



Turfmow 1000 Technician's Manual

Software version 3.5

Familiarity with the contents of this manual is required before operating the robot.



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1 What's New

Release 3.5

- The release number of the manual has been adjusted to match the software version to which it relates.

 **Note:** This implies that there are no manuals with release numbers 3.2, 3.3 or 3.4

- Update to the [troubleshooting section](#) (page 130).
- More information available for the [Service](#) (page 121) menu.
- Updates to the [portal interface](#) (page 146).
- [Winter service check list](#) (page 196).
- [Lift sensor raiser kits](#) (page 186)
- [Peripheral board replacement](#) (page 187)

Release 3.1

- The contents of the [technicians menu](#) (page 114) have been re-organized.
- The contents of the [How Turfmow 1000 works](#) (page 21) has been updated to distinguish between installations that use a positioning beacon and those that use a "return to station loop".
- In [The Actions menu](#) (page 99) there is a new option to start the robot working in a specific parcel.
- Instructions on [Installing an inductor in the charging station](#) (page 46).

Release 3.0

[Multi-fields](#) (page 60).

- [Return to station with a station loop](#) (page 88)
- [Complex garden and with station loop](#) (page 90)

[Mono-field with two start zones](#) (page 87)

[Correcting lid closure problems](#) (page 189).

[Installing the positioning beacon](#) (page 63)

[Installing the positioning board in the charging station](#) (page 64)

[Installing the positioning board outside of the charging station](#) (page 66)

[Changing the positioning board and components](#) (page 68)

[LCD settings](#) (page 106)

[Advanced parameters](#) (page 128)

2 Introduction

This manual is intended for technicians responsible for the operation, installation, servicing and repair of Turfmow 1000.

This manual contains the original instructions.

Technical developments are taking place constantly, so the information contained in this document is provided as an indication and is in no way contractual. It can be changed at any moment by Echo EU, without the need for prior announcement. Updated information can be obtained from the website <https://myrobot.echorobotics.com>.

Turfmow 1000 has been designed to high safety standards, but residual risks are always possible and the recommended safety and protective measures must be followed.

Version

This manual refers to:

- Software version 3.5
to see the [current software and system versions](#) (page 110)

Contact details

customerservice@yambiko.eu

3 Conventions used in the manual

 To charge the battery	Indicates the start of a procedure to be followed.
<i>blue text</i> (page 9)	A link to another section of the manual.
<i>green text</i> (page 9)	A link to a word in the glossary.
Use active periods	Indicates an option to highlight in the user interface.
this is <i>less than</i> 5m	<i>italic</i> script for <i>emphasis</i>
1	An entry in the user interface
	Indicates a maintenance operation.
menu entry	Sequence of menu selections in the interface. Infrastructure > Peripheral wires
{ }	Indicates a variable parameter value.

4 Turfmow 1000 description

All the elements of the robot system are shown in the figure below.

This chapter describes all the mechanical characteristics of the robot, the charging station and the positioning beacon for the robot to locate the charging station.

The peripheral wire is part of the complete installation. For more information see [How Turfmow 1000 works](#) (page 21).

The robot contains a comprehensive set of [Sensors](#) (page 18) which ensure its safe and reliable operation.

A user can exercise direct control over the robot using the [User Interface](#) (page 96).

Once a robot is registered on the portal running on a web-server, the robot can send information to this server, alarms and activities for example, which a user can see by connecting to the server. Through this server the user can also issue commands to the robot. For more information see [Connecting to robots](#) (page 146).

