HIGH - TECH
IN AGRICULTURE

D-H002.0607EN

LELY INDUSTRIES N.V.
DAIRY EQUIPMENT

DISCOVERY
BARN CLEANER

Manual

(Dutch original instructions for use)

www.lely.com

DISCOVERY

Manual

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List of included amendments

Amendment	Date (mm/yy)	Chapter(s)	Remarks
Basic	01/05	All	New
Amendments	03/06	All	Drawings, text and alerts
Amendments	07/06	All	Drawings, text and alerts

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Safety

The symbol ATTENTION - DANGER! means:

WARNING! TAKE CARE! OUR SAFETY IS AT RISK!

The safety symbol draws your attention to important safety warnings on your Discovery barn cleaner and in the manual. Wherever you see this symbol, take special care to avoid the risk of (fatal) bodily injury. Observe the instructions on every safety sticker (decal).

SIGNAL WORDS:

Note the use of the signal words **WARNING** and **CAUTION** in the safety messages. The signal words beside each notice have the following meanings:

⚠DANGER

- ***DANGER. Indicates a highly hazardous situation with the risk of serious injury or death, if the instructions are not followed.***

⚠ WARNING

- **Indicates a potentially hazardous situation with the risk of serious injury or death, if the instructions are not followed, and includes hazards that may arise from removal of safety features.**

⚠ CAUTION

- *Indicates a situation with a risk of minor bodily injury or damage to product or property, if the instructions are not followed.*

NOTE

- *This indicates additional helpful information.*

SAFETY INSTRUCTIONS

You are responsible for **SAFE** operation and maintenance of your barn cleaner. **You** must ensure that you (and anyone else who will operate, maintain or in any way come in contact with the system) are familiar with the operating and maintenance procedures and related **SAFETY** information in this manual. This manual will take you step by step through your working day and alerts you to all good safety practices while operating the barn cleaner.

Remember: **You** are the key to safety. Safety measures protect not only yourself, but also the people around you. Make these measures part of your daily routine. Make sure that **EVERYONE** operating this appliance is familiar with the recommended procedures and observes all safety measures. Remember: most accidents can be prevented. Take no unnecessary risks; safety is a serious matter.

- Barn cleaner owners must provide operating instructions for the equipment to employees or others who will be operating it before allowing them to operate the robot for the first time. Knowledge should be refreshed at least once a year.
- The most essential safety measure is the proper safety awareness of the person using the machine. It is the operator's responsibility to read, understand and follow ALL safety and operating instructions in this manual. Most accidents can be avoided.
- A person who has not read and understood all operating and safety instructions is not qualified to operate this appliance. An untrained operator exposes himself and bystanders to the risk of serious injury or death.
- It is prohibited to modify the barn cleaner in any way. Unauthorised modifications may impair the operation and/or the safety and service life of the appliance, and may also endanger the operator and bystanders.
- Use only genuine parts, and have them installed by an authorised technician if the necessary instructions are not available.
- Think SAFETY! Work SAFELY!

GENERAL SAFETY

- Before you supply power to the barn cleaner or operate, maintain or adjust the machine, first read the manual carefully and familiarise yourself with all the safety notices.
- Only trained and competent persons may operate the barn cleaner. An untrained operator is not qualified to operate this system.
- Have a first aid kit close at hand for use in the event of accidents. Make sure it is clearly visible and accessible.
- Have a fire extinguisher close at hand. Make sure it is clearly visible and accessible.
- Install all guards and shields before operating the machine and secure them properly (mechanically or electrically).
- Wear appropriate protective clothing.
- SWITCH the machine OFF and completely disconnect the power supply before doing any servicing, maintenance, adjustment, repairs or cleaning.
- Always have the telephone number of the nearest medical centre close at hand.
- Contact your nearest Lely service provider if you have any questions.
- Review safety-related items frequently (annually) with all those who operate the barn cleaner.

SAFE OPERATION

- Before you supply power to the barn cleaner or operate, maintain or adjust the machine, first read the manual carefully and familiarise yourself with all the safety notices.
- Only authorised and suitably trained persons may operate the barn cleaner. It is prohibited for untrained persons to operate this appliance.
- The barn cleaner unit may be used solely for the purpose for which it was designed.
- SWITCH the machine OFF and completely disconnect the power supply before doing any servicing, maintenance, adjustment, repairs or cleaning.
- Before operating the machine, first install all supplied safety features and ensure that these are fitted and functioning as intended (mechanically and electrically).
- Keep hands, feet and hair away from moving parts.
- Before starting the appliance, clear all bystanders, especially children, away from the appliance.

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- Contact your nearest Lely service provider if you have any questions.
- Hold a regular (annual) safety review with all persons who work with the equipment.

INSTALLATION SAFETY

- Read and observe the instructions in the manual. By choosing the correct place to install the appliance in your cowshed, and mounting it securely, you will reduce the risk of mechanical errors.
- Before connecting the power, take steps to ensure that the power supplied is sufficient and has the correct voltage, phase and frequency (see also the details on the rating plate).
- Have an authorised electrician provide electrical power to the barn cleaner.
- Ensure that the earthing of the electrical system conforms to local regulations or standards that may be in force.

MAINTENANCE SAFETY

- Study all the information in the manual about operation, maintenance and adjustment of the barn cleaner; make sure you understand these fully.
- SWITCH the machine OFF and completely disconnect the power supply before doing any servicing, maintenance, adjustment, repairs or cleaning.
- Once you have completed your servicing, ensure that all safety features are back in place, working and properly secured.
- Make certain that the power supply is SHUT OFF before you work with any electrical parts of the appliance. Electrical circuits can cause bodily injury.

SAFETY AND ELECTRICITY

- Have an authorised electrician provide electrical power to the barn cleaner.
- Ensure that the earthing of the electrical system conforms to local regulations or standards that may be in force.
- Make sure that all electrical switches are in the OFF position before you turn the electrical power back on.
- SWITCH the appliance OFF and completely cut off the power supply before doing any servicing, maintenance, adjustment, repairs or cleaning.
- Replace any damaged electrical wiring, conduits, switches or other components immediately.
- Do NOT open the electrical panel to work on the electrical system, unless the electrical power is completely disconnected at the master panel.

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Safety stickers (if present)

Maintenance of safety stickers (decals):

The safety decals applied on the Discovery barn cleaner contain important and useful information to ensure that you can continue to use your machine/installation safely.

Please follow the instructions provided below to ensure that all decals remain in place and in good condition.

- Keep safety decals clean and legible at all times. Use soap and water; do not use mineral spirits, abrasive cleaners or other similar agents that may damage the decal.
- Replace safety decals that are missing or have become illegible.
- When replacing parts, always apply a new safety decal where there was previously a decal on the replaced part.
- Safety decals are obtainable from your local Lely service provider.

Applying safety decals:

- Make sure the surface is clean and dry.
- Ensure that the temperature of the surface is at least 5°C.
- Decide on the exact position before you remove the backing paper.
- First, remove only the smaller section of backing paper from the decal.
- Align the decal over the intended position and carefully press the exposed adhesive of the smaller section onto the surface.
- Slowly peel back the remaining paper and carefully smooth the rest of the decal into place.
- Small air bubbles can be pierced with a pin and smoothed out using the piece of decal backing paper.

LOCATION AND CONTENT OF SAFETY DECALS

Safety decals of a general nature are covered in this section. Specific safety instructions are incorporated in various sections of the manual for those situations that are particularly hazardous if the instructions or procedures are not obeyed.

The locations of the different safety decals are indicated below.

NOTE - if a safety decal is damaged, missing or illegible, or if parts with a decal have been replaced by parts without a decal, a new safety decal must always be applied. New safety decals are available from your nearest Lely service provider.

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SAFETY INSTRUCTIONS

⚠ WARNING

- **Read the manual for the barn cleaner unit carefully. Observe all safety measures and instructions.**
- **For more detailed information, please refer to the "Safety" chapter.**

Introduction

Congratulations on your purchase of a Lely DISCOVERY barn cleaner. This advanced appliance has been developed and manufactured to meet the needs of discerning dairy farmers who recognise the benefits of having an automated cowshed cleaning system.

In order to ensure safe, efficient and trouble-free operation of your barn cleaner, it is of vital importance that you and any other person who will be operating or maintaining the device **READ, UNDERSTAND** and **OBSERVE** all instructions and recommendations given in this manual regarding safety, operation, maintenance and troubleshooting.

This manual is specifically intended for the barn cleaner that has been supplied by the Lely organisation concerned. It is possible that certain options required to adapt this device to specific local conditions will not be covered in this manual. In that case, please contact your Lely organisation for information about such options. Please refer to the table of contents to find specific information.

NOTE

- *On receiving this manual, it is the responsibility of the owner and/or those operating the barn cleaner to study this manual and to follow the instructions it contains. Some components or systems have their own manual with detailed instructions. Study each manual before use. If the instructions are unclear, please contact your nearest Lely service provider.*

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General view

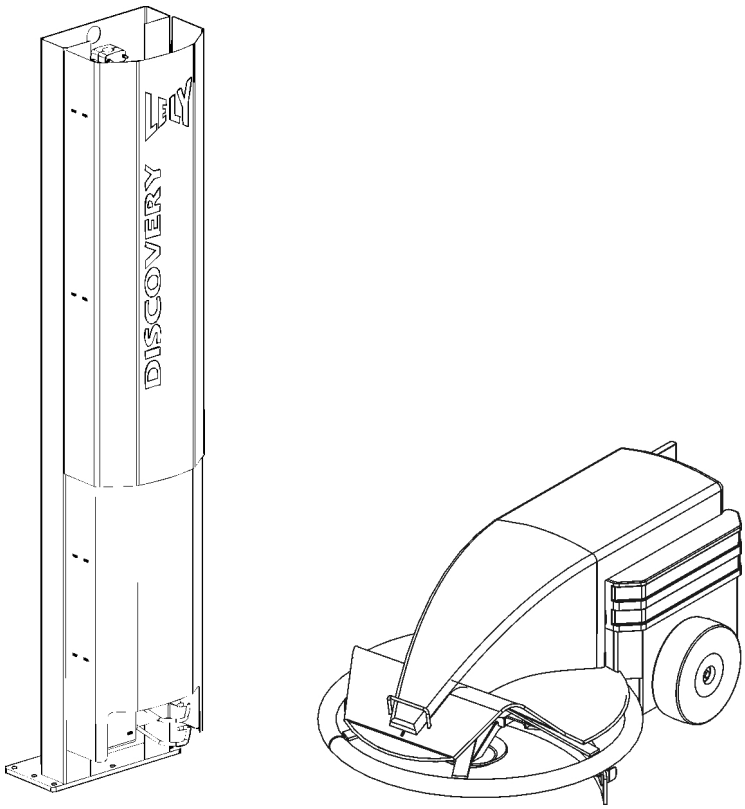
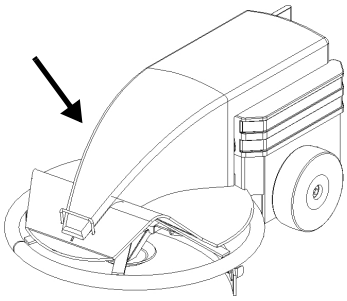


Figure 1 Discovery barn cleaner (floor-mounted charger unit)

Registration

The item number/serial number identification plate is mounted on the top of the barn cleaner (under the cover).

Please always state the item number and serial number of your unit in correspondence or when ordering spare parts. Take a moment now to fill the details in on this page:



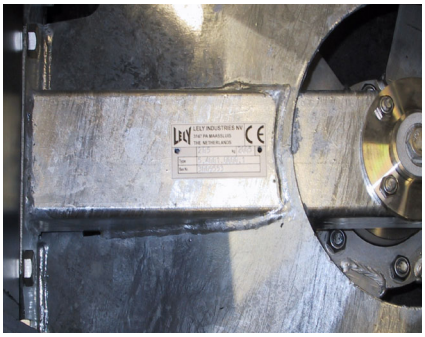
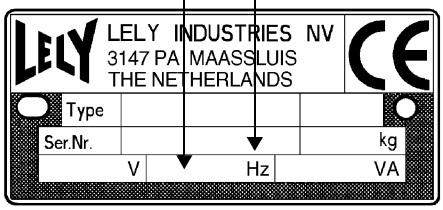


Table 1 Item number and serial number identification plate

Type:	
Ser. no.:	



The table below shows the item number of the barn cleaner that this manual has been written for.

