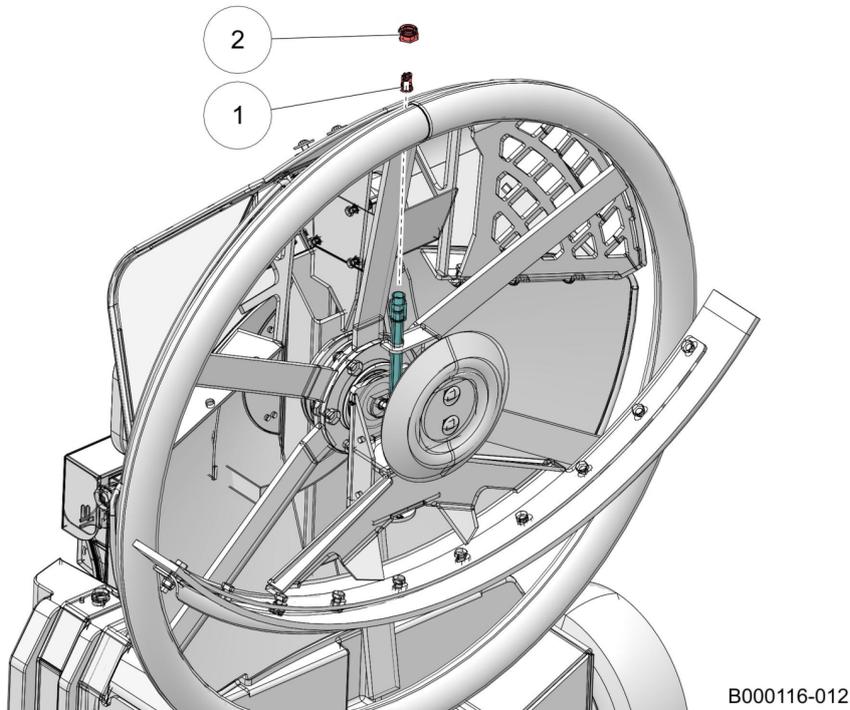
*Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.*

CAUTION

*Heavy parts.
Risk of personal injury.
Use suitable lifting or tilting equipment.*

2. Use a suitable lifting or tilting tool to lift the front of the machine and put the vehicle on its rear.

Clean

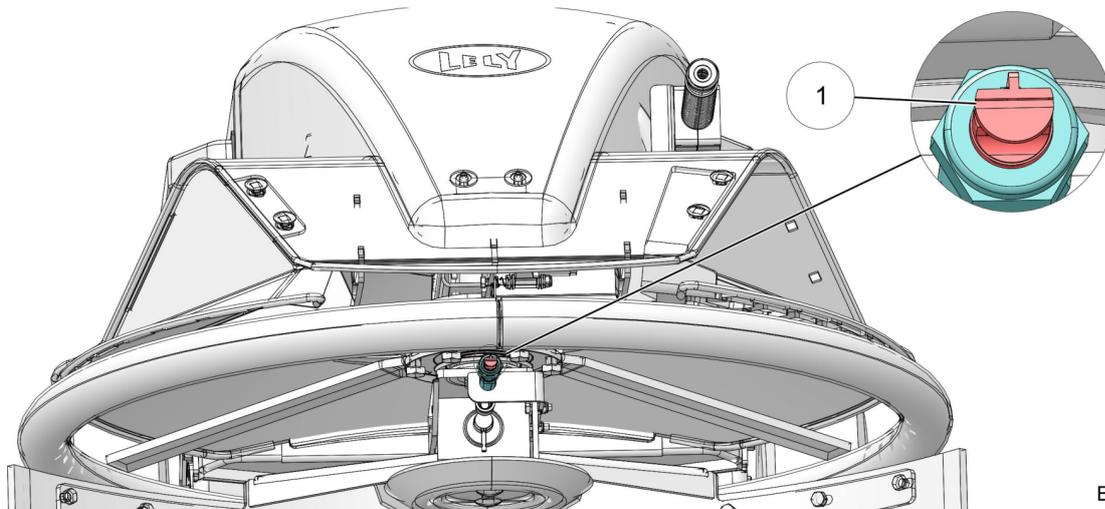


B000116-012

Figure 45. Clean the nozzle

KEY: 1. Nozzle - 2. Coupling nut

1. Remove all manure from the sensing wheel and the manure scraper.
2. Remove the nozzle (1) from its base with a spanner.
3. Clean the nozzle.
4. Install the nozzle on its base.
 1. Make sure to position the line in the nozzle horizontally (1) (see figure 46 on page 6-10).
 2. Make sure the nozzle sprays in the direction of the floor.



B000116-013

Figure 46. Horizontally positioned nozzle

KEY: 1. Nozzle

Close-up

1. Use a suitable lifting or tilting tool to put the machine back onto its wheels.
2. Test the spraying as follows:
 1. In the main menu select **Test** and push .
 2. Select **Test sprinkler** and push  and check if the nozzle sprays correct.
3. Drive the Machine to the Charging Station (see page 5-6).
4. Start the time path (see Start or Stop the Time Path on page 5-32).

6.3.5 Clean the Ultrasonic Sensor

NOTICE

Inspect the black foam ring on the ultrasonic sensor after cleaning. Replace the foam ring if it is damaged.

Preparation

1. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).

Clean

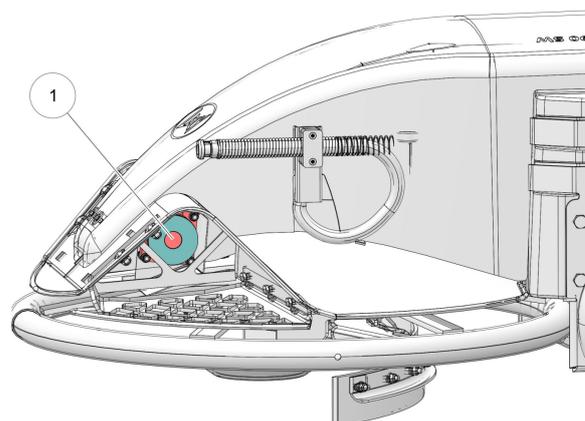


**Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.**

NOTICE

Do not use sharp objects to clean the ultrasonic sensor.

1. Clean the ultrasonic sensor (1) with a tissue via the ultrasonic sensor opening.



B000120-010

Figure 47. Ultrasonic sensor

KEY: 1. Ultrasonic sensor

Close-up

1. Manually drive the machine to the charging station (see Drive the Machine to the Charging Station on page 5-6).
2. Start the time path to put the machine into operation (see Start or Stop the Time Path on page 5-32).

6.3.6 Clean the Sensing Wheel

NOTICE

Do not use water to clean the sensing wheel!

Preparation

1. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).

Clean

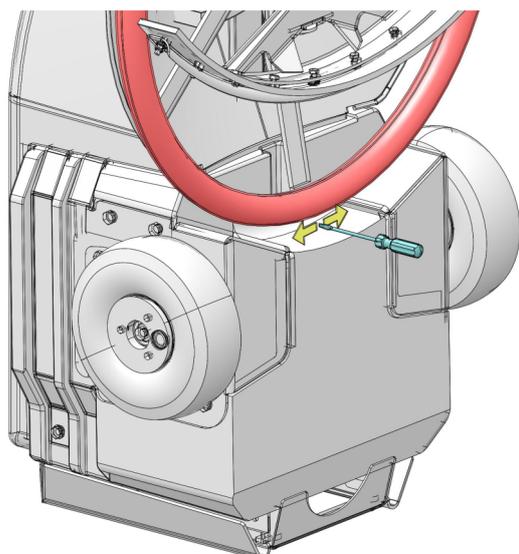


**Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.**



**Heavy parts.
Risk of personal injury.
Use suitable lifting or tilting equipment.**

1. Use a suitable lifting or tilting tool to lift the front of the machine and put the vehicle on its rear (see figure 48 on page 6-12).
2. Remove the dirt between the sensing wheel and the nose with a brush.
3. Remove the dirt between the sensing wheel and the concrete block with a screw driver and a brush.
4. Make sure that the sensing wheel can turn freely.
5. Use a suitable lifting or tilting tool to put the machine back onto its wheels.