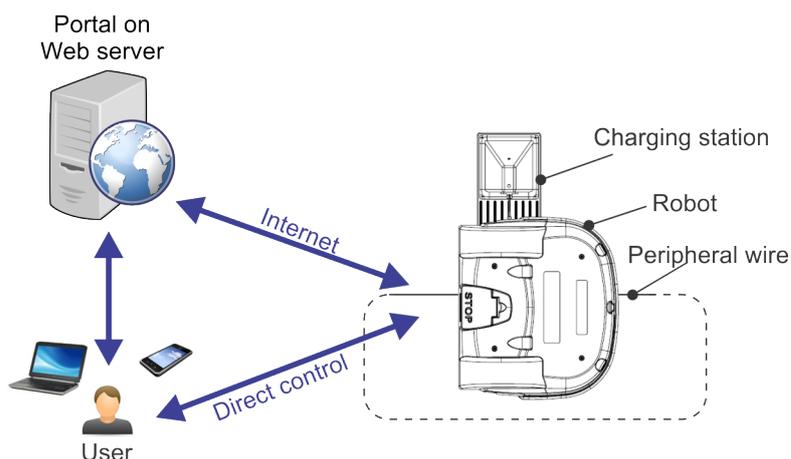


Figure 1: Components of the mowing system

4.1 The robot

Turfmow 1000 components

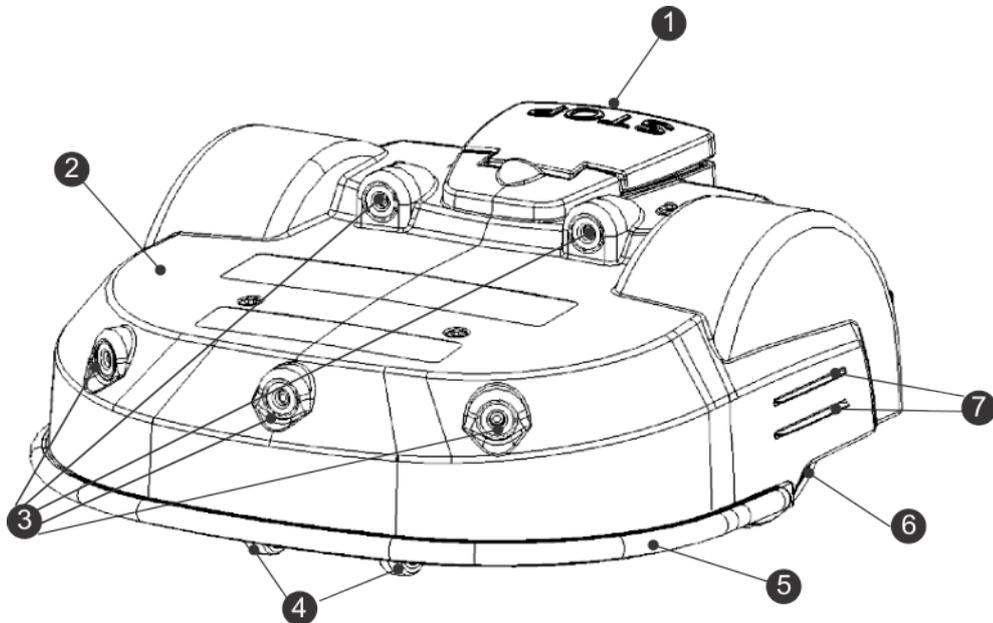


Figure 2: Top view of robot components

(1) STOP button

Hitting this button will stop the robot at any point.

It is also a lid that provides access to the so-called smart box that contains the on board computer that controls the operation of the robot. A [user interface](#) (page 96) is provided with which to set and modify the robot's operational parameters.

(2) Body

The body houses sensors and covers the mechanical components.

(3) Obstacle detection sonars

Sensors detect an object in the path of the robot. For more information see [Obstacle detection sonars](#) (page 18)

(4) Front wheels

Front wheels.

(5) Bumper

The [bumper](#) (page 18) is a pressure sensor which will cause the robot to change direction when it touches an obstacle.

(6) Rear wheels

The rear wheels are driven and are equipped with brakes to ensure safety on slopes or when machine is stopped.

(7) Charge contacts

There are two pairs of charge contacts on either side of the robot. They connect with the charging arms in the charging station.