Table 2 Discovery barn cleaner item number

Description	Item number
Discovery barn cleaner	5.4001.0010.1

1 Packaging

1.1 Charger unit packaging

Check that the following components are present in the packaging for the charger unit:

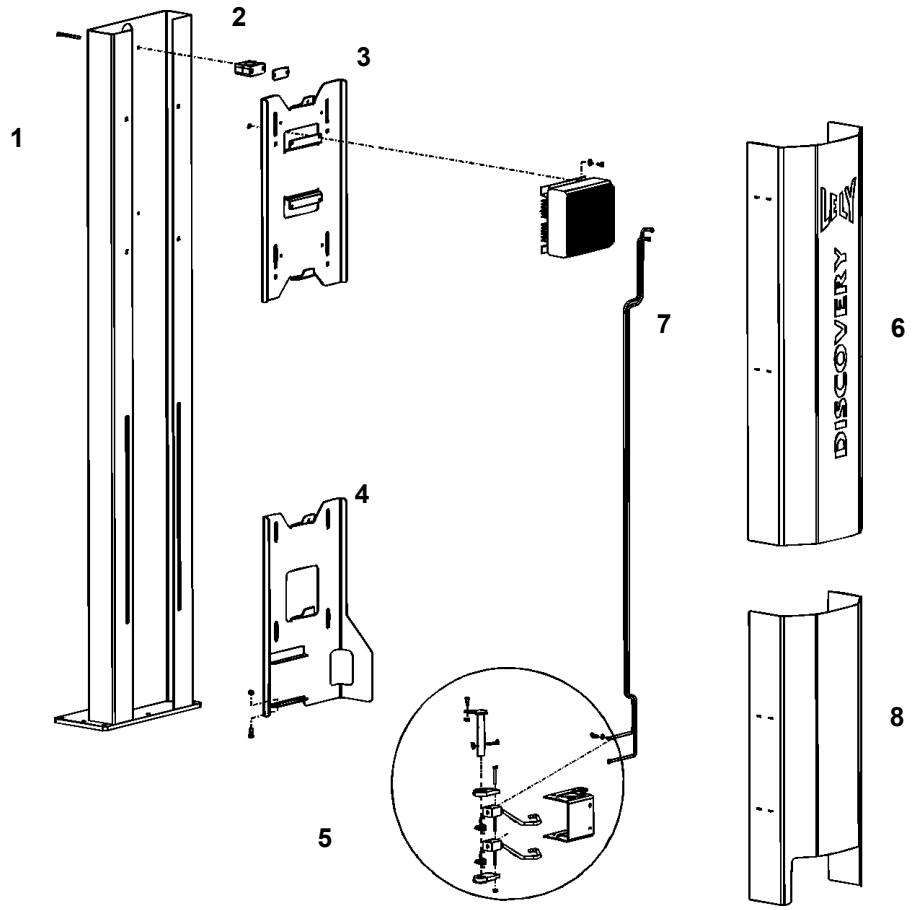


Figure 1 1 Construction of the charger unit

1. Floor column (1x) (optional)
2. Cable grip[1]
3. Upper mounting support (1x) (standard)[1]
4. Lower mounting support (1x) (standard)[1]
5. Electrode assembly (complete) (2x)[1]
6. Upper cover (1x)[1]
7. Battery charger + cabling (packed separately)[1]
8. Lower cover (1x)

1) including fastenings

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1.2 Discovery barn cleaner packaging

Check that the following components are present in the packaging for the barn cleaner:

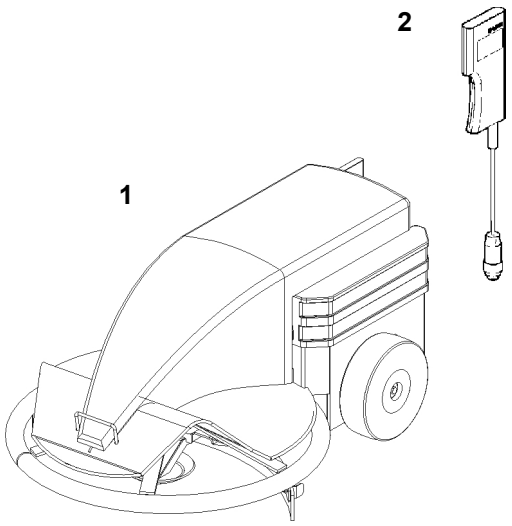

Figure 1 2 Construction of the Discovery barn cleaner

1. Discovery barn cleaner (complete)
2. E-link manual controller
3. Technical documentation (not shown)

2 Installing the components

2.1 Charger unit

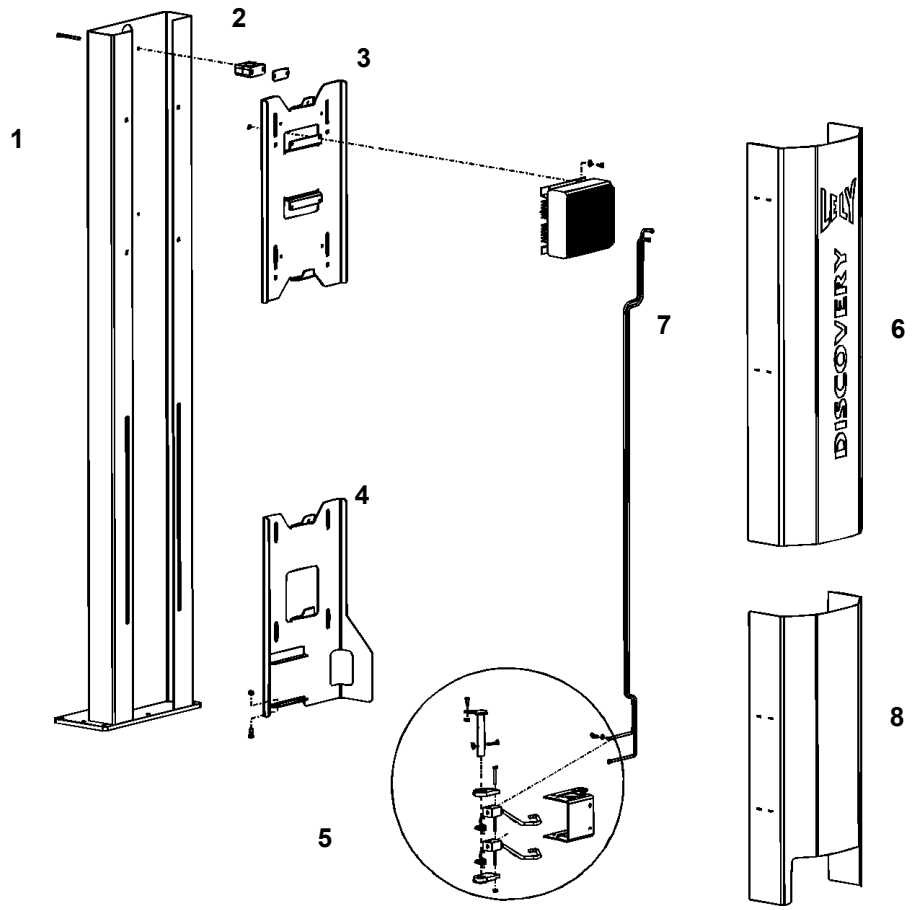

Figure 2 1 Construction of the charger unit

NOTE

- *The placement of the charger unit within the cowshed is very important. Place the charger unit somewhere in the cowshed where there is a minimum of cow movements. Avoid drinking troughs and narrow passageways when positioning it.*
- *Mount the floor column (if present) on a clean and even floor surface.*
- *Redundancy in the routes can be reduced by finding a position in the cowshed that is as central as possible.*
- *Make sure that a 230VAC power supply (an earthed socket) is available near the battery charger.*

The charger unit can be installed in two ways, namely:

1) Wall-mounted (standard)
2) Floor-mounted (optional, requiring a floor column)

2.1.1 Hoisting point

When hoisting the Discovery, it must be lifted by the appropriate point. This is located within the motor compartment. The hoisting eye can be found by opening the black cover. The strip that the hoisting eye is integrated into can be found in front of the battery. This is the lifting eye that can be used for moving the Discovery safely.

2.1.2 Placement of the charger unit

NOTE

- *The precise placement of the charger unit (figure 2 2) within the cowshed is extremely important. Find a central (quiet) spot in the shed where the charger unit can be installed.*
- *Make the barn cleaner follow part of the wall first, before embarking on the actual route; this allows the gyroscope settings to be compensated.*
- *The positioning of the charger unit is important. To allow the barn cleaner to park and depart correctly, there must be 2.5m room in front of the charger unit and 1.5m room behind it.*

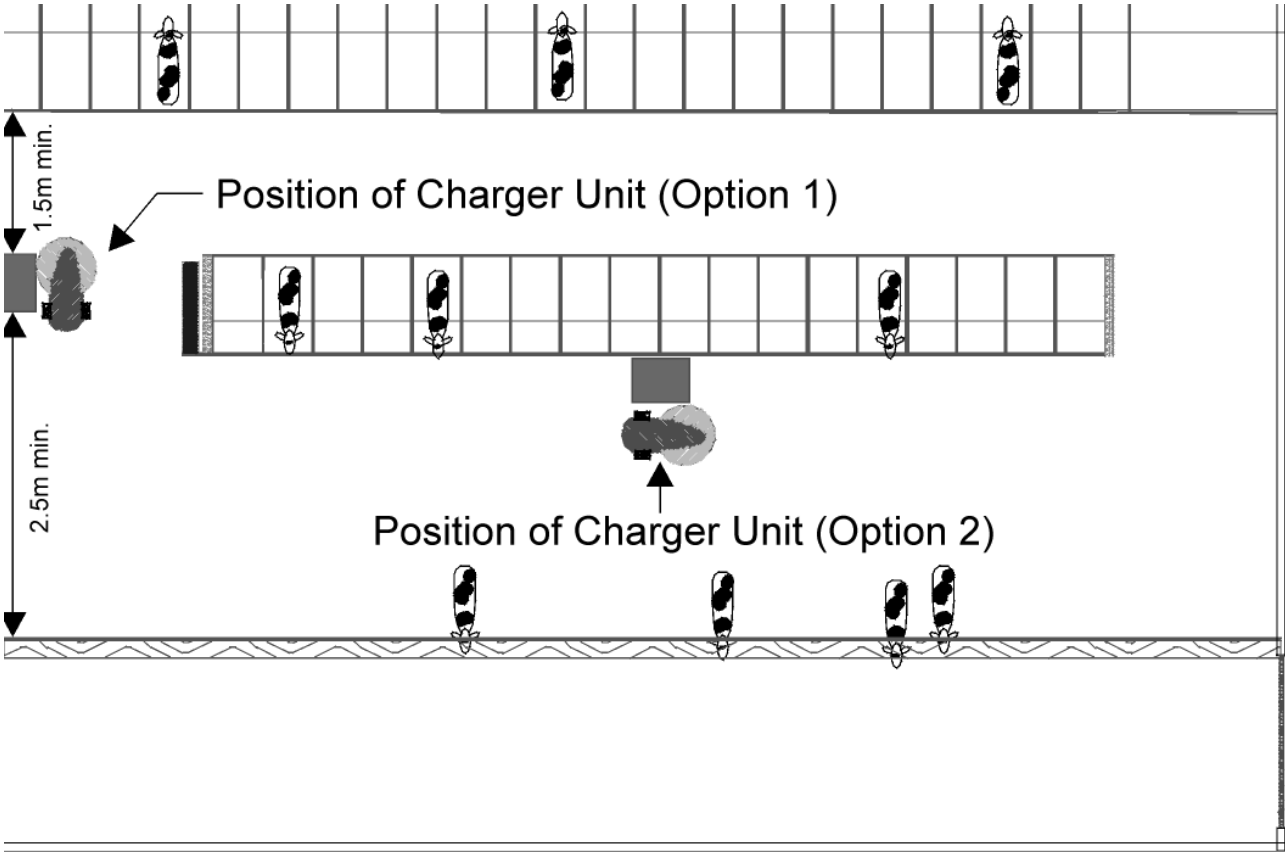

Figure 2 2 Positioning of the charger unit

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2.1.3 Installing the charger unit on the cowshed floor

1) Fit the electrodes (5, figure 2 1) to the lower support (4) with M8 bolts (4x).
2) Fix the floor column (1) to the shed floor with M10 bolts (8x - not supplied). Make sure that the whole unit is level.
3) Fit the lower support (4), including the electrodes, into the grooves on the floor column and tighten by hand (figure 2 3). Adjust the height of the support (4, figure 2 1) so that the centre line of the lower electrode (measured from the cowshed floor) is at 33 cm (figure 2 3).