B000120-005

Figure 48. Remove the dirt between the sensing wheel and the concrete block

KEY: 1. Sensing wheel - 2. Concrete block

Close-up

1. Manually drive the machine to the charging station (see Drive the Machine to the Charging Station on page 5-6).
2. Start the time path to put the machine into operation (see figure 39 on page 5-32).

6.3.7 Clean the Manure Scraper

Preparation

1. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).

Clean



***Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.***



***Heavy parts.
Risk of personal injury.
Use suitable lifting or tilting equipment.***

1. Use a suitable lifting or tilting tool to lift the front of the machine and put the vehicle on its rear.
-

NOTICE

To prevent damage of the electronics, do not clean the manure scraper with a high pressure cleaner! (see figure 49 on page 6-14)

2. Clean the manure scraper with water and a brush (see figure 50 on page 6-14).

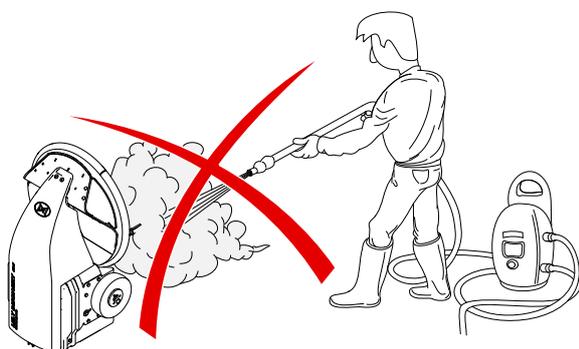


Figure 49. Do not clean the manure scraper with a high pressure cleaner

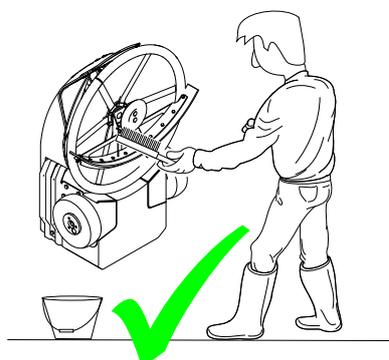


Figure 50. Clean the manure scraper with water and a brush

Close-up

1. Use a suitable lifting or tilting tool to put the machine back onto its wheels.
2. Clean the ultrasonic sensor with a tissue if it got dirty during cleaning of the manure scraper.
3. Manually drive the machine to the charging station (see Drive the Machine to the Charging Station on page 5-6).
4. Start the time path to put the machine into operation (see Start or Stop the Time Path on page 5-32).

6.3.8 Clean the Covers

Preparation



WARNING

**Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.**

1. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).

Clean

NOTICE

Do not spray water on the vehicle.

1. Clean the upper cover with water and a brush.

Close-up

1. Manually drive the machine to the charging station (see Drive the Machine to the Charging Station on page 5-6).
2. Start the time path to put the machine into operation (see Start or Stop the Time Path on page 5-32).

6.3.9 Replace the Manure Scraper

Preparation

1. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).
2. Switch Off the Machine (see page 5-3).

Removal



***Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.***



***Heavy parts.
Risk of personal injury.
Use suitable lifting or tilting equipment.***

-
1. Use a suitable lifting or tilting tool to lift the front of the machine and put the vehicle on its rear.



Make sure not to lose the pin and locking pin, bolts, washers and nuts through the openings of the slatted floor.

2. Remove the locking pin (1) and pin (2) and remove the scraper assembly (3) from the machine.
3. Clean the manure scraper.

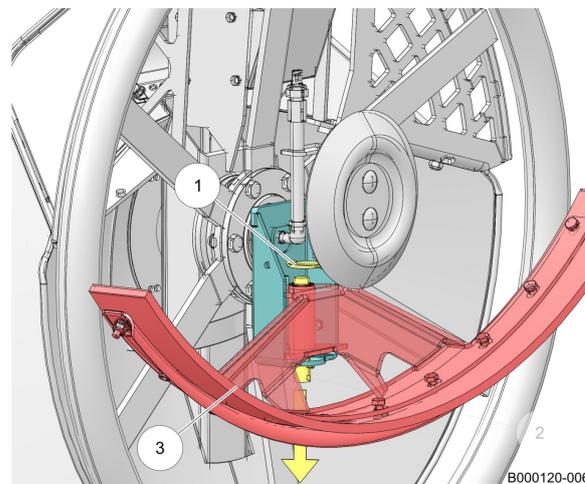


Figure 51. Remove the scraper assembly

KEY: 1. Locking pin - 2. Pin - 3. Scraper assembly

4. Remove the ten bolts (4), nuts (6) and washers (5) that attach the clamping strip (7) and the manure scraper (8) to the fixation plate (9).

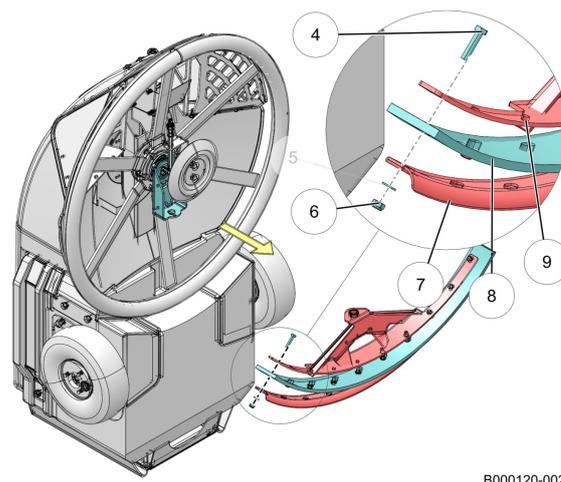


Figure 52. Remove the scraper

KEY: 4. Bolt M8x35 - 5. Washer - 6. Nut M8 - 7. Clamping strip - 8. Manure scraper - 9. Fixation plate

Installation

1. Loosely install the new manure scraper (8) (see figure 52 on page 6-16) between the fixation plate (9) and the clamping strip (7) with the ten bolts, washers and nuts.
2. Put the fixation plate (9) with the manure scraper (8) on a flat surface.
3. Make sure the manure scraper (8) is installed equally divided between the fixation plate (9) and the clamping strip (7).
4. Tighten all nuts (6). Tighten the nuts at the far ends of the manure scraper a little less to prevent the manure scraper from tearing.
5. Put the scraper assembly (3) with the pin (1) (see figure 51 on page 6-16) and locking pin on the machine.

Close-up

1. Use a suitable lifting or tilting tool to put the machine back onto its wheels.
2. Switch On the Machine (see page 5-3).
3. Start the Lely Control Application (see page 5-4).
4. Push .

NOTICE

During the calibration process you must not move the machine.

5. Push  **Yes** to start the gyroscope calibration process.
6. Wait until a beep is heard (about 5 minutes) to confirm that the calibration is complete.
7. Drive the Machine to the Charging Station (see page 5-6).
8. Start the time path to put the machine into operation (see Start or Stop the Time Path on page 5-32).

6.3.10 Replace the Sliding Disc

Preparation

1. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6).
2. Switch Off the Machine (see page 5-3).

Replace

WARNING

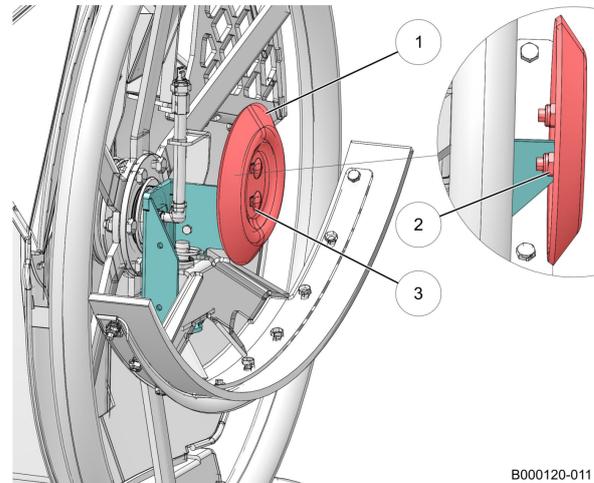
***Unexpected cow movement.
Risk of being crushed or trampled.
Block the cow traffic.***

CAUTION

***Heavy parts.
Risk of personal injury.
Use suitable lifting or tilting equipment.***

1. Use a suitable lifting or tilting tool to lift the front of the machine and put the vehicle on its rear.

2. Remove the nuts (2), coach bolts (3) and the sliding disk (1).
3. Install the new sliding disk (1) with the bolt (3) and the nut (3).