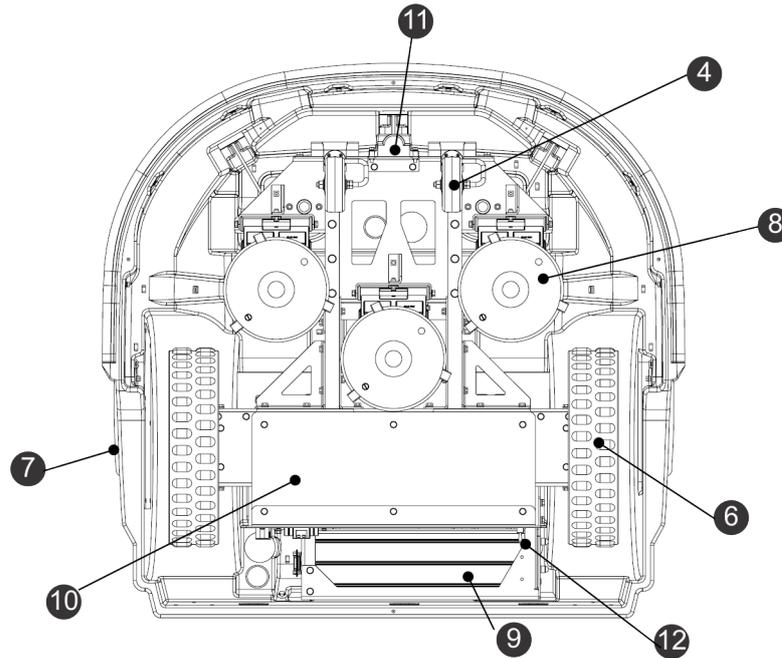


Figure 3: Bottom view of robot components

(8) Cutting heads

The robot is fitted with 3 rotating cutting heads. Each cutting head is equipped with three cutting blades, which are rotated on the head and which cut the grass.

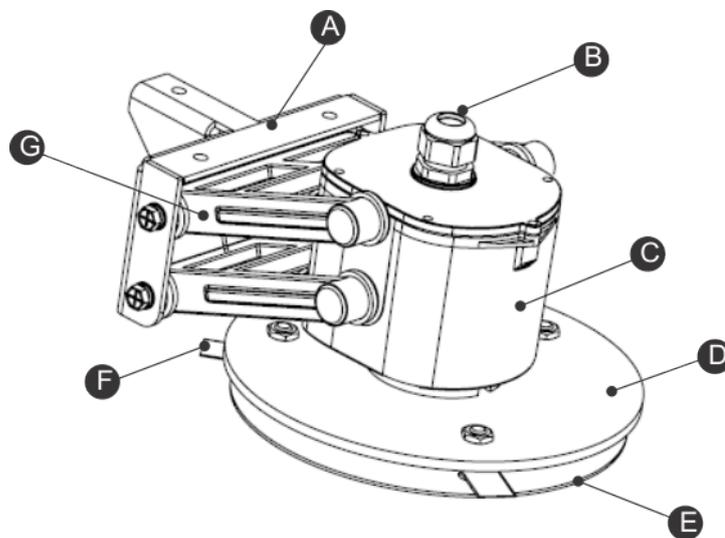


Figure 4: Detail of the cutting head

- (A) Bracket
- (B) Cable entry
- (C) Motor housing
- (D) Blade support disc
- (E) Anti-friction disc
- (F) Cutting blade
- (G) Pantograph

If a problem is detected it is possible to *disable any number of cutting heads* (page 103).

The cutting blades need to be replaced on a regular basis to ensure optimal mowing performance.

The height of the cutting head determines the length of grass that is cut. This can be adapted to match the required conditions. See [setting the cutting height](#) (page 105).

(9) Battery

An LFP battery powers Turfmow 1000 whilst mowing. When the battery needs charging the robot will return to the charging station. See [Go to charging station mode](#) (page 25).

Information on the labels on the battery are given in [Notices](#) (page 192).

(10) Sealed Electronic box

This contains the electronics and the robot motor.

 **Note:** This should only be opened or manipulated by an authorized technician.

(11) Coil

The robot is equipped with a coil that detects the magnetic field generated by the peripheral wire. When the robot crosses the peripheral wire, it registers a change in phase of the signal in the wire, which indicates it is leaving the field. As a consequence it will change direction in order to return into the field. See [Work mode](#) (page 23).

(12) On/Off switch

Switches the robot on or off.

Identification labels

There are two identification labels providing information about the individual robot.

The identification label can be found on the inside of the Stop button lid as shown below.



Figure 5: Identification label under the Stop lid.

A second one, which contains identical information is situated on the sealed electronic box (component 10 in [Figure 3: Bottom view of robot components](#) (page 12)) and is not normally visible. This ensures that whenever the robot is dismantled, for whatever reason, the body and smart box containing the interface are correctly matched with the mechanical components.



Figure 6: Identification label on the chassis

Options

The wheel brushes are an optional extra that are installed behind the rear wheels to clean them.