NOTE

- *The electrodes can be bent a little with respect to each other, meaning that the distance of 40 cm may no longer be exact. Check the distance and adjust manually if required (alignment).*

4) Check the height of the upper electrode (figure 2 3). This must be at 40 cm (measured from the shed floor).
5) Tighten the bolts for the lower support (4).
6) Fit the battery charger (7) on the upper cover.
7) Fit the upper support (3). To make sure that there is a proper overlap between the covers, the separation between the two supports must be 50 cm.
8) Put the electrical wiring in place (red + and black -).

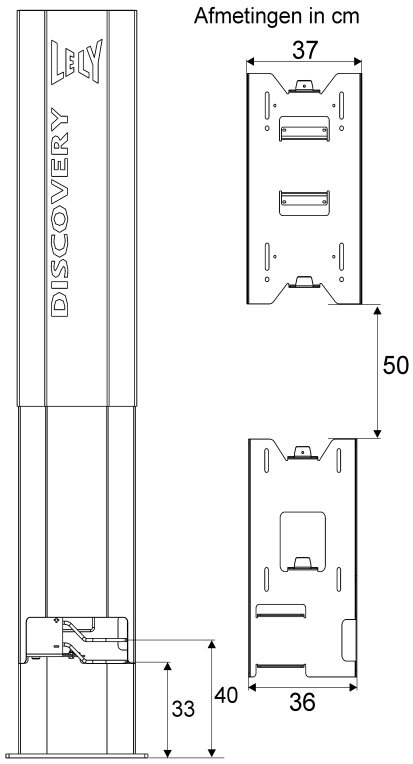

Figure 2 3 Installation dimensions

⚠ CAUTION

- *Read through the safety instructions carefully before assembling and connecting the battery charger. For more information see chapter 2.1.5 'Installing the battery charger'.*

9) Fit the lower cover (9) and then the upper cover (6).

2.1.4 Installing the charger unit on a wall

NOTE

- *For the correct placement within the cowshed, see details as described in* figure 2 2.

1) Fit the electrodes (5, figure 2 1) to the lower support (4) with M8 bolts (4x).
2) Place the support (4), with the electrodes, against the wall. Adjust the height of the support (4) so that the centre line of the lower electrode (measured from the floor) is at 33 cm (figure 2 3).
3) Mark the centres of the groove holes (4x) in the support (4, figure 2 1).
4) Fit the support (4, figure 2 1) to the wall using suitable bolts (not supplied). Make sure that the groove holes are in line, rather than the sides of the plate (because there is a 10 mm difference). Ensure that the whole unit is level and standing straight. Check the height of the upper electrode (measure from the cowshed floor). This must be at 40 cm.

NOTE

- *The electrodes can be bent a little with respect to each other, meaning that the distance of 40cm may no longer be exact. If this is the case, you should alter the distance for the upper electrode manually.*

5) Tighten the bolts for the lower support (4).
6) Fit the battery charger (7) on the upper cover.
7) Fit the upper support (3). To make sure that there is a proper overlap between the covers, the separation between the two supports must be 50 cm.
8) Put the electrical wiring in place (red + and black -).

⚠ CAUTION

- *Read through the safety instructions carefully before fitting and connecting the battery charger. For more information see* chapter 2.1.5 'Installing the battery charger'.

9) Fit the lower cover (9) and then the upper cover (6).

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2.1.5 Installing the battery charger

⚠ CAUTION

- *Before you supply power to the barn cleaner or operate, maintain or adjust the machine, first read the safety instructions carefully and familiarise yourself with all the safety notices. For more information see chapter 'Safety'.*
- *Check that the mains voltage from the power source matches the mains voltage required by the charger.*
- *Replace damaged wires/cables immediately.*

1) The battery charger must be mounted vertically (so that the LEDs are visible through the cut-away) with the heads of the bolts used to attach it facing upwards.
2) Then attach the other end of the RED power cable to the (+) terminal of the "upper" electrode on the charger unit. Repeat this with the BLACK power cable, fitting this one to the (-) terminal of the "lower" electrode on the charger unit.

Once the connections have been made between the barn cleaner's charger contacts and the charger unit, you can plug the unit into a working, earthed socket. The charging process then starts.

NOTE

- After being connected to the barn cleaner's battery, the battery charger will always go through the main charging process for a little while. In this case, the orange "charge" LED will be illuminated (figure 3 5).

Figure 2 4 barn cleaner at the charger unit

⚠ CAUTION

- *Only break the connection between the battery charger and the barn cleaner's battery (by driving it away) when the 100% LED (green) is illuminated.*
- *Allow for the fact that there is always a voltage across the barn cleaner's charging strips (figure 2 4). If you want to get the barn cleaner away from the battery charger, it is important that you always ensure that the charging process has been completed. The "charge" LED is not lit.*

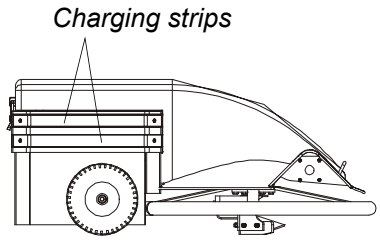

Figure 2 5 Location of the charging strips

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3 Description of components

The LELY DISCOVERY barn cleaner system (figure 3 1) consists of a number of distinct components, namely:

1) Discovery barn cleaner.
2) Charger unit.
3) Electrodes.
4) Battery charger (12V).
5) E-link manual controller.

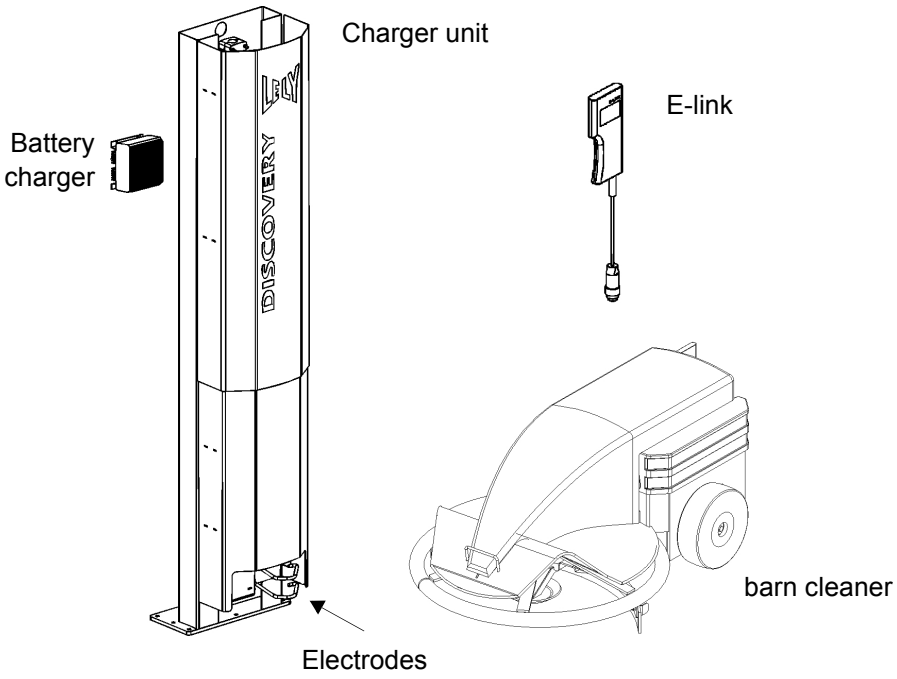

Figure 3 1 Discovery barn cleaning system

3.1 Discovery barn cleaner

The barn cleaner is a battery-powered vehicle that cleans the grid floor of the cowshed so that the cattle can walk on a clean and dry grid floor. The barn cleaner is designed to travel over a flat grid floor.

The barn cleaner is driven by two wheels that are powered by 2 drive motors. The drive motors use a 12V power supply from a single rechargeable battery. When the battery is fully loaded, the barn cleaner can operate for about 4 hours, after which the device has to be recharged for a similar period. Charging takes place at what is known as a charger unit (see chapter 3.2 'Charger unit').
In practice this means that the barn cleaner is working for 50% of the time and spends 50% of the time at the charger unit.

The route that the barn cleaner follows is programmed once by the farmer using the E-link manual control (see chapter 3.4 'E-link manual controller'). Different routes are possible, so that the farmer has the option of cleaning particular parts of the cowshed more intensively at certain times of day.

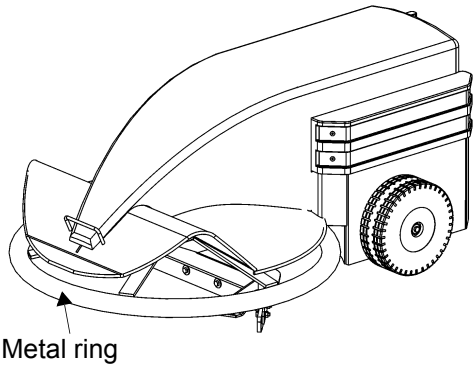

Figure 3 2 Barn cleaner (metal ring)

The barn cleaner has a large, movable metal ring (figure 3 2) above the manure scraper (figure 3 3) on the front of the machine. The integrated ultrasound sensor allows the device to follow the wall at a given distance. Turns are made and corrected using a built-in electronic gyroscope. The metal ring can follow the wall and can avoid any obstacles such as beams and the legs of the cows and/or calves.

The Discovery barn cleaner has the following specific features:

- adjustable speed
- distinctive shape > animal-friendly
- fitted with a fully hinged (swinging) manure scraper
- manure scraper has a large front area and is made of plastic and easy to replace
- low-maintenance and easy to keep clean
- equipped with an acoustical warning system

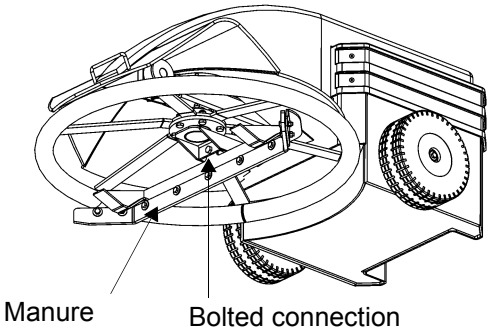

Figure 3 3 Barn cleaner (manure scraper)

3.2 Charger unit

Once pre-programmed, the barn cleaner recharges itself at the charger unit (figure 3 4).
The charger unit can be fitted in the cowshed in two ways:

- wall-mounted
- floor-mounted

A programmed route lets the barn cleaner get back to the charger unit.
The charger unit is also the starting and finishing point for all routes.
The 230V power supply must come into the charger unit from above.
The battery charger electrodes (at the bottom of the charger unit) are then wired up to supply 12V.

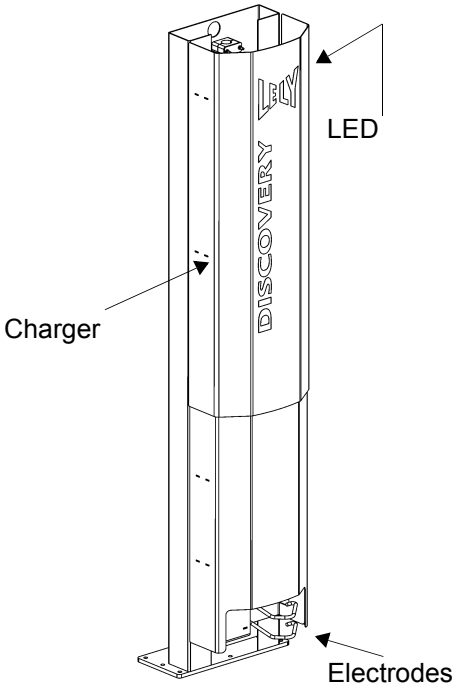

Figure 3 4 Charger unit (floor-mounted)

3.3 Battery charger

The TBC500 batter charger (figure 3 1) is enclosed behind the cover at the top of the charger unit. The batter charger can be left permanently connected to the mains voltage and to the barn cleaner, which keeps the battery in good condition.