B000120-011

Figure 53. Remove the sliding disk

KEY: 1. Sliding disk - 2. Nut M10 - 3. Coach bolt M10

Close-up

1. Use a suitable lifting or tilting tool to put the machine back onto its wheels.
2. Switch On the Machine (see page 5-3).
3. Open the Lely Control app on the smartphone.
4. Push .

NOTICE

During the calibration process you must not move the machine.

5. Push soft button  **Yes** to start the gyroscope calibration process.
6. Wait until a beep is heard (about 5 minutes) to confirm that the calibration is complete.
7. Manually drive the machine to the charging station (see Drive the Machine to the Charging Station on page 5-6).
8. Start the time path to put the machine into operation (see Start or Stop the Time Path on page 5-32).

7 Test and Adjustment

7.1 Introduction

This chapter contains the test- and adjustment procedures for the machine.

NOTICE

Several options shown on the display of the user interface are not relevant for standard test and adjustment procedures, but may be useful for troubleshooting by your service provider.

7.2 Settings

7.2.1 Set the Real-Time Clock

1. Start the Lely Control Application (see page 5-4).
2. In the main menu select **Settings** and push .
3. In the menu **Settings** select **RealTime clock** and push .
4. Push soft button   (see RealTime clock on page 4-26)



The real-time clock has a 24 hour format. For instance 7:00 is not the same as 19:00.

5. Push  or  to increase or decrease the value of the selected option.
6. Push  to confirm and go one level up.

7.2.2 Set the Display Language

1. Start the Lely Control Application (see page 5-4).
2. In the main menu select **Settings** and push .
3. Select **Language** and push .
4. Push  or  to select the display language.

5. Push  to confirm and go one level up.

7.2.3 Set the Motor Power

1. Start the Lely Control Application (see page 5-4).
2. In the main menu select **Settings** and push .
3. Select **Motor power** and push .
4. Push  or  to modify the power.
5. Push  to confirm and go one level up.

7.2.4 Modify the Beep Frequency for a Route

1. Start the Lely Control Application (see page 5-4).
2. In the main menu select **Routes** and push .
3. Select **Beepfreq route** and push .
4. Select the route you want to modify and push .
5. Push  or  to modify the number of beeps per second.



The standard value 0.5 equals one beep per two seconds.

6. Push  to confirm and go one level up.

7.2.5 Modify the Beep Length

1. Start the Lely Control Application (see page 5-4).
2. In the main menu select **Settings** and push .
3. Select **Beep length**.
4. Push  or  to modify the length (see Beep Length on page 4-27).



The standard value is 200 mSec.

5. Push **Esc** to confirm and go one level up.

7.2.6 Set the Water Fill Settings

1. Start the Lely Control Application (see page 5-4).
2. In the main menu select **Settings** and push .
3. Select **Water Discovery** and push .
4. Select **Water in use**.
5. Select **Yes** or **No** To set the water fill function 'On' or 'Off' (see Fill Water on page 4-27).

Close-up

1. Push **Esc** to confirm and go one level up.

7.3 Tests

7.3.1 Analyse the Reliability of a Route

1. Start the Lely Control Application (see page 5-4).
2. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
3. In the main menu of the Lely Control app, select **Routes** and push .

To Analyse the Reliability per Route

1. Select **Route analysis** and push .
2. Select **Fail. problty** and push .



Push  or **Esc** to display routes that are not displayed.

3. If a route has a failure probability of more than 2 (see Failure Probability per Route on page 4-21):
 1. Make a note of the route number.
4. Push **Esc** to confirm and go one level up.



Because a route can not be modified, you have to delete an unreliable route and to make a new one. Before doing so it is good to figure out what is wrong.

To Analyse the Cause of an Unreliable Route

1. Select **Failure analys** and push .
2. Select the noted route number and push .
3. Make a note of the fault categories (A-E) that have an (action) number and note the numbers (see Failure Analysis on page 4-22).
4. Push  and make a note of the fault categories (F-H) that have an (action) number and note the numbers.
5. Make a note of the percentage bump points.
6. Make a note of the percentage short routes.
7. Push  and look up the explanation of the noted fault categories (A-H).
8. Make sure you understand the explanation of the noted fault categories.
9. Make a test route and find out where the notes risky action numbers appear (see Test a Route on page 7-4).
10. Delete the route (see Delete a Route on page 5-28).
11. Make a new route.

7.3.2 Test a Route

1. Put the route into a manual route.
2. Start the manual route (see Start, Stop or Pause a Manual Route on page 5-33).
3. Find the actions and action numbers on the display of the user interface of the Lely Control app.
4. Make sure the route is correct.

7.3.3 Make sure the Battery is Charged

1. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).

2. In the main menu of the Lely Control app, select **Work** and push .

3. Make sure the battery voltage is more than 12500 mV (see figure 54 on page 7-5).

4. If the voltage is less than 12500 mV:

1. Drive the Machine to the Charging Station (see page 5-6).
2. Make sure the Battery is Charging (see page 7-5).

9:23:54	OFF
NextRun:	9:30:00
Route :	1
Action :	
Act.nr :	-
Runnr :	0
Battery:	13506

Figure 54. Battery voltage

5. Charge the battery for one hour.

7.3.4 Make sure the Battery is Charging

1. Make sure the machine is connected to the charging station.
2. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).

3. In the main menu of the Lely Control app, select **Work** and push  (three times).

4. Read the safety message and confirm if you have a clear view on the machine.

5. Make sure the menu **MANUAL CHARGER** is displayed.

6. Make sure the charging current is more than 10 A.

7. If the charging current is less than 1.0 A, make sure the orange LED on the charging station is ON (see Charging Station on page 4-8).

MANUAL CHARGER	
	
13.5V	
8.0A	
L	R

Figure 55. Charging current

8. If not, make sure the main power is connected to the battery charger.
9. If the machine is still not charging, make sure the electrodes are connected to the battery charger.
10. If the machine is still not charging, Clean the Charging Strips and the Charging Electrodes (see page 6-2).
11. If the machine is still not charging, make sure all power connection are connected properly.
12. If the machine is still not charging, call the local service provider.

7.3.5 Make sure the Bluetooth Connection is Reliable

1. Start the Lely Control Application (see page 5-4).
2. Connect the smartphone to the machine.
3. Push the button **Settings** at the right top corner of the smartphone display.
4. Select **Signal Strength**.

5. Examine the value of the signal of the machine.

- 0 = very good
- -20 --25 = poor
- < -25 = very bad

7.3.6 Test the Ultrasonic Sensor

Test

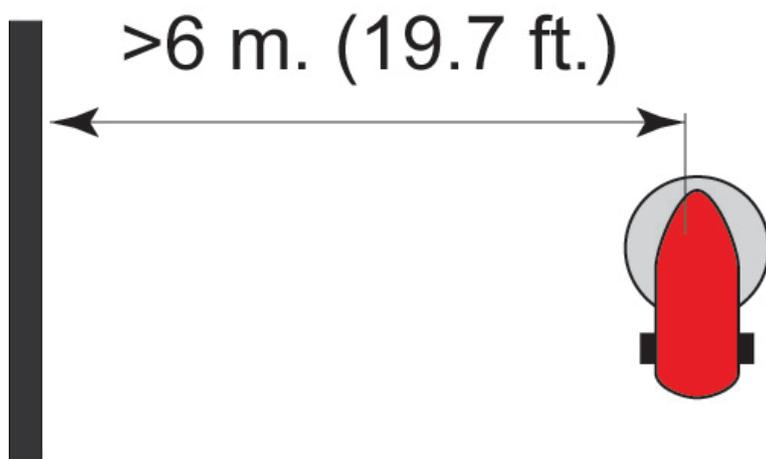


Figure 56. Test the ultrasonic sensor

1. Manually drive the machine to a location more than 6 m (6.6 yrd) from a wall (see Manually drive the Machine on page 5-6).
2. Make sure no object is between the ultrasonic sensor and the wall.
3. In the main menu of the Lely Control app, select **Test** and push
4. Select **Ultrasound** and push
5. If the ultrasonic sensor is on the left, push soft button **L**, else push **R**.
6. Make sure the machine is between you and the wall.

NOTICE

Make sure not to interrupt the sensing beam while turning the wheel.

7. Monitor the display of the user interface while you turn the sensing wheel.
8. Make sure the **Pulse 1: mm**, **Pulse 2: mm**, **Pulse 3: mm** and **Filter: mm** values are 0, when the wheel is rotating.
9. If the values are not 0, clean the ultrasonic sensor with a tissue.



10. Repeat the steps 7 and 8.
11. If the values are not 0, call your local Lely service provider.
12. If the pulse and filter values are 0:
 1. Put an object exactly 1 m. (1.1 yrd) from the ultrasonic sensor.
 2. Make sure the **Pulse 1: mm** and **Filter: mm** show 1000 (mm).Else call your local service provider.

Close-up

1. Drive the Machine to the Charging Station (see page 5-6).
2. Start the time path to put the machine into operation (see Start or Stop the Time Path on page 5-32).



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8 Troubleshooting

8.1 Introduction

This chapter contains the troubleshooting procedures for the machine.

- Alarms and reports.
- Troubleshooting table.
- Recovery procedures.

8.2 Alarms and reports

The machine monitors itself continuously. As soon as it detects an error it generates a message, the system also generates and displays reports with important information:

- A critical alarm message: 3 beeps sound and the machine stops functioning. The user interface on the smartphone displays the message **ALARM** with a description. The error requires an error recovery procedure.
- A non-critical report is recorded in the report list, the machine continues functioning (see Report List on page 8-11).
- The system also displays information about the operation of the machine (see Information Report List on page 8-13).

8.2.1 Recover Alarms

When the machine is in normal operation and a critical alarm occurs:

- The machine stops.
- An alarm message is displayed on the smartphone.
- The LED in the pause button on the machine blinks.
- An alarm sounds.

To recover the critical alarm:

1. Push any key on the smartphone to accept the alarm. The alarm sound stops. The LED in the pause button still blinks.
2. Remove the cause of the alarm (see Alarm List on page 8-3).
3. Start the time path to put the machine into operation (see Time Path ON/OFF on page 4-12)

8.2.2 Read Alarm Messages

1. Start the Lely Control Application (see page 5-4).
2. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
3. In the main menu of the Lely Control app, select **Alarms** and push .

4. Push  to select the menu **Alarm list**.

The display displays the number, the date and time when the alarm occurred and the alarm number (see table 2 on page 8-2):

Table 2. Alarm number

No.	Date	Time	Alarm
1	4-1	22:17	7
2	4-1	21:33	10



Select an alarm in the list and push  to open the alarm message for extra information.

5. Note the alarm number and refer to the alarm list (see Alarm List on page 8-3).
6. Do the recovery procedure described in the alarm list.

8.2.3 Read a Report

1. Start the Lely Control Application (see page 5-4).
2. Stop the time path to take the machine out of operation (see Start or Stop the Time Path on page 5-32).
3. In the main menu of the Lely Control app, select **Alarms** and push .
4. Select **Report list** and push .

Table 3. Report list

No.	Date	Time	Alarm
1	4-1	20:10	6
2	4-1	21:31	15



Select a report in the list and push  to open the report for extra information.

5. Note the report number and look it up in the report list (see Report List on page 8-11).
6. Do the indicated procedure.

8.2.4 Alarm List

The table below gives the alarm numbers and any actions to be taken:

Alarm code and message	Description / cause	Recovery procedure
1 EMPTY_BATTERY Battery power too low to start route, charge first! Check charge strips for dirt	<ul style="list-style-type: none"> • Bad contact with battery charger due to dirt and/or corrosion. • Loose connections. • Before the start of a route the level is too low. 	<ol style="list-style-type: none"> 1. Clean the charging strips and the charging electrodes (see Clean the Charging Strips and the Charging Electrodes on page 6-2). 2. Manually drive the machine to the charging station (see Drive the Machine to the Charging Station on page 5-6). 3. Make sure the battery is charging (see Make sure the Battery is Charging on page 7-5). 4. If the machine is still not charging, call your local service provider.
2 DOUBLE_ACTION	<ul style="list-style-type: none"> • Software failure. 	<ol style="list-style-type: none"> 1. Call your local Lely service provider.
3 DIS_OFF_RANGE Discovery lost -> searching bump point Slip: reduce - wall bump force - motor power	<ul style="list-style-type: none"> • No bump point found. 	<ol style="list-style-type: none"> 1. Calibrate the gyroscope (see Calibrate the Gyroscope on page 8-19). 2. Test the route (see Test a Route on page 7-4). 3. If the problem remains: <ol style="list-style-type: none"> 1. Do a route analysis (see Analyse the Reliability of a Route on page 7-3). 2. Modify the routes that are unreliable (see Modify a Route on page 5-27). <ol style="list-style-type: none"> 1. Test the route (see Test a Route on page 7-4). 2. If the problem remains, call your local Lely service provider.
4 TURN BLOCK Discovery can not take the turn!	<ul style="list-style-type: none"> • Mechanical problem, worn parts, dirt causing resistance. • Vehicle has not turned far enough. 	<ol style="list-style-type: none"> 1. Make sure there are no obstacles. 2. Make sure the sliding disc is not worn out, replace if necessary. 3. Make sure the manure scraper is not worn out, replace if necessary (see Replace the Manure Scraper on page 6-15).

Alarm code and message	Description / cause	Recovery procedure
		<p>4. If the problem remains:</p> <ol style="list-style-type: none"> 1. Do a route analysis (see Analyse the Reliability of a Route on page 7-3). 2. Modify the routes that are unreliable (see Modify a Route on page 5-27).
<p>5 NO TIME No active time!</p>	<ul style="list-style-type: none"> • No active time! 	<ol style="list-style-type: none"> 1. Set the time path and try again (see Set a Time Path on page 5-29).
<p>6 BLOCKAGE_DISC Discovery blocked!!</p>	<ul style="list-style-type: none"> • Obstacle. • Gyroscope inaccurate. 	<ol style="list-style-type: none"> 1. Make sure there are no obstacles. 2. Try to run the route again. 3. If the machine is blocked on the same. place: <ol style="list-style-type: none"> 1. Do a route analysis (see Analyse the Reliability of a Route on page 7-3). 2. Modify the routes that are unreliable (see Modify a Route on page 5-27). <ol style="list-style-type: none"> 1. If the machine is blocked at a different place, calibrate the gyroscope (see Calibrate the Gyroscope on page 8-19).
<p>7 DISCOV_LOST Discovery deviates from correct directn! - obstacle - gyro drifting - bend in action Slip: reduce - wall bump force - motor power</p>	<ul style="list-style-type: none"> • While turning, the vehicle did not reach the programmed position and not even after retrying. 	<ol style="list-style-type: none"> 1. Make sure there are no obstacles. 2. Calibrate the gyroscope (see Calibrate the Gyroscope on page 8-19). 3. Test the ultrasonic sensor (see Test the Ultrasonic Sensor on page 7-6). 4. Test the motors. 5. Put the machine into operation (see Start, Stop or Pause a Manual Route on page 5-33).