NOTE

- *There is only a voltage across the electrodes during the charging process, when the barn cleaner is at the charging unit.*

The battery charger continuously checks the voltage of the battery. This is kept to the correct voltage automatically. This means that it is not possible to overcharge the battery.

3.3.1 Battery charger LED indicators

There are a number of LED indicators on the battery charger (figure 3 5). The meaning of the LEDs is as follows:

- Power LED (green): charger is connected to the lighting ring main (normal status)
- Charge LED (orange): charger is recharging the battery; the intensity indicates the charging current
- Error LED (red): connection are back to front

The LEDs can be seen through a cut-away at the upper right of the charger unit (figure 3 4).

Figure 3 5 Battery charger LED

3.4 E-link manual controller

You can use the E-link manual control (figure 3 6) to operate and programme the barn cleaner.

The E-link manual controller consists of an LCD display with 9 function buttons. The following buttons are used for operating the barn cleaner:

(1) - Next screen/ENTER
This button is used to open the selected menu and call up the next menu screen. Data is input or changed via the screen currently displayed.

(2) - Previous screen/ESC
Use this key to select the previous screen of the current menu.

(3) - Display

(4) - UP button +
Depending on the screen currently displayed, this key is used to select an option, modify a value or confirm a command.

(5) - DOWN button –
See description of previous button

(6) - Start/Stop button
There are a limited number of cases where a procedure can be stopped or started using this button.

(7) - PR button
Is used to reduce the speed when programming the barn cleaner, in particular when approaching a collision point (reference point).

(8) - Buttons Soft1 to Soft3 (from left to right)

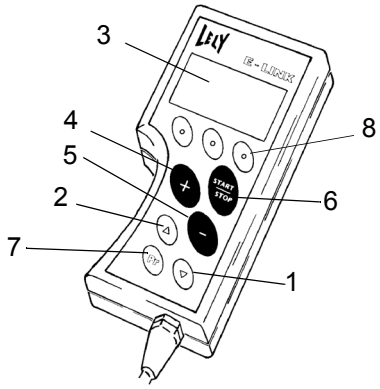

Figure 3 6 E-link manual controller

3.5 Printed circuit board (multiboard ADS3800B)

3.5.1 PCB connectors

Table 3.1 Connector 201 - shortcut between pins 1 and 2

Pin	Description	Colour	Voltage (VDC)
1	Not used		
2	Shortcut	Black	0.0
3	Shortcut	Black	0.0

Table 3.2 Connector 202 - Power

Pin	Description	Colour	Voltage (VDC)
1	- GND	Black	0.0
2	+ POWER	Red	12.0

Table 3.3 Connector 402 - CAN-BUS

Pin	Description	Number	Voltage (VDC)
1	Not used		
2	CAN high	2	2.7
3	CAN low	1	2.7
4	Not used		

Table 3.4 Connector 801 - Ultrasound sensor

Pin	Description	Colour	Voltage (VDC)
1	+ POWER	Blue	0.0
2	RX (stop)	Grey	
3	TX (start)	Green	
4	Temp	Yellow	5.0
5	- GND	Brown	5.0

Table 3.5 Connector 1201 - Gyroscope

Pin	Description	Colour	Voltage (DC)
1		Black	0.0
2		Green	2.5
3		Grey	5
4	Not used		

Table 3.6 Connector 1202 - Gyroscope

Pin	Description	Colour	Voltage (DC)
1		White	0.0
2		Yellow	2.5
3	Not used		
4	Not used		

Table 3.7 Connector 1304 - Gyroscope

Pin	Description	Colour	Voltage (DC)
1		Brown	5.0
2	Not used		
3	Not used		
4	Not used		

Table 3.8 Connector 1305 - Enc 1

Pin	Description	Colour	Voltage (VDC)
1	- GND	White	0.0
2	A	Yellow	
3	B	Green	
4	+ POWER	Brown	5.0

Table 3.9 Connector 1306 - Enc 2

Pin	Description	Colour	Voltage (VDC)
1	- GND	White	0.0
2	A	Yellow	
3	B	Green	
4	+ POWER	Brown	5.0

Table 3.10 Connector 1401 - Battery charge current measurement

Pin	Description	Colour	Voltage (VDC)
1	+ POWER	Brown	+ 0.0
2	- GND	White	- 0.0

Table 3.11 Connector 1701 - Motor 1 left-hand wheel (as seen from the direction of motion)

Pin	Description	Colour	Voltage (VDC)
3	+ POWER	Red	
4	- GND	Black	

Table 3.12 Connector 1801 - Motor 2 right-hand wheel (as seen from the direction of motion)

Pin	Description	Colour	Voltage (VDC)
3	+ POWER	Red	
4	- GND	Black	

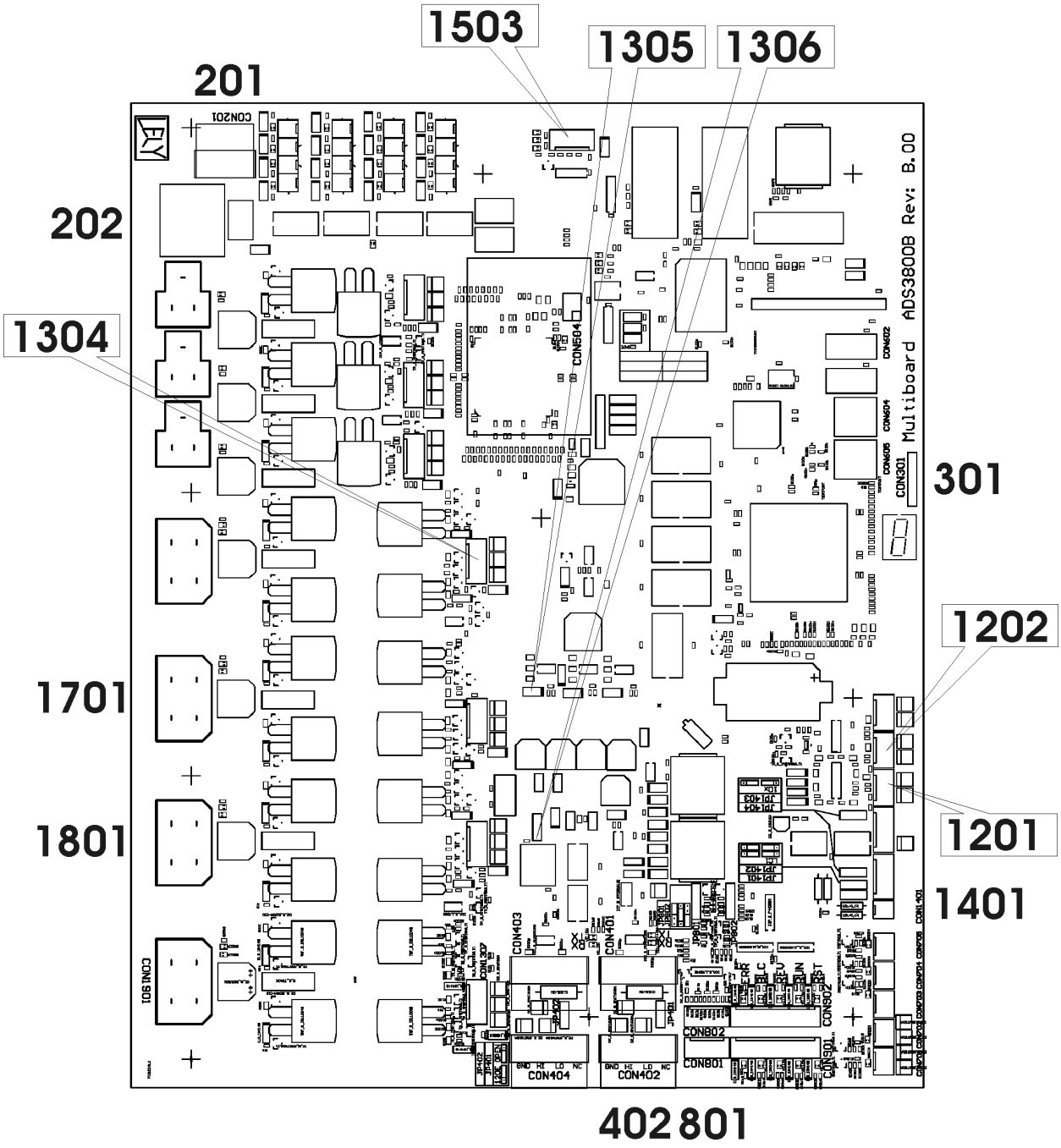

Figure 3 7 PCB connectors (multiboard ADS3800A)

4 System operation

4.1 General

The route (figure 4 1) that the barn cleaner follows is programmed once only by the farmer using the E-link manual control. Different routes are possible, so that there is the option of cleaning particular paths within the cowshed more intensively at certain times of day.
The barn cleaner is powered by a battery and goes back to the charger unit to complete every route; the charger is strategically placed within the cowshed (figure 2 2). The charger unit is thus the starting and finishing point for all routes.

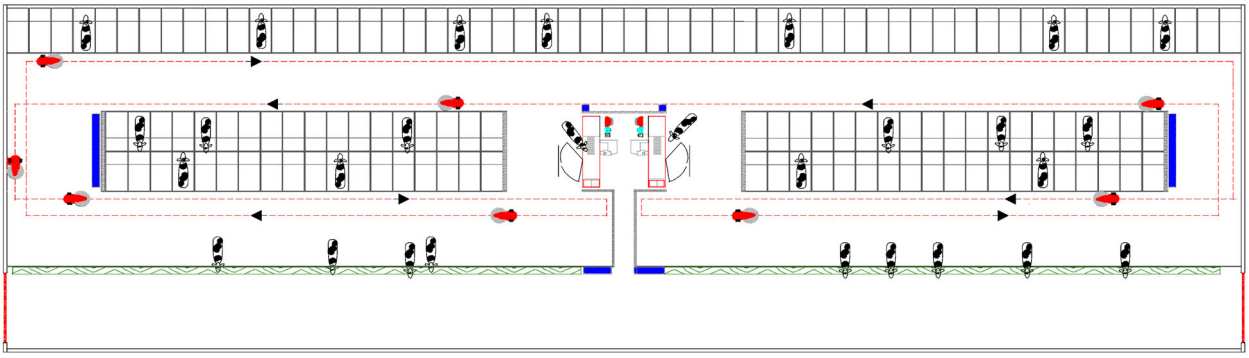

Figure 4 1 Example route for barn cleaner

4.2 Programming with the E-link manual control

We recommend that all users read the manual to familiarise themselves with the positioning and function of all control elements before starting to use the machine.

the E-link manual control (figure 4 2) is used to operate the barn cleaner (see chapter 3.4 'E-link manual controller').

Figure 4 2 E-link manual controller

4.3 Menu structure

The following data can be seen when starting up the E-link display:

- **Work**
- **Routes**
- **Test**
- **Adjustments**
- **Alarms**
- **Service**

4.3.1 "Work" menu

The "Work" menu consists of the following submenus:

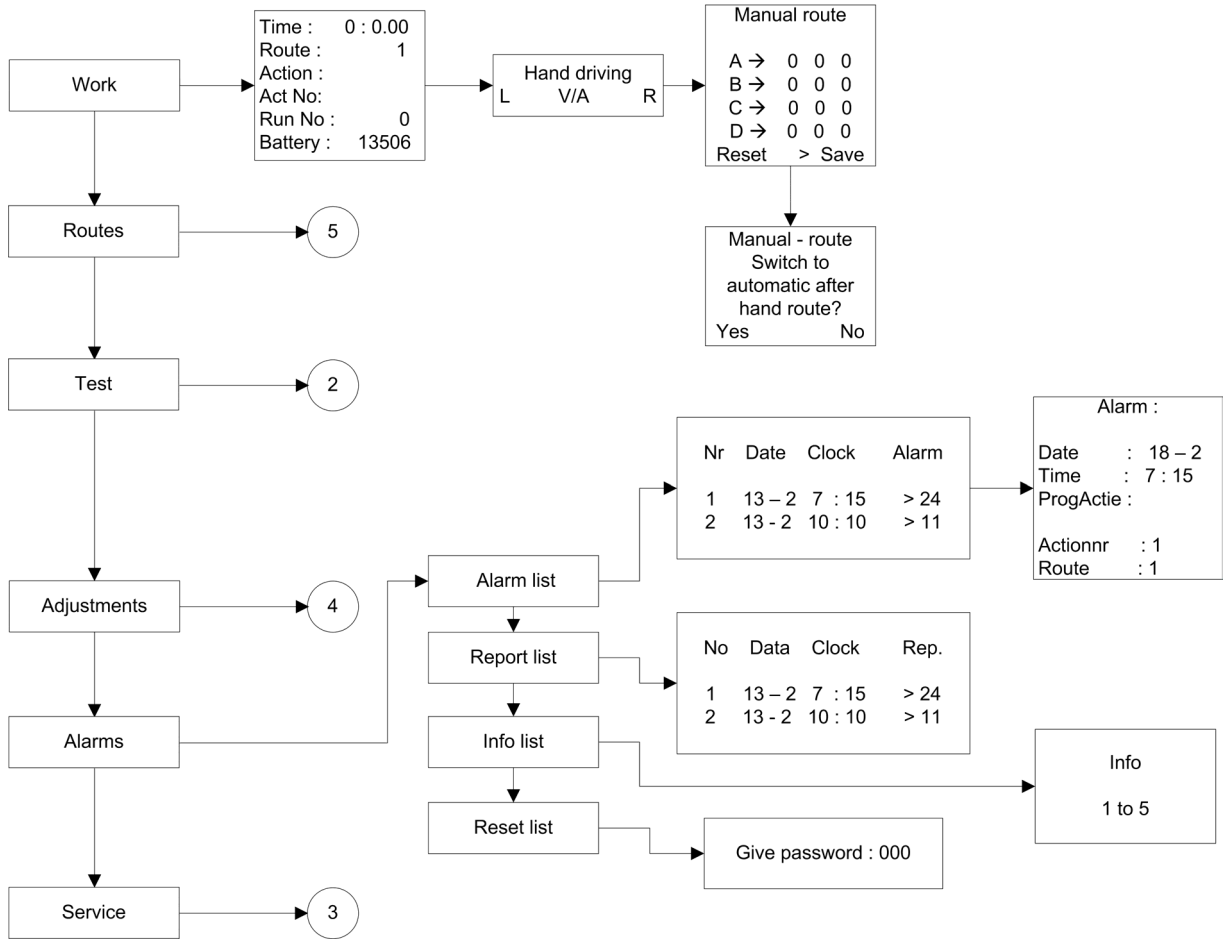

Figure 4 3 "Work" flow diagram

After the timeline has been set, it is still not active until ENTER is pressed once in the main menu. This screen indicates when the Discovery is going to travel the next route.

If you press START now, the bar at the top of the screen goes black. The route now becomes active.

4.3.2 "Routes" menu

The "Routes" menu consists of the following submenus:

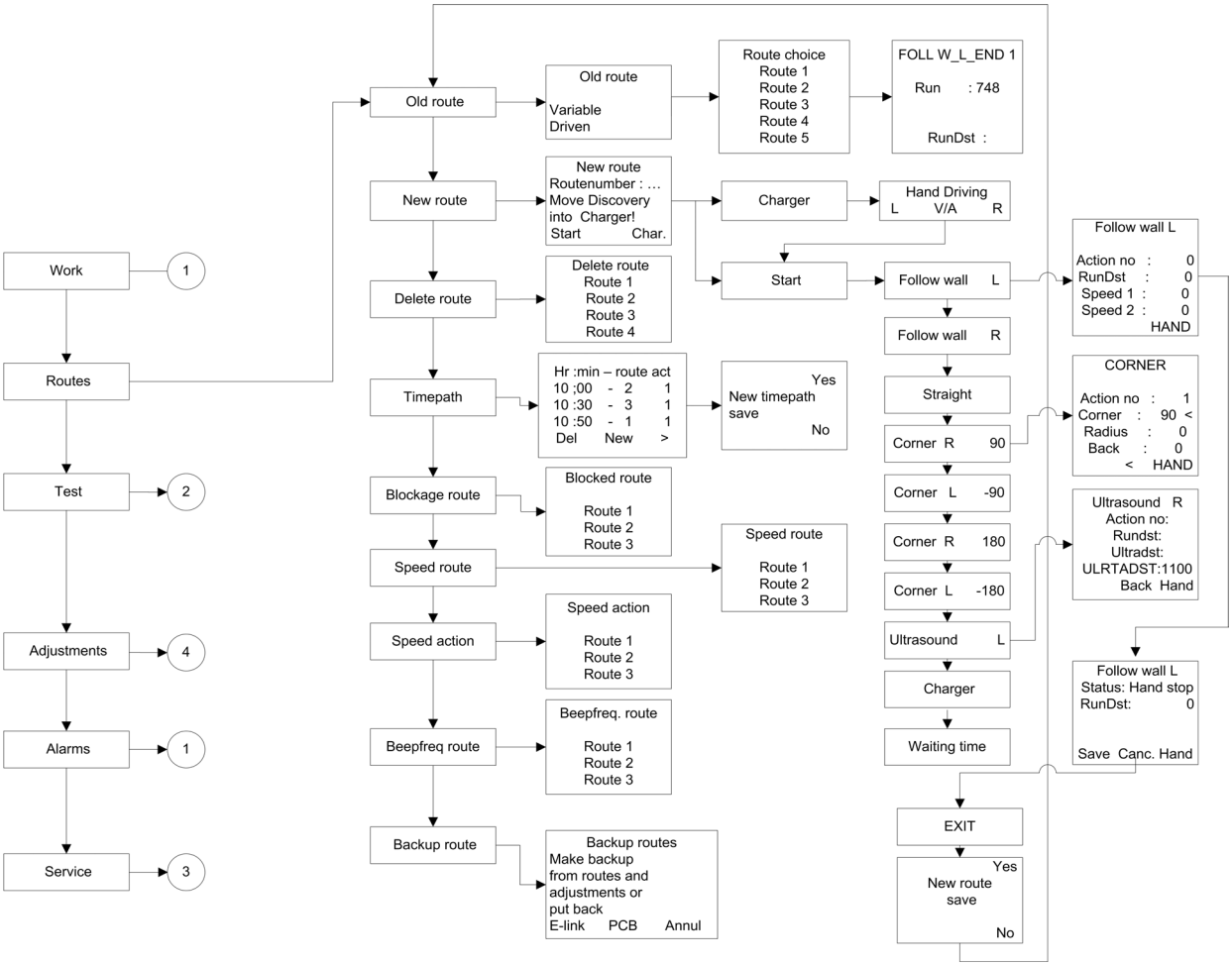

Figure 4 4 "Routes" flow diagram

"Routes > Old route" menu item

Select "Old route" submenu:

- Using the UP and DOWN buttons (+ and -), scroll around the list of routes (route 1, 2, etc.). Use the ▼ button to go the screen where the variables for the chosen action can be selected. You can use Soft2 to select the variables and adjust the height using the UP/DOWN buttons (+ and -).
- The Soft1 button can be used to clear the action concerned.

Use the ▲ button to go back to the "Routes" menu. You are then asked whether or not the change should be saved. The UP/DOWN selection buttons (+ and -) can be used to respond "Yes/No". Then use the ▼ and ▲ buttons to go back to the "Routes" menu.

"Routes > New route" menu item

Before programming a route, it is important that you already have the route partially set out in your mind. Think a couple of steps ahead when you are programming. Pick the best route for the barn cleaner. Specific points to consider are:

- Include as many collision points as possible when programming the route. This is very important, because these are the points where the distance travelled is reset and the counter starts again. This improves the reliability of the route. The cubicle stalls will be hypothetically subdivided along two axes (length and width). Collision points have to be included in both directions.
- When travelling straight forward, the deviation after 5 metres can be more than 0.5m.
- Try to use several small routes if possible (e.g. maximum of 16 actions) instead of a single long route. If there are several routes, small sections of the cubicle stalls can be covered several times a day.
- Always do a gyroscope calibration before setting off on a new route.
- An action (wall following, straight ahead, ultrasound) must be for at least 4 metres and must end facing straight so that the gyroscope can be reset. A short action that does not go straight can then follow.
- Do not do too many "small actions" in succession; this can cause large cumulative deviations as the gyroscope counts the angles. You should therefore alternate between shorter and longer routes.
- Make turns of exactly 90 or 180 degrees. Straighten with the manual control if necessary. For other angles, the barn cleaner has to be pointed in the right direction.
- Use the ultrasound feature (maximum 2 metres)
- The positioning of the charger unit is important. To allow the barn cleaner to park and depart correctly, there must be 2.5m room in front of the charger unit and 1.5m room behind it.

In short:

- as many long actions as possible
- point it in precisely the right direction
- go straight to your target
- alternate short and long actions
- changing later is not possible

The starting point for a new route is the charger unit. A fixed starting position maximises the degree of certainty that the route is being programmed correctly.
The "Charger" (Soft3) button can be used to manoeuvre the barn cleaner manually to the charger unit.
The "Start" button (Soft1) reveals the options such as "Wall following L", "Wall following R", "Straight ahead", etc.

After starting a new route, you are taken to a scroll menu containing various action options. For the first function, only left and right wall following are possible. For subsequent actions, choices from the full menu are available. The UP/DOWN selection buttons (+ and -) can be used to select an action. Confirm the chosen action with the ▼ button. A screen for the action selected is then shown, containing a number of variables. Variables are indicated with a "<" symbol. The following actions are possible:

- **BACK (Soft1 or Soft2 button)**:
  Back to the action scroll menu without doing anything.
- **If present (Soft2 button)**:
  Select the variable whose setting is to be changed.
- **MANUAL (Soft3 button)**:
  Manual operation: adjusting the barn cleaner to get a good starting position (direction) - for example to help it steer through a bend.
- **Start/Stop**:
  Starting: The "Start/Stop" button activates the selected action. Depending on the action, this will proceed automatically, or Stop or PR must be used to complete the action.
- **UP/DOWN selection buttons (+ and -)**:
  Modify a variable: the UP/DOWN selection buttons (+ and -) can be used to modify the value. If there are

several adjustable variables, they can be selected with the Soft2 button and then modified as described previously.

The other variables are the current values for the barn cleaner.
After stopping, there is a screen showing the options for the Soft and Start/Stop buttons:

- **SAVE (Soft1 button)**: store the action in memory.
- **CANCEL (Soft2 button)**: undo the action (cancel); this takes you automatically into manual operation and then goes back to the previous situation (most recent "SAVE" point).
- **MANUAL (Soft3 button)**: to adjust the barn cleaner a little more before storing the action (for example to help it make a turn; this final gyroscope value is then stored).
- **Start-Stop/Starting**: continue with the original action (so you can stop for a moment if there are cows in the way).

The scroll menu then lets you make the following choices:

1) **Follow Wall L** (tracking along a wall on the left: left-hand motor runs at 90% and the right-hand motor runs at 100%):
   The following variables are shown:
- **Act.no.**: sequence number for the actions in this route
- **RunDst**: current distance travelled in mm
- **Speed1**: left wheel speed in mm/s
- **Speed2**: right wheel speed in mm/s

There are two ways of stopping:

- **PR, collision point**: let the barn cleaner bump into the collision point; this point is also stored in the memory. Try to use as many collision points as possible within the shed. When approaching such a collision, press the "PR" button. The Discovery is now anticipating a collision point and will move more slowly. If there is a bit of wheel spin when traversing the route, the barn cleaner will then still keep going until the collision point.
- **Start/Stop, stopping manually**: a certain distance travelled is stored in memory via this action.

2) **Follow Wall R** (tracking along a wall on the right) The following variables are shown:
- **Act.no.**: sequence number for the actions in this route
- **RunDst**: current distance travelled in mm
- **Speed1**: left wheel speed in mm/s
- **Speed2**: right wheel speed in mm/s

There are two ways of stopping:

- **PR, collision point**: let the barn cleaner bump into the collision point; this point is also stored in the memory. Try to use as many collision points as possible within the shed. When approaching such a collision, press the "PR" button. The Discovery is now anticipating a collision point and will move more slowly. If there is a bit of wheel spin when traversing the route, the barn cleaner will then still keep going until the collision point.
- **Start/Stop, stopping manually**: a certain distance travelled is stored in memory via this action.