Alarm code and message	Description / cause	Recovery procedure
		<p>6. If the problem remains:</p> <ol style="list-style-type: none"> 1. Do a route analysis (see Analyse the Reliability of a Route on page 7-3). 2. Modify the routes that are unreliable (see Modify a Route on page 5-27). <p>1. If the problem remains, call your local Lely service provider.</p>
<p>8 TURN ERROR</p> <p>Discovery turns more than 360 deg!</p> <ul style="list-style-type: none"> - Check gyroscope - Calibrate via menu Settings 	<ul style="list-style-type: none"> • More than 360 degree turn. 	<ol style="list-style-type: none"> 1. Calibrate the Gyroscope (see page 8-19).
<p>9 LOADING</p> <p>No charging current!</p> <p>Check charge strips for dirt</p>	<ul style="list-style-type: none"> • Machine does not reach the charging station. 	<ol style="list-style-type: none"> 1. Make sure there are no obstacles. 2. Clean the Charging Strips and the Charging Electrodes (see page 6-2). 3. Manually drive the machine to the charging station (see Manually drive the Machine on page 5-6). 4. Make sure the Battery is Charging (see page 7-5). 5. If the machine is still not charging, call your local service provider.
<p>10 STARTUP</p>		<p>Alarm appears with every startup of the machine. For information only.</p>
<p>11 ROUTE-MEMORY</p> <p>Route memory is full</p> <p>Delete a route!!</p>	<ul style="list-style-type: none"> • Route memory has reached the maximum of 16 different routes. 	<ol style="list-style-type: none"> 1. Delete a route prior to programming a new one (see Delete a Route on page 5-28).
<p>12 NO_ULTRASIGN</p> <p>No ultrasound signal:</p> <ul style="list-style-type: none"> - dirt on sensor - dirt sensing wheel - no object 	<ul style="list-style-type: none"> • Dirt on the ultrasonic sensor. • Dirt on sensing wheel. • No object within reach of the sensor. • Sensor broken. 	<ol style="list-style-type: none"> 1. Clean the Ultrasonic Sensor (see page 6-10). 2. Clean the Sensing Wheel (see page 6-11). 3. Test the Ultrasonic Sensor (see page 7-6).
<p>13 BENDSKIDDING</p> <p>Discovery skid in the turn!</p>	<ul style="list-style-type: none"> • Although the motors did run, the gyroscope did not observe any rotation, not even after retrying. 	<ol style="list-style-type: none"> 1. Make sure the floor is not slippery.

Alarm code and message	Description / cause	Recovery procedure
		<ol style="list-style-type: none"> 2. Make sure the wheels are not worn out. If so, call your local service provider. 3. Make sure the manure scraper is not worn out, replace if necessary (see Replace the Manure Scraper on page 6-15). 4. Test a Route (see page 7-4). 5. If the problem remains, call your local Lely service provider.
14 EXTRA CHARGE1		Voltage is too low, the machine recharges for an extra hour. For information only.
15 EXTRA CHARGE2		More than 20Ah used. For information only.
16 EXTRA READY1		Recharging is complete. For information only.
17 EXTRA READY2		Recharging is complete. For information only.
18 CHARG TIMEOUT Timeout charger: battery not charging! Check charge LEDs on charger and clean charge strips	<ul style="list-style-type: none"> • Battery not full despite charging. 	<ol style="list-style-type: none"> 1. Clean the Charging Strips and the Charging Electrodes (see page 6-2). 2. Manually drive the machine to the charging station (see Manually drive the Machine on page 5-6). 3. Make sure the Battery is Charging (see page 7-5). 4. If the problem remains, call your local Lely service provider.
19 DOUBLE TIME Similar points in time exist!		<ol style="list-style-type: none"> 1. Correct the start and end times in the time path (see Set a Time Path on page 5-29).
20 BATTVOLT LOW Battery power too low to start route! Drive Discovery to charger or clean charge strips!		<ol style="list-style-type: none"> 1. Clean the Charging Strips and the Charging Electrodes (see page 6-2). 2. Manually drive the machine to the charging station (see Manually drive the Machine on page 5-6). 3. Make sure the Battery is Charging (see page 7-5). 4. If the problem remains, call your local Lely service provider.

Alarm code and message	Description / cause	Recovery procedure
21 SKIDDING. WFL	<ul style="list-style-type: none"> Skidding (the angle calculated from wheel distance and angle from gyro differ) during straight, wallfollow or ultrasonic actions. 	<ol style="list-style-type: none"> Make sure the floor is not slippery. Make sure the wheels are not worn out. If so, call your local service provider. Make sure the manure scraper is not worn out, replace if necessary (see Replace the Manure Scraper on page 6-15). Test a Route (see page 7-4).
22 SKIDDING_STOP	<ul style="list-style-type: none"> The machine stopped because alarm 13 was generated multiple times. 	<ol style="list-style-type: none"> Make sure the manure scraper is not worn out, replace if necessary (see Replace the Manure Scraper on page 6-15). Manually run the route again. If the problem remains, decrease the motor power.
23 HEAVY DRIVE Discovery drives hard!!	<ul style="list-style-type: none"> The machine has difficulties driving the route. 	<p>If the alarm is repeated more than 5 times per week:</p> <ol style="list-style-type: none"> Make sure there are no obstacles. Make sure the barn bedding has no long hay. If the problem remains: <ol style="list-style-type: none"> Do a route analysis (see Analyse the Reliability of a Route on page 7-3). Modify the routes that are unreliable (see Modify a Route on page 5-27).
24 Flash error!!		<ol style="list-style-type: none"> Call your local Lely service provider.
25 SHORT-CIR. 1R		<ol style="list-style-type: none"> Call your local Lely service provider.
26 SHORT-CIR. 2R		<ol style="list-style-type: none"> Call your local Lely service provider.
27 BACKUP ERROR Error backup: Try again!	<ul style="list-style-type: none"> Smartphone is not connected. Software on the smartphone is not correct. Smartphone is defect. Not enough storage space. 	<ol style="list-style-type: none"> Make sure the smartphone is connected via bluetooth. Make sure to use the correct version of the Lely Control app. Free up storage space. Try to make another backup.



Alarm code and message	Description / cause	Recovery procedure
		5. If the problem remains, call your local Lely service provider.
29 NO_GYRO_START		1. Call your local Lely service provider.
30 M1 THERMISCH Motor 1 thermic out	<ul style="list-style-type: none"> Current left motor too high, probably due to dirt or worn parts. 	<ol style="list-style-type: none"> Remove any dirt or obstacles. Make sure there are no worn parts (manure scraper, sliding disk).
31 M2 THERMISCH Motor 2 thermic out	<ul style="list-style-type: none"> Current right motor too high, probably due to dirt or worn parts 	<ol style="list-style-type: none"> Remove any dirt or obstacles. Make sure there are no worn parts (manure scraper, sliding disk).
32 COOL DOWN	<ul style="list-style-type: none"> Machine pauses to cool down the motors. 	<ol style="list-style-type: none"> Remove any dirt or obstacles. Make sure there are no worn parts (manure scraper, sliding disk). If the alarm is repeated more than 5 times a week, call your local Lely service provider.
33 FULL CHARGING	<ul style="list-style-type: none"> Not enough charging time between routes. The machine must recharge fully during nighttime. 	<ol style="list-style-type: none"> Modify the routes (see Modify a Route on page 5-27). Make sure the time period between the routes is long enough to fully recharge the battery.
35 BATT ERROR	<ul style="list-style-type: none"> Battery recharge failed, too low charging current. Bad contact with battery charger due to dirt and/or corrosion. Loose connections. 	<ol style="list-style-type: none"> Clean the Charging Strips and the Charging Electrodes (see page 6-2). Make sure the Battery is Charging (see page 7-5).
37 GYROANGLEFACT		1. Call your local Lely service provider.
38 LOADING No charging current! Check charge strips for dirt	<ul style="list-style-type: none"> Bad contact with battery charger due to dirt and/or corrosion. Loose connections 	<ol style="list-style-type: none"> Clean the Charging Strips and the Charging Electrodes (see page 6-2). Make sure the Battery is Charging (see page 7-5). Charge the machine.
39 GYRO_TEMP		1. Call your local Lely service provider.
41 COM_BATTCHAR2	<ul style="list-style-type: none"> Gyro calibration failed. 	1. Try again.