3) **Straight**

NOTE

- *For this action, it is important that the barn cleaner's direction of travel when started up is correct. Only then is the gyroscope value concerned stored in the memory. This gyroscope value is used when starting the route, to ensure that it starts off in the right direction.*

The following variables are shown:

- **Act.no.**: sequence number for the actions in this route
- **RunDst**: current distance travelled in mm
- **Speed1**: left wheel speed in mm/s
- **Speed2**: right wheel speed in mm/s

NOTE

- *Use the "Straight" option as little as possible. If it really is necessary, for example to get it through a doorway, make the distance travelled as small as possible. Once through the doorway, continue with left or right wall following or "Ultrasonic L". Programming it like this will improve the accuracy of the route to be travelled.*

There are two ways of stopping:

- **PR, collision point**: let the barn cleaner bump into the collision point; this point is also stored in the memory. Try to use as many collision points as possible within the shed. When approaching such a collision, press the "PR" button. The Discovery is now anticipating a collision point and will move more slowly. If there is a bit of wheel spin when traversing the route, the barn cleaner will then still keep going until the collision point.
- **Start/Stop, stopping manually**: a certain distance travelled is stored in memory via this action.

4) **Corner R 90**: pre-programmed turn to the right by 90°.
- Positive value = turn right
- Negative value (-) = turn left[1]

The following variables are shown in this menu:

- **Act.no.**: sequence number for the actions in this route
- **Corner**: angle of turn (variable and adjustable)
- **Radius**: the radius of the turn (variable and adjustable) that the barn cleaner will make:
  0 = on the spot
  300 = about one of the drive wheels
  600 = a sweeping curve
- **Back**: the distance (adjustable) that the barn cleaner first goes backwards before making the turn (needed if the barn cleaner comes up against an obstacle).
- **SAVE**: stores the given gyroscope value. The direction the barn cleaner is facing must now be correct (adjust by hand if necessary).

5) **Corner L -90**: pre-programmed turn to the left by 90°.
Please refer to point 4 for more information about the variables.

6) **Corner R 180**: pre-programmed turn to the right by 180°.
Please refer to point 4 for more information about the variables.

7) **Corner L -180**: pre-programmed turn to the left by 180°.
Please refer to point 4 for more information about the variables.

1) Any numerical value may be entered.

8) **Ultrasound L**: towards ultrasound signal on the left. The following variables are shown:

- **Act.no.**: sequence number for the actions in this route
  RunDst: current distance travelled in mm
  UltraDst:
  Information not yet available.
- **ULTRADST**:
  Information not yet available.

9) **Charger**: programme in the location of the charger.
The barn cleaner finds the charger unit independently (default = on the left). If the charger is fitted on the right-hand side, this can be set in the appropriate screen using the Soft1 button. When a new route is programmed, stop the Discovery about 1 metre before the charger unit and let the barn cleaner then go to the charger unit using the "Charger" menu. Once the charger unit has been found, go to "Exit". The following question will now be displayed on the screen > "New route... save Yes/No".

The following variables are shown:

- **Act.no.**: sequence number for the actions in this route
- **RunDst**: current distance travelled in mm
- **Charge:**

10) **Waiting time**: Gives the possibility to program the barn cleaner to wait an adjustable time in a route.

"Routes > Delete route" menu item

Select the route that you want to delete and then press "▼". Confirm with a "Yes" in the "Route... delete? Yes/No" screen to erase the route in question.

"Routes > Timepath" menu

This menu is where the times are given that a particular route is to be traversed. Up to 48 settings are possible per day (timed to the minute). Extra time rows can be added by pressing "New" and entering the appropriate time and route.

Example:

Route 1 - only behind the cubicle stalls

Route 2 - the entire space between the front gate and the stalls

Route 3 - the entire space between the stalls

Route 4 - section for cows not being milked.

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Table 4.1 Timepath (example)

Time	Route	Active
12.00	1	1
12.15	2	1
12.35	3	1
13.00	4	1
13.55	3	1
14.25	2	1
14.45	3	1
14.50	1	1
15.20	2	1
16.50	4	1

When settings are changed, a confirmation ("Yes/No") is always requested before anything is stored. If a particular route cannot be traversed at a given time, this can easily be modified by changing the value in the "Active" column from 1 to 0.

"Routes > Blockage route" menu item

NOTE

- *Blocking a route manually is not possible using the "Work > Hand Driving > Manual route" menu item.*

In this menu, it is possible to block one or several routes manually. If the shovelling actions are not possible in part of the shed, this is a quick way to block the routes.

"Routes > Speed route" menu item

This menu allows you to set the speed for each route. The value that is supplied by default is 300, which is the maximum speed. A value of 150 is therefore half speed. Any value from 0 to 300 is possible. During programming, the speed is 300. The speed is set to 180 for traversing the route, so that the cattle can get used to the barn cleaner. The speed for each route can then be increased, depending on the cowshed and the herd.

"Routes > Speed action" menu item

This menu allows you to set the speed for each action, for example driving slowly just before the feed barriers. For more information refer to the **Speed Route** menu item.

"Routes > Beepfreq route" menu item

This menu allows the beep frequency to be switched on an off for each route. When the barn cleaner goes behind the stalls, the beep can be switched off, but it can be left one when the route stays in front of the gate. The cows that are present at that time will be alerted and can move out of the way in their own good time.

"Routes > Backup route" menu item

This menu allows you to store the routes on the E-link or copy them back to the PCB.

4.3.3 "Test" menu

The "Test" menu consists of the following submenus:

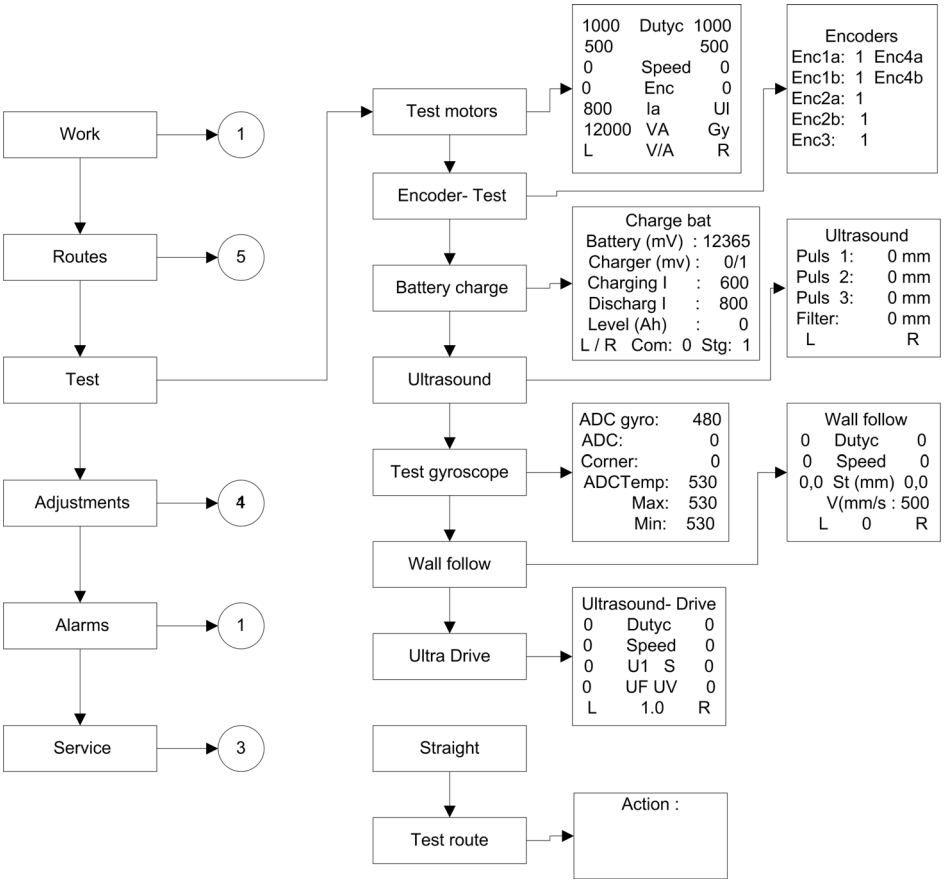

Figure 4 5 "Test" flow diagram

"Test > Test motors" menu item

This submenu lets you read information such as:

a) Dutyc = power value (left and right motor) on a scale of 0 to 1000
b) Set v = speed selection (left and right motor) in mm/s
c) Speed = read current wheel speed (left and right) in mm/s
d) Encx = pulse value (left and right motor)
e) Ia = charging current value (ADC value)
f) UI = distance according to ultrasound sensor in mm
g) VA = battery voltage in mV
h) Gy = gyroscope value in degrees
i) R = right motor selection
j) L = left motor selection
k) ↑ = forward direction of travel
l) ↓ = reverse direction of travel

NOTE

- *An input selection on the E-link manual control is shown as a grey cross-hatched block.*

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Use the E-link manual control to select the left and right motors (L and R) and then choose a direction of travel (↑ or ↓).

UI:

An object can be held up near the ultrasound sensor to affect the measurement it gives. Check that the measured distance increased as the separation between the object and the sensor grows. The maximum distance measured is about 3000mm.

"Test > Encoder Test" menu item

Check that the pulse such as enc1a etc. are present. As the distance travelled increases, this value should be incremented.
Use the E-link manual control to select the left and right motors (L and R) and then select a direction of travel (↑ or ↓); the barn cleaner should travel in a straight line and the pulse values should be the same.

"Test > Battery Charge" menu item

This menu lets you check the charging current. Manoeuvre the barn cleaner manually to a few metres in front of the charger unit. Go to the "Test > Battery Charge" menu, then press the "Start" button on the E-link manual control (the barn cleaner will start to move).
Check the "Delta V" value (this must be between 300 and 450). When it has found the charger unit, the "Charging" value will change from a 0 to a 1. The "Delta V" value will then increase to a value of above 600.
Battery empty = high "Delta V" value
Battery full = low "Delta V" value (see also chapter 7 'Troubleshooting').

"Test > Ultrasound" menu item

An object can be held up near the ultrasound sensor (mounted under the barn cleaner's cover) to affect the measurement it gives. Check that the distance measured from the sensor to the object goes up as the actual distance is increased. The maximum distance measured is about 3000mm.

Check if the ultrasound sensor is responding to any reflections coming from the tracer wheel.
This can be checked for each pulse (pulse measurement 1, 2 and 3). Naturally, no pulses should be observed (see also chapter 7 'Troubleshooting').

If pulses are observed, you should then reduce the value of what is known as the "Start pulse" (see also chapter '"Service > Installation 1" menu item"') by decrements of 10 until no pulses are recorded any more. The default value for the start pulse is 500.

Test > Gyroscope" menu item

This menu item is for engineering use only.

"Test > Wall follow" menu item

Select the "Wall follow" submenu and use the E-link manual control to pick a direction of travel (↑ of ↓).
The wheel that is closest to the wall will run at 80% (see "Speed" info) whereas the opposite one will be at 100%. This allows the barn cleaner to follow the wall contour. The following information can be read off:

- Dutyc = power
- Speed
- St = distance (mm)
- V = set speed (mm/s)
- L = track the wall on the left
- R = track the wall on the right

"Test > Ultra Drive" menu item

The "Ultra Drive" submenu allows the following information to be read:

- Dutyc = power
- Speed
- U1 = ultrasound measurement 1
- S = distance (mm)
- UF = ultrasound filter
- UV = ultrasound vector (angular setting for the ultrasound signal)
- L = left (ultrasound signal source)
- 1000 = distance (mm) to the barn cleaner, measured from the wall
- R = right (ultrasound signal source)

When a distance of 1.0 is given, the barn cleaner will keep this distance from the wall or the cubicle planking. Also check whether the barn cleaner follows a straight path without too many swerving motions.
Too many direction changes are caused by excess reflections that the ultrasound sensor is picking up. To check this: see description section '"Test > Ultrasound" menu item'.

Test > Staight" menu item

This menu item is for engineering use only.

"Test > Test route" menu item

The actions deriving from a pre-programmed route can be read out using this screen. Also well-suited for demonstration purposes (a route that has to be traversed continuously).

4.3.4 "Adjustments" menu

The "Adjustments" menu consists of the following submenus:

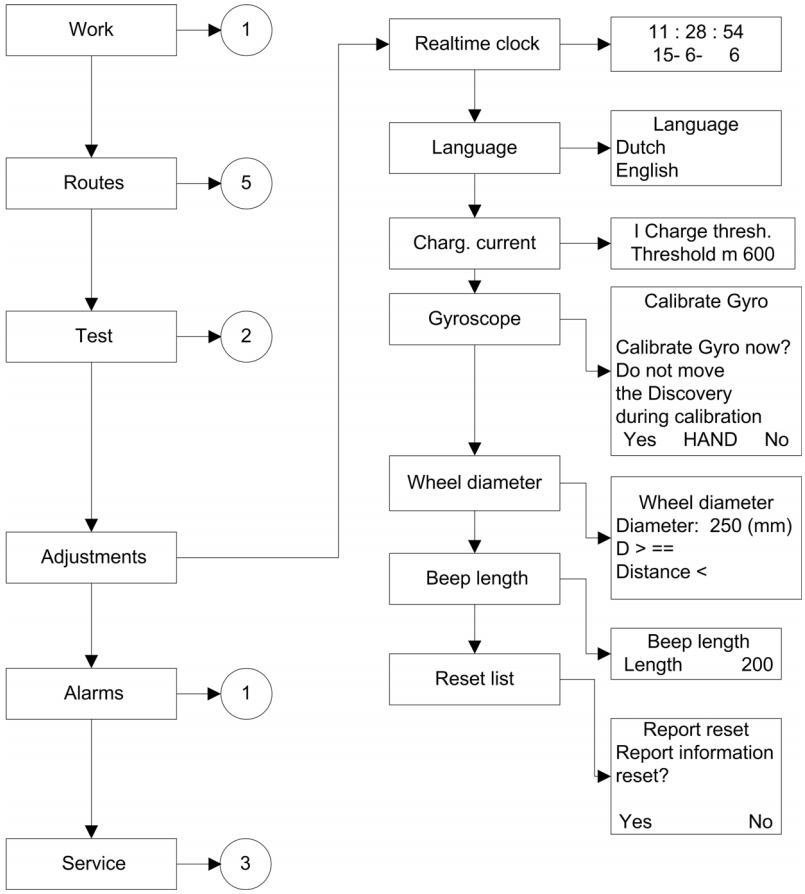

Figure 4 6 "Adjustments" flow diagram

"Adjustments > Real-time clock" submenu

The correct date and time should be entered in this screen. The time settings for the barn cleaner as based on this clock. The correct date setting is also important, for searching for alert reports on that date.

Clock 11:53
Date 2-9-2004 (dd/mm/yy)

To set the date and time, select the "Real-time clock" menu and then the "▼" button. The date and time can be adjusted using the Soft2 button (↓) together with the UP/DOWN selection buttons (+ and -).

"Adjustments > Language" menu item

This screen allows you to change the language of the software screens.

"Adjustments > Gyroscope" menu item

This screen allows you to recalibrate the gyroscope. The Discovery must not be moved during the calibration, not even slightly.

"Adjustments > Wheel diameter" menu item

This screen allows you to specify the diameter of the wheels of the barn cleaner. The default is 250 mm.

"Adjustments > Beep length" submenu

The length of the bleep is adjustable (default value is 200)
Beep length (value) large = longer note
Beep length (value) small = shorter note

"Adjustments > Reset list" submenu

Resets the alarms that are stored in the alarm list.

4.3.5 "Alarms" menu

The “Alarms” menu is constructed as follows:

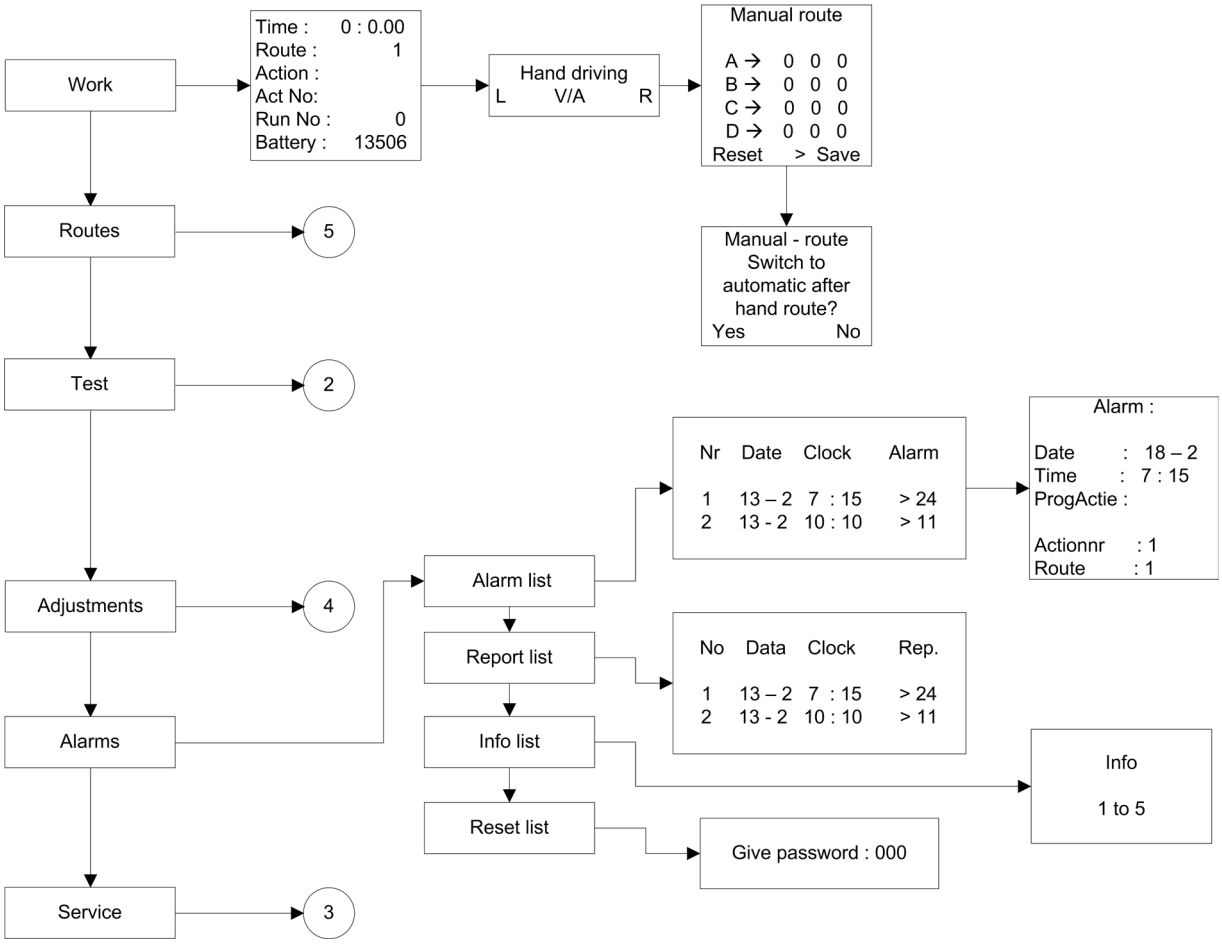

Figure 4 7 "Alarms" flow diagram

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"Alarms > Alarm list" submenu

The alarm list gives a summary of the alarms received. This list stores up to 50 alarms. Once 50 alarms have been stored, the next alarm will overwrite the oldest one in the list.

The alarm list screen looks like this:

Table 4.2 Alarm list (example)

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

To get more details about an alarm, you should first select it and then press the ▼ (ENTER) button.
The table below gives the alarm numbers and any actions to be taken:

Table 4.3 Alarms and codes

Alarm code	Description
1	Empty battery
2	Double action (delete an action)
3	barn cleaner out of control
4	Blocked in a turn
5	No time defined
6	barn cleaner blocked
7	Angle greater than 360 degrees/gyroscope not correctly calibrated
8	Charge current measurement error - reset the PCB
9	Failed to find charger unit
10	Start up the PCB
11	Maximum of 16 routes
12	No ultrasound signal
13	barn cleaner wheels slipping when turning
14	Voltage too low, therefore recharged for 1 hour extra
15	More than 20Ah used
16	Charging completed
17	Charging completed
18	Battery charger timeout
19	Identical times
20	Setting off with battery voltage too low
21	barn cleaner's wheels slip when following a wall (barn cleaner will retry)
22	After five failures due to wheels spinning, the barn cleaner stops and generates an alert. Then (after 2, 30 and 60 minutes) it will try again.
23	Having difficulty moving

Table 4.3 Alarms and codes

Alarm code	Description
24	Memory error
25	Short circuit in motor 1
26	Short circuit in motor 2
27	Communications error/software problem
30	Motor 1 overloaded
31	Motor 2 overloaded
32	Time required for motors to cool
33	Battery is being recharged
34	Battery is full
35	Battery recharge failed/mains voltage too low
36	Factory reset after cooling down
37	Factory reset
38	Recalibrate
39	Not at temperature/connect the brown wire
40	Communications error with "dump mode"
41	Communications error with "set mode"
42	Difference between charger/battery voltages too great

"Alarms > Report list" menu item"

The "Report list" menu item shows the description of the alarms from the "Alarm list".

"Alarms > Info list" menu item"

The "Info list" menu item is for servicing only.

"Alarms > Reset list" menu item"

The "Reset list" menu item is for engineering only.

4.3.6 "Service" menu

The "Service" menu consists of the following submenus:

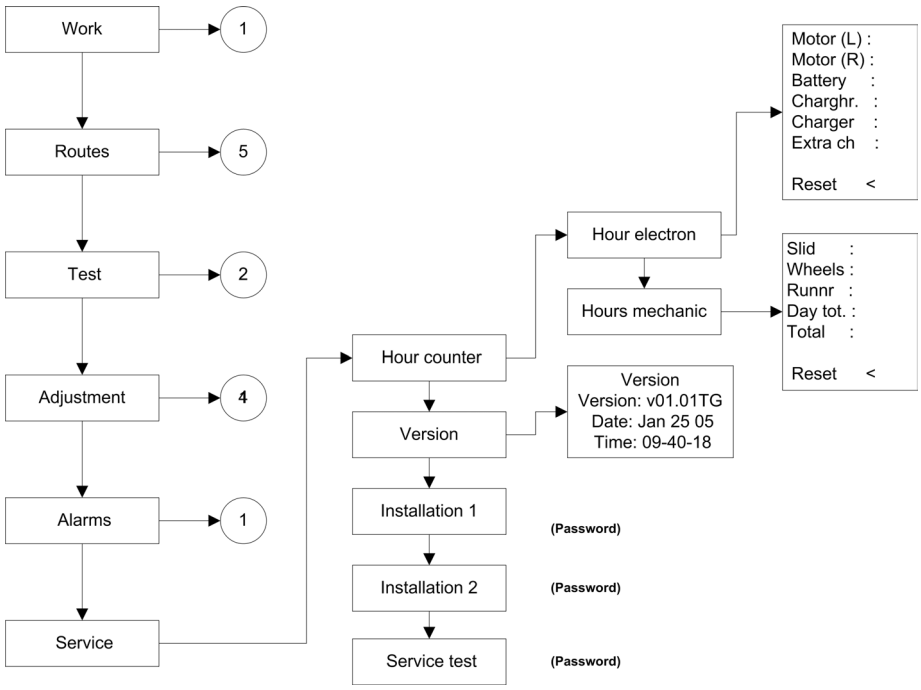

Figure 4 8 "Service" flow diagram

"Service > Hour counter > Hour electron" submenu"

The following hours are recorded under "Hour electron":

- Motor (L):
  Operational hours for the left-hand motor
- Motor (R):
  Operational hours for the right-hand motor
- Battery:
  Operational hours for the battery
- Charging hours:
  Time spent recharging
- Charge:
- Extra l.:
  Additional recharging (if the battery voltage is too low, the Discovery will recharge for 1 hour longer).