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Alarm code and message	Description / cause	Recovery procedure
43 BATTERY_STOP Discovery battery runs down. Switch off or charge Discovery	<ul style="list-style-type: none"> • More than 24 hours not charged or started a route. • The machine stops and beeps for 1 hour. 	<ol style="list-style-type: none"> 1. Clean the Charging Strips and the Charging Electrodes (see page 6-2). 2. Make sure the Battery is Charging (see page 7-5). 3. Charge the machine.
44 BATT_FATAL_ER		<ol style="list-style-type: none"> 1. Call your local Lely service provider.
45 GYRO_TYPE		<ol style="list-style-type: none"> 1. Call your local Lely service provider.
47 GYRO_AUTOSTOP	<ul style="list-style-type: none"> • Automatic gyro recalibration has been interrupted. 	<ol style="list-style-type: none"> 1. Recalibrate the gyroscope in settings menu (see Calibrate the Gyroscope on page 8-19).
48 BATTERY_OFF	<ul style="list-style-type: none"> • After 1 hour of alarm #43, the machine will power off to protect the battery. 	<ol style="list-style-type: none"> 1. Clean the Charging Strips and the Charging Electrodes (see page 6-2). 2. Make sure the Battery is Charging (see page 7-5). 3. Charge the machine.
49 BATTERY_CABLE Loader error! Check cable connections		<ol style="list-style-type: none"> 1. Manually drive the machine to a clean and quiet location (see Manually drive the Machine on page 5-6). 2. Make sure the charging wires are connected correctly to the battery.
50 DIRECTION_DIS Discovery not in correct direction! - obstacle - gyro drifting - bend in action		<ol style="list-style-type: none"> 1. Make sure there are no obstacles. 2. Calibrate the Gyroscope (see page 8-19). 3. Test the Ultrasonic Sensor (see page 7-6). 4. Test the motors. 5. If the problem remains: <ol style="list-style-type: none"> 1. Do a route analysis (see Analyse the Reliability of a Route on page 7-3). 2. Modify the routes that are unreliable (see Modify a Route on page 5-27).
52 ULTRAS_CALIB		<ol style="list-style-type: none"> 1. Call your local Lely service provider.
53 Calibrate I PCB		<ol style="list-style-type: none"> 1. Call your local Lely service provider.

Alarm code and message	Description / cause	Recovery procedure
54 CLOCK ERROR The 24 hours clock is not correct -> adjust the time!!	<ul style="list-style-type: none"> Internal clock is not set. 	<ol style="list-style-type: none"> Make sure the real-time clock is set in the correct 24 hour format (see Set the Real-Time Clock on page 7-1). Make sure all start and end times in the time path are entered in the correct 24 hour format. Correct the clock or the start and end times if necessary.
55 BACKUP ERROR2	<ul style="list-style-type: none"> No backup on the Smartphone. 	<ol style="list-style-type: none"> Make a Backup.
56 Short-circuit brush motors!		<ol style="list-style-type: none"> Call your local Lely service provider.
57 GYRO_SPI		<ol style="list-style-type: none"> Call your local Lely service provider.
58 GYRO_I_INSTAB		<ol style="list-style-type: none"> Call your local Lely service provider.
59 GYRO_TIMEOUT		<ol style="list-style-type: none"> Call your local Lely service provider.
60, 61 - 64GYRO_BIAS 1 2 - 5.		<ol style="list-style-type: none"> Call your local Lely service provider.
65 Gyroscope type does not match output signal!! Reset PCB		<ol style="list-style-type: none"> Switch Off the Machine (see page 5-3) and wait at least 10 seconds. Switch On the Machine (see page 5-3). If the problem remains, call your local Lely service provider.
66 Gyro heater current is not 0!		<ol style="list-style-type: none"> Call your local Lely service provider.
70 DIS_OFF_RANGE Discovery lost -> searching bump point Slip: reduce - wall bump force - motor power	<ul style="list-style-type: none"> No bump point detected after expected bump point. 	<ol style="list-style-type: none"> Wait for the machine to correct itself.
73 NO_ULTRASIGN No ultrasound signal: - dirt on sensor - dirt sensing wheel - no object	<ul style="list-style-type: none"> Appears when alarm 12 is not resolved. 	<ol style="list-style-type: none"> Clean the Ultrasonic Sensor (see page 6-10). Clean the Sensing Wheel (see page 6-11). Make sure an object is within 2.5 m (8.2 ft).

Alarm code and message	Description / cause	Recovery procedure
		4. Test the Ultrasonic Sensor (see page 7-6). 5. If there is still no signal, call your local Lely service provider.
77 EXTRA CHARG3	<ul style="list-style-type: none"> Battery machine has insufficient capacity to complete the route. 	
78 EXTRA READY3	<ul style="list-style-type: none"> Battery is charged enough to start the route. 	
80 Emergency stop button pushed!!		1. Call your local Lely service provider.
84 Hardware safety protection!		1. Call your local Lely service provider.
89 FPGA error.		1. Call your local Lely service provider.
90 - 98 Software FAILURE Call Lely! 1-5.		1. Call your local Lely service provider.
120 Unexpectedly in Waterfillstation (90 SW).		1. Call your local Lely service provider.

8.2.5 Report List

The table below gives the report numbers and any actions to be taken:

Report code and report	Description/Procedure
2 Left chain is slack. Check chain tension	1. Call your local Lely service provider.
3 Right chain is slack. Check chain tension	1. Call your local Lely service provider.
4 Left tire has a smaller diameter. Route less reliable!!	1. Call your local Lely service provider.
5 Right tire has a smaller diameter Route less reliable!!	1. Call your local Lely service provider.
6 Drive distance increases Check skid. Route less reliable!!	1. Make sure the floor is not slippery. 2. Make sure the machine does not skid.
7 Ultrasonic sensor gives too many reflec Check startpulse Clean ultrason sensor Clean sensing wheel	1. Clean the Ultrasonic Sensor (see page 6-10) and the sensing wheel. 2. If the problem remains, call your local Lely service provider.

Report code and report	Description/Procedure
8 Ultrasonic sensor gives too many reflex Check startpulse Clean ultrason sensor Clean sensing wheel	<ol style="list-style-type: none"> 1. Clean the Ultrasonic Sensor (see page 6-10) and the sensing wheel. 2. If the problem remains, call your local Lely service provider.
9 Left motor drives harder than the right motor -> check the drive	<ol style="list-style-type: none"> 1. Call your local Lely service provider.
10 Right motor drives harder than the left motor -> Check drive	<ol style="list-style-type: none"> 1. Call your local Lely service provider.
11 Low charging current! -Clean chargingstrips with sandpaper -Check charger and battery	<ol style="list-style-type: none"> 1. Drive the Machine to the Charging Station (see page 5-6). 2. Clean the Charging Strips and the Charging Electrodes (see page 6-2). 3. Make sure the Battery is Charging (see page 7-5).
12 The charging current is too low, check connection points and power	Refer to report 11.
13 Battery condition is bad. Install a new battery	<ol style="list-style-type: none"> 1. Install a new battery (operator is NOT allowed to open the PCB box).
14 Battery is overloaded too many times See battery yield and check battery and capacity	Vehicle drives back 20 cm automatically to protect the battery. <ol style="list-style-type: none"> 1. Call your local Lely service provider.
15 Battery power too low to start route, charge first!	<ol style="list-style-type: none"> 1. Clean the Charging Strips and the Charging Electrodes (see page 6-2). 2. Charge the Machine (see page 8-20).
16 Battery power too low to start route! Drive Discovery to charger or clean charge strips!	<ol style="list-style-type: none"> 1. Clean the Charging Strips and the Charging Electrodes (see page 6-2). 2. Charge the Machine (see page 8-20).
17 Discovery is not finished with test route Please switch on the route.	<ol style="list-style-type: none"> 1. Call your local Lely service provider.
18 Battery condition deteriorates. Check battery	<ol style="list-style-type: none"> 1. Call your local Lely service provider.
19 The current of the batt is low when the Discovery drives Check charger pcb!	<ol style="list-style-type: none"> 1. Call your local Lely service provider.
20 Bad signal of ultrasonic sensor-> clean: - ultrasonic sensor - sensing wheel	<ol style="list-style-type: none"> 1. Clean the Ultrasonic Sensor (see page 6-10) and the sensing wheel.
21 Route is not correct - unreliable - see route analysis - see manual	<ol style="list-style-type: none"> 1. Do a route analysis (see Analyse the Reliability of a Route on page 7-3).