Each hourly counter (L/R motors, battery, etc.) can be reset individually. Place the "<" cursor next to the hourly counter in question using the Soft2 button, then select "Reset".

"Service > Hour counter > Hour mechanic" submenu"

The following hours are recorded under "Hour mechanic":

- Slid:
  Number of hours that the scraper has been working

- Wheels:
  Number of hours that the tyres have been in motion
- Runnr:
  Number of runs made per day
- Day tot.:
  Total number of runs made on the day in question
- Total: total number of runs made (cannot be reset)

Each hourly counter (scraper, wheels, etc.) can be reset individually. Place the "<" cursor next to the hourl counter in question using the Soft2 button, then select "Reset".

"Service > Version" menu item"

The "Version data" submenu shows the revision number of the software (e.g. v01.01R). This also gives details of when the software was written.

"Service > Installation 1" menu item"

The "Installation 1" submenu is only accessible after entering a password[1]. Various parameter settings are possible from within this submenu.

"Service > Installation 2" menu item"

The "Installation 2" submenu is only accessible after entering a password[2]. Various parameter settings are possible from within this submenu.

"Service > Service test" menu item

The "Service test" submenu is only accessible after entering a password[3]. Various parameter settings are possible from within this submenu.

4.4 Hints for programming

4.4.1 General

- Before programming, you should ensure that the floor and wall under the feeding gate are clean. This prevents wheel spin and improves the overall precision of the work (including being able to find its way back to the charger unit independently).
- Try to use as many collision points and reference points as possible (x+4 reference); this is because of the slight slippage that can occur when travelling (the barn cleaner continues until it gets to the given collision point/reference point).
- Before programming, have a look to see what the most efficient route will be (accounting for obstacles and collision points).
- The distance between the ultrasound sensor and the stall planking is least (start at right angles to the wall) when traversing a right-handed circuit (figure 4 10); this means that the accumulated discrepancies will be less.

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1) The information is only accessible for the service engineer.
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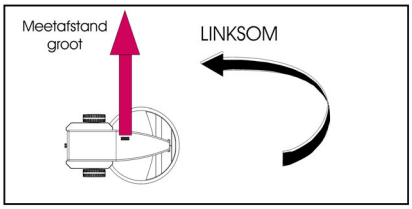

Figure 4 9 Left-handed circuit

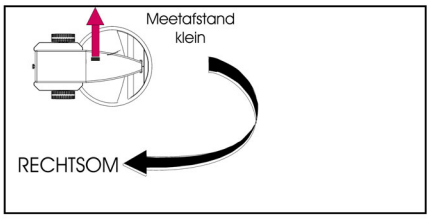

Figure 4 10 Right-handed circuit

- Try not to make the turns too tight (figure 4 12) - drive on a little and then start the turn (figure 4 11).

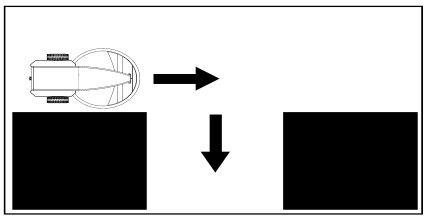

Figure 4 12 Route with a tight curve

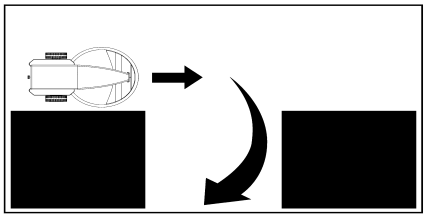

Figure 4 11 Route with a gradual curve

- When starting a route, the barn cleaner has to follow the wall a little (not straight ahead), since it is not possible to commence with a turn. The barn cleaner will otherwise bump into the charger unit.
- Avoid programming in routes where reversing is required.
- Routes cannot be modified later. The only possible change is to alter the speed for part of a route (e.g. when passing the feeding gate).
- The best routes are a mixture of wall following and ultrasound tracking.
- Once a route is programmed in, it is store in memory when the "store route Yes/No" choice is confirmed.
- You can make a backup of all the routes and settings. This can be done by "Routes > Backup > Create a backup of the current routes" or going back to "E-link / Print / Cancel".

4.4.2 Installation

A number of instructions are given below that apply during the initial period after you start using the barn cleaner (the cattle have to get used to it).

- Start with a small route (for example, just cleaning up behind 5 or 10 stalls) and then go back to the charger unit. This can be done with wall following or ultrasound tracking at a value of 600. This value will make the barn cleaner travel a small distance behind the stall planking. Try to avoid having the cows herded together

(into a corner or up against fencing). You can also programme a wait into a route if necessary, giving the cows time to get out of the way.

- Programming is done at the usual speed (default 300). The speed is automatically reduced to 180 when the route is traversed.
- The routes can be started up manually during these first days. Or they can be defined automatically using the timeline.
- The beep can be switched on and off for each route. 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).
- Extend the routes slowly so that the cattle have time to get used to it.
- If the barn cleaner comes up against an obstacle in the cowshed while traversing a route, for example a cow that won't move, then the barn cleaner reverses and tries again (up to 3x), then goes back again and makes a turn to the left or right. This depends on the previous action (left or right wall tracking / ultrasonic). Turns 45 degrees and goes round it in a curve, until it can find the original route again.

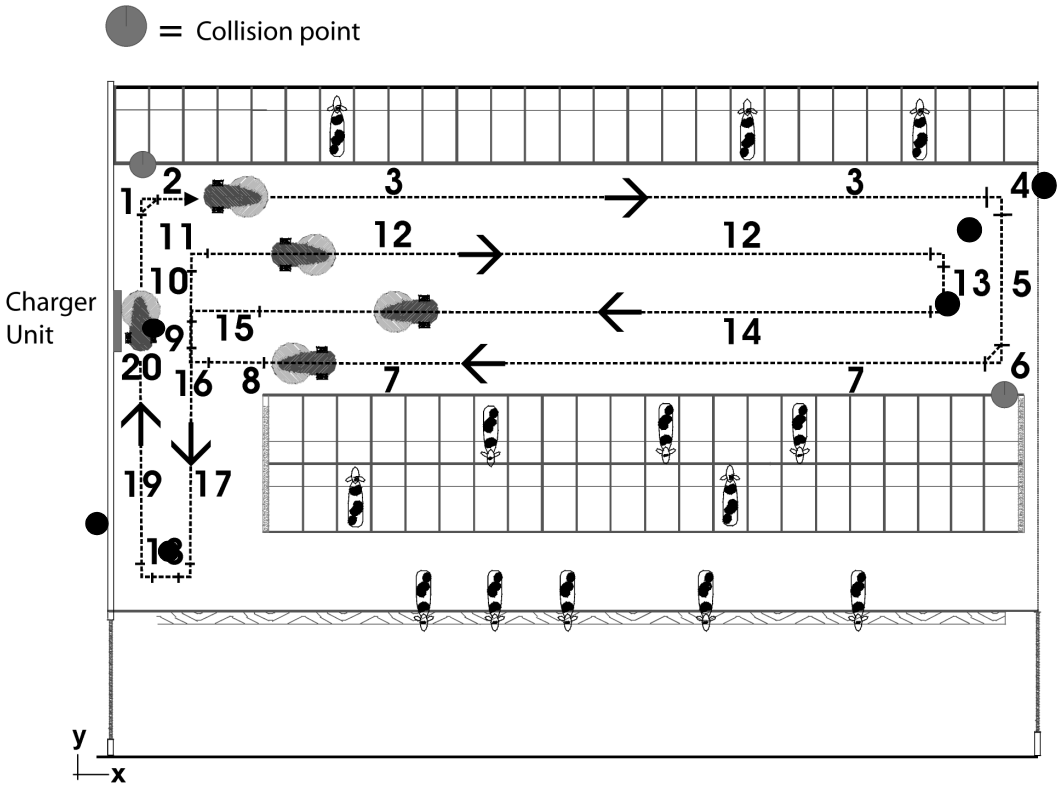

Figure 4 13 Example route

Table 4.4 Example route

Route number	Description
1	Wall following L (collision point)
2	60° turn
3	Wall following L
4	90° turn
5	Straight ahead (collision point)
6	60° turn
7	Wall following L
8	Straight ahead
9	90° turn
10	Straight ahead
11	90° turn
12	Ultrasound L (1100)
13	180° turn (radius 300)
14	Ultrasound L (1100)
15	Straight ahead
16	90° turn
17	Ultrasound L (1100)
18	180° turn
19	Wall following L
20	Charger

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5 Service and maintenance

Maintenance to be carried out by the farmer:

- *When carrying out maintenance work:*

1) Put the Discovery mobile barn cleaner in a clean place in the shed.
2) Make sure that no animals can get at the Discovery barn cleaner.
3) Be careful that no manure falls into the metal casing when opening the black cover.
4) Clean the charging strips on the Discovery.
5) Clean the charging electrodes on the charger unit.
6) Tighten the bolts on the charging strips (Allen key and 10mm spanner).
7) Check the drive chains.
8) Check the tyre pressures (1.4 bar).
9) Check the battery voltage.
10) Clean the ultrasound sensor regularly.

NOTE

- *If you still have any questions or further comments about the Discovery barn cleaner after reading this manual, please contact your local service agent.*

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6 Technical specifications

Table 6.1 Technical specifications of the Discovery barn cleaner and components

Length (cm)	130
Width (cm)	86
Height (cm)	60
Weight (kg)	260
Manure scraper mountings	Swinging
Manure scraper width (cm)	85
Drive (number)	Electric motor (2)
Number of wheels (pneumatic tyres)	2
Travel speed (m/min)	9 to 18
Charging time (hours)	4 (50% charging / 50% driving)
Maximum driving time without charging (hours)	4
Number of batteries	1
Voltage	12
Capacity (Ah)	55
Determination of direction of motion	Using gyroscope and ultrasound
Determination of distance travelled	Via sensors on rear wheel
Number of programmable routes	Max 16
Number of different trips per 24 hours	Max 48
Route programming	Manual (with remote control)
Calibration points	Walls / charging unit
Maximum width of manure conduit (cm)	500

Table 6.2 Technical specifications of the charger unit

Width (cm)	38
Depth (cm)	22
Height (cm)	Min. 165 Max. 205

Table 6.3 Technical specifications of the TBC 512-1-15 battery charger

Input voltage (VAC)	180 - 240 (50 Hz)[1]
Output voltage (VDC)	12
Cut-in voltage (V)	> 4
Max. charge current (A)	15
Ideal ambient temperature (°C)	5 to 20
Safety features	reversed connections, short circuit, temperature
Max. humidity (%)	90
Cooling	Mechanical
Battery connection	M6 bolts (brass / nickel)
Dimensions (mm)	200 x 200 x 110
Weight (kg)	6

1) 110V (60 Hz) version available (optional)

Table 6.4 Battery

Weight (kg)	19.9
Nominal voltage (V)	12
Capacity (Ah)	55
Spare capacity (min.)	120
Length (mm)	254
Width (mm)	174
Height, including battery terminals (mm)	195
Height, excluding battery terminals (mm)	173

7 Troubleshooting

NOTE

- *If the battery charger is still not working after you have run through the list of actions below, please take the charger back to your Lely service organisation. Under no circumstances should you try to repair the charger yourself or to open it.*

Table 7.1 Battery charger faults

Problem	Cause	Possible solution
Error LED (red) illuminated	1. Connections back to front 2. Short circuit	1. Remove the connection and attach the cables correctly. 2. Eliminate the short circuit.
There is a battery connected to the charger, but the battery charger is not working	1. Mains voltage absent or too low 2. Poor contact (or no contact) between battery and charger 3. Thermal cut-out in the battery charger 4. A diode bridge has been connected that is blocking the battery voltage so that the battery charger cannot switch on. The battery charger requires a counter-voltage (from a battery) to activate it.	1. Measure the mains voltage. This has to be above 180VAC. 2. Check the connection and the cables. 3. The loading process will continue automatically once the charger has cooled sufficiently. 4. The battery charger must have a D+ connection if it is to work properly. Use a diode bridge of the same brand as the charger
There is no battery in the charger and you cannot measure any voltage	The battery charger requires a counter-voltage (from a battery) to activate it.	Connect a battery to the charger and repeat the measurement.

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