Report code and report	Description/Procedure
	2. Modify the routes that are unreliable (see Modify a Route on page 5-27).
34 Battery is charged The charge cyclus is complete	For information only.
40 The factory route is complete. Discovery team thank you!	For information only.
50 - 55 Battery is overloaded too many times See battery yield and check battery and capacity	1. Call your local Lely service provider.
60 Ultrasonic sensor gives too many reflec Check startpulse Clean ultrason sensor Clean sensing wheel	1. Clean the Ultrasonic Sensor (see page 6-10) and the sensing wheel. 2. Test the Ultrasonic Sensor (see page 7-6). 3. If the problem remains, call your local Lely service provider.
61 Bad signal of ultrasonic sensor-> clean: - ultrasonic sensor - sensing wheel	1. Clean the Ultrasonic Sensor (see page 6-10) and the sensing wheel.
62 Gyroscope values deviate -> check drift!	1. Calibrate the Gyroscope (see page 8-19). 2. If the problem remains: <ol style="list-style-type: none"> 1. Do a route analysis (see Analyse the Reliability of a Route on page 7-3). 2. Modify the routes that are unreliable (see Modify a Route on page 5-27).

8.2.6 Information Report List

The table below gives the reports that are not recorded and any actions to be taken:

Description	Explanation
Time path contains % drive time	The machine must not drive more than 40% of the total time in a time path. It must spend minimum 60% of the total time charging at the charging station.
Not enough bump points in route: % Low reliability of of the route!!	At least 25% of the actions in a route must have a bump point. If not, the route is less reliable.
Too many actions in one route. Not possible to finish the route!!	The number of actions in the present route is more than the maximum 125. You must start again, break up the route in smaller parts.
You have the possibility to program actions in this route!!	Gives you the number of actions left in the present route until the maximum 125 is reached.

Description	Explanation
ERROR: time path contains % of the drive time. Max 50%	The machine must not drive more than 40% of the total time in a time path. It must spend minimum 60% of the total time charging at the charging station. Delete some routes from the time path.
NOTE: bump points! Program as much as possible bump points PR-button==slowly Discovery auto stop	For information only.
NOTE: Gyroscope! End actions straight Alternate long action with short action Nose in drivedirect.	For information only.
Is Discovery nose in the correct direction?	Manually turn the vehicle in the correct direction with Manual Drive if the direction is not correct (see Manually drive the Machine on page 5-6).
At start ultrasound action, Discovery was not pointing in the intended direction Route less reliable!!	Angle of more than 20 degrees between the start and the reset point. This could be due to an angled start point. Refer to Failure Analysis (see Failure Analysis on page 4-22).
ERROR: Distance correction on exist routes -> check on skid during drive	The control system has corrected the drive distance because the expected bump point was not reached in time. This could be due to skidding. Refer to Control System
Direction ERROR - Action with bends - Gyroscope drifting Route is not reliable!!	The driving direction is not reliable. This could be due to a drifting gyroscope or to a programmed action that did not follow a straight course. Refer to Failure Analysis (see Failure Analysis on page 4-22).
12 standard turns Switch between the 4 screens with Enter and Escape!	You can choose from 12 standard turns that are displayed on 4 screens. Push  to open the next screen, or  to go one level up.

8.3 Troubleshooting Tables

8.3.1 Troubleshooting Table Vehicle

Symptom	Possible cause	Action
The smartphone does not connect to the machine / connection lost	The farmer password is not set on the smartphone.	Ask the Lely service provider for the password, see Install or update the Lely Control App on your Smartphone (see page 5-1).
	The smartphone is not paired with the machine.	1. Make sure bluetooth of the smartphone is switched on.

Symptom	Possible cause	Action
		<p>2. Examine in the bluetooth settings of the smartphone if the machine is paired. If not, try to pair (PIN = '0000').</p> <p>Refer to the user manual of the smartphone.</p>
	The machine is switched OFF.	Switch On the Machine (see page 5-3).
	The distance between the smartphone and the machine is too big	Move the smartphone towards the machine and try to connect (see Start the Lely Control Application on page 5-4).
The vehicle does not move.	Machine is switched OFF.	<p>Switch On the Machine (see page 5-3).</p> <p>Put the machine into operation (see Start, Stop or Pause a Manual Route on page 5-33).</p>
	The route is blocked.	Remove the blockade.
	The battery is low.	<p>Drive the Machine to the Charging Station (see page 5-6).</p> <p>Charge for one hour.</p>
	The fuse is blown.	Call your local Lely service provider.
	The power supply is not connected.	Connect the power supply.
	Other.	Call your local Lely service provider.
The machine drives more shaky than before.	The chains are not tightened correctly.	Call your local Lely service provider.
	The wheel bearing is worn out.	Call your local Lely service provider.
Machine swings.	The gyroscope is drifting.	Calibrate the gyroscope (see Calibrate the Gyroscope on page 8-19).
	The ultrasonic sensor does not function correctly.	<p>Clean the Ultrasonic Sensor (see page 6-10).</p> <p>Test the Ultrasonic Sensor (see page 7-6).</p>
	Other.	Call your local Lely service provider.
Machine does not stop at the charging station.	The charging strips or electrodes do not make contact.	Clean the Charging Strips and the Charging Electrodes (see page 6-2).
	No power supply.	Make sure the charging station is connected to the power supply.
	Springs that hold the electrodes are loose.	Attach the springs properly.
	The 'Go to the charger' action is not started within 1-3 meters from the charger (see Go to	<ul style="list-style-type: none"> • Modify a Route (see page 5-27). • Delete a Route (see page 5-28).



Symptom	Possible cause	Action
	the Charging Station on page 5-26).	<ul style="list-style-type: none"> Setup a new route.
	The battery charger is out of operation and gives an alarm signal.	Remove any dirt. Disconnect the mains for 30 s and connect again.
Machine does not stop at a bump point.	Floor is less slippery than before.	Adjust the motor power to a lower level (see Set the Motor Power on page 7-2).
	Other.	Call your local Lely service provider.
	Bad route.	Modify a Route (see page 5-27).
Machine does not fill water	Water filling function switched Off	Switch On the water filling function (see Switch ON or OFF the Water Filling Function (OFF during Wintertime) on page 5-7).
	Water supply disrupted	Make sure the water filling station supplies water when you push against the water outlet. If the water filling station does not supply water: Call your local Lely service provider.
The backup process of the routes does not function.	The software version of the smartphone is not correct	Make sure the software version on the smartphone is correct. If the version is not correct update the smartphone software.
Machine is not starting a route.	The time path is not correct.	Make sure the time path is correct (see Set a Time Path on page 5-29).
	The battery is low or not charged.	Drive the Machine to the Charging Station (see page 5-6).
	The route is blocked.	Unblock the route (see Block a Route on page 5-34).
	No route is programmed.	Program a short test route and try again.
	Other.	Call your local Lely service provider.

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8.3.2 Troubleshooting Table Charging Station

Symptom	Possible cause	Action
Green and Yellow LED together blink 2 times, followed by a few seconds rest.	Battery loader defect.	Call your local Lely service provider.
Green and Yellow LED together blink 4 times, followed by a few seconds rest.	Temperature lower than - 15 degrees C (5 degrees F).	Warm the barn and try again.
	Battery loader defect.	Call your local Lely service provider.



Symptom	Possible cause	Action
Green and Yellow LED together blink 5 times, followed by a few seconds rest.	Internal temperature is higher than 85 degrees C (185 degrees F).	Remove plug from the mains. Connect plug and retry after one hour.
Green and Yellow LED together blink 7 times, followed by a few seconds rest.	Current too high (>20 A).	Remove short-circuit, else: Call your local Lely service provider.

8.3.3 Troubleshooting Table iPhone

Symptom	Possible cause	Action
iPhone does not connect to the machine software	Not logged off correctly the last time after you finished to operate the machine software, The button Back was not pushed to log off from the software of the machine.	<ol style="list-style-type: none"> 1. On the iPhone go to Settings > Bluetooth tap and hold the machine in the list of devices for 3 seconds. 2. In the next screen that appears select Forget this device  <ol style="list-style-type: none"> 3. Now you can pair the machine in the bluetooth list of devices on the iPhone and enter the password 0000. 4. Check in the list of Bluetooth devices if the machine is connected, tap once to connect if it is not connected.
The iPhone displays no connection after tapping the machine in the Bluetooth list		<ol style="list-style-type: none"> 1. If the device does not connect, switch the Bluetooth on the iPhone Off and On.  <ol style="list-style-type: none"> 2. Now you can pair the machine in the bluetooth list of devices on the iPhone and enter the password 0000. 3. Check in the list of Bluetooth devices if the machine is connected, tap once to connect if it is not connected.
The machine is not listed in the Bluetooth list on the iPhone		If the device is not displayed in the list.

Symptom	Possible cause	Action
		<ol style="list-style-type: none"> 1. First switch the Wifi on the iPhone Off and On. 2. After that switch Bluetooth Off and On. 3. Now you can pair the machine in the bluetooth list of devices on the iPhone and enter the password 0000. 4. Check in the list of Bluetooth devices if the machine is connected, tap once to connect if it is not connected.

8.4 Recovery Procedures

8.4.1 Reset the Control System

1. Start the Lely Control Application (see page 5-4).
2. Manually drive the machine away from the charging station (see Manually drive the Machine on page 5-6).
3. Remove the upper cover (see Remove or install the Covers on page 5-2) .
4. Remove the lower cover.
5. On the PCB box, push button Off.
6. On the PCB box, push button On.
7. Calibrate the gyroscope (see Calibrate the Gyroscope on page 8-19).
8. Manually drive the machine to the charging station (see Manually drive the Machine on page 5-6).

8.4.2 Calibrate the Gyroscope

1. Start the Lely Control Application (see page 5-4).
2. Stop the time path to take the machine out of operation (see figure 39 on page 5-32).
3. Select **Settings** and push .
4. Select **Gyroscope**.
5. The message **SAFETY WARNING Manual operation is permitted only with a clear overview of the vehicle. Confirm?** appears on the smartphone display. Confirm if you have a clear view on the machine.

NOTICE

Do not move the machine.

6. Push soft button  **Yes** and wait until you hear a beep sound (approximately 5 minutes).

8.4.3 Charge the Machine

1. Drive the Machine to the Charging Station (see page 5-6).
2. Make sure the machine is charging (orange and green LEDs are ON (see Charging Station on page 4-8).
3. Let the machine be charged for one hour minimum.



9 Disposal

Disposing this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

Decommissioning and disassembly of the product can be dangerous and must be done only by qualified recycling organizations. All components must be disposed in compliance with the local rules and regulations.

Lubricants and fluids must be disposed correctly to prevent pollution of the environment. Read the safety data sheets of the used lubricants and fluids for correct disposal. All lubricants and fluids must be disposed in compliance with the local rules and regulations.

Contact your local authority or local Lely service provider for further details.



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10 EG Declaration of Conformity

EC DECLARATION OF CONFORMITY
EG-KONFORMITÄTSEKTLÄRUNG
DECLARATION DE CONFORMITÉ AUX NORMES DE LA CE
DICHIARAZIONE CE DI CONFORMITÀ
CERTIFICADO DE CONFORMIDAD CEE
DECLARAÇÃO DE CONFORMIDADE CE
DEKLARACJON EU MASKINDIREKTIV
VAATIMUSTENMUKAISUUSVAKUUTUS
EU-KONFORMITETSERKLÆRING
EG-FÖRSÄKRAN OM ÖVERENSSTÄMMELSE
CB – SAMRÆMISYFIRLÝSING



ΔΗΛΩΣΗ ΣΥΜΜΟΡΦΩΣΗΣ Ε.Ε.
DECLARAȚIE DE CONFORMITATE CE
EU MEGFELELŐSÉGI NYILATKOZAT
ES-PROHLÁŠENÍ O SHODĚ
DEKLARACJA ZGODNOŚCI WE
ES – PREHLÁŠENIE O ZHODE
VASTAVUS EU DIREKTIIVIDELE
ES ATITIKTIES DEKLARACIJA
ЗАЯВЛЕНИЕ О СООТВЕТСТВИИ НОРМАМ ЕС
EG - POTVRDA O SUKLADNOSTI
ES IZJAVA O SKLADNOSTI

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We manufacturer
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производитель
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naziv proizvajalca

verklaan geheel onder eigen verantwoordelijkheid dat de machine:
herewith declare, on our own responsibility, that the machinery:
erklärt hiermit eigenverantwortlich, dass die Maschine:
déclarons que les machines désignées ci-après :

productbeschrijving

description of product
Produktbezeichnung
description du produit
descrizione del prodotto
nombre del producto
designação de produto
produktnavn
tuotenimi
produktnavn
produktnamn
vörulýsing

Lely Discovery 90 SW

περιγραφή του προϊόντος
descrierea produsului
termék megnevezése
označení produktu
opis produktu
označenie výrobku
toote kirjeldus
gaminio aprašymas
наименование изделия
naziv proizvoda

typennummer

model number
Typnummer
numéro de modèle
numero di modello
modelo
número do modelo
modelnummer
mallinnumero
modellnummer
gerðarnúmer

5.4006.00xx.x

αριθμός μοντέλου
numărul modelului
típus száma
numer modelu
typové číslo
tūbi number
modelio numeris
номер модели
broj modela
številka artikla

waarop deze verklaring betrekking heeft, in overeenstemming is met de bepalingen van de volgende Richtlijn(en):
which this declaration refers to, is in accordance with the conditions of the following Directive(s):
worauf sich diese Erklärung bezieht, hergestellt ist gemäß den Bestimmungen der Richtlinie(n):
auxquelles la présente déclaration se rapporte, sont conformes aux dispositions de la ou des directives suivantes :

è conforme alle direttive
de acuerdo con las directivas
de acordo com a directiva
opfylder følgende direktiver
täyttää seuraavien direktiivien vaatimukset
opfylder følgende direktiver
uppfyller följande direktiv
uppfyllir eftirlitrandi tilskipanir

Machinery directive 2006/42/EC
Low voltage directive 2014/35/EU
Electromagnetic compatibility 2014/30/EU

conform cu directivele
rendelkezeléseknél megfelelően
podle směrnice
zgodny z dyrektywą
v zhode so smernicami
direktiveide järgi
ragal direktivas
соответствует требованиям директив
po smjernicama
v skladu z direktivo

en in overeenstemming is met de volgende normen of andere normatieve documenten :
and is in conformity with the following standard(s) or other such specifications :
und den folgenden Normen oder vergleichbaren Spezifikationen entspricht:
et aux normes et autres spécifications suivantes :

è conforme alle norme
de acuerdo con las normas
de acordo com as normas
opfylder følgende standarder
täyttää seuraavien standardien vaatimukset
opfylder følgende standarder
uppfyller följande standarder
uppfyllir eftirlitrandi staðla
πληροί τις προδιαγραφές

EN-ISO 12100:2010, EN 1717:2000
EN 55022:2010, EN 55024:2010
EN 60204-1:2006/AC:2010, EN 60950-1:2006/A2:2013

în conformitate cu standardele
megfelel a szabványoknak
odpovídá normám
zgodny z normą
zodpovedá normám
normidele vastavus
atitinka standartus
соответствует стандартам нормам
v skladu sa standardima
v skladu s standardi

handtekening en datum

signature and date
Unterschrift und Datum
signature et date
firma e data
firma y fecha
assinatura e data
underskrift og dato
allekirjoitus ja päiväys
signatur og dato
underskrift och datum
undirskrift og dagsetning

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Director Product Development
Lely Industries N.V.

J.W. Rodenburg
Manager Product Safety & Compliance
Lely Industries N.V.

υπογραφή και ημερομηνία
semnătura și data
aláírás és dátum
podpis a dátum
podpis i data
podpis a dátum
allkiri ja kuupäev
parašas ir data
подпись и дата
rotpis i datum
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