See [Installing the wheel brushes](#) (page 72)

Dimensions

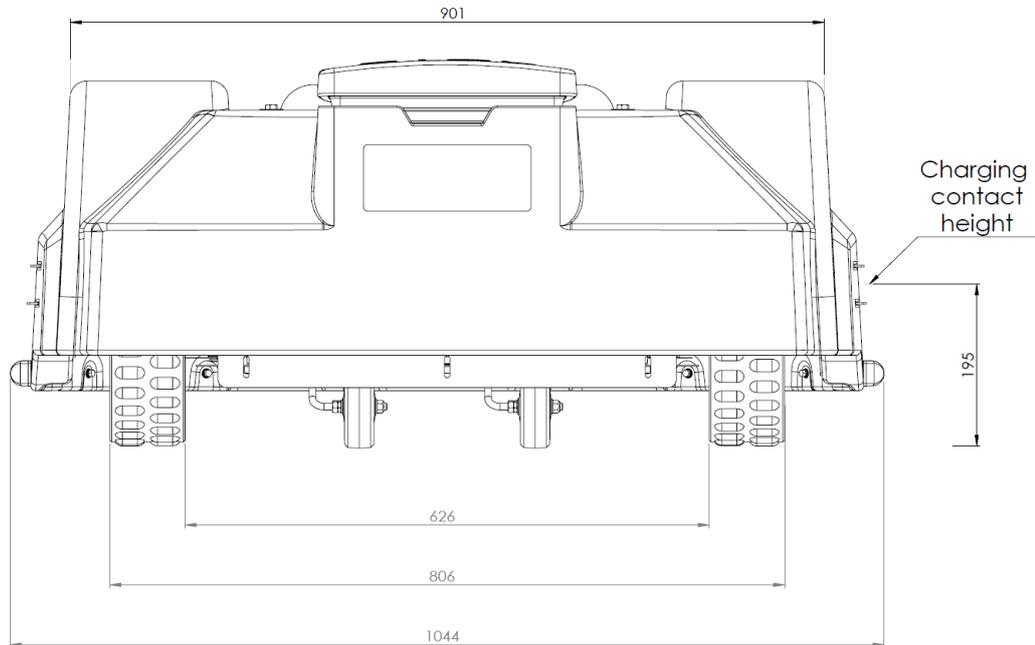


Figure 7: Rear view dimensions

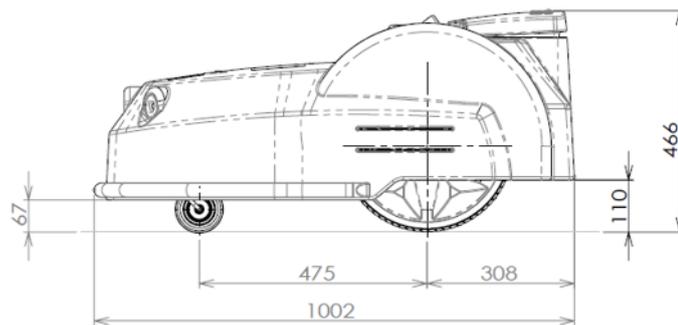


Figure 8: Side view dimensions

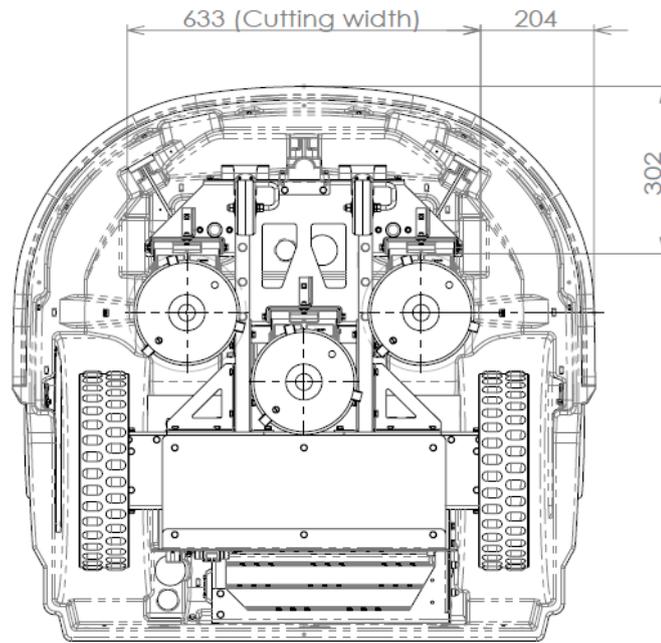


Figure 9: Bottom view dimensions

Technical details

For detailed technical specifications see [Technical specifications Turfmow 1000](#) (page 194).

Sound level: The A-weighted emission sound pressure level at the operator position does not exceed 70 dB(A).

Mass in kilograms: This can be seen on the identification label. See [Figure 5: Identification label under the Stop lid](#). (page 13).

4.2 The charging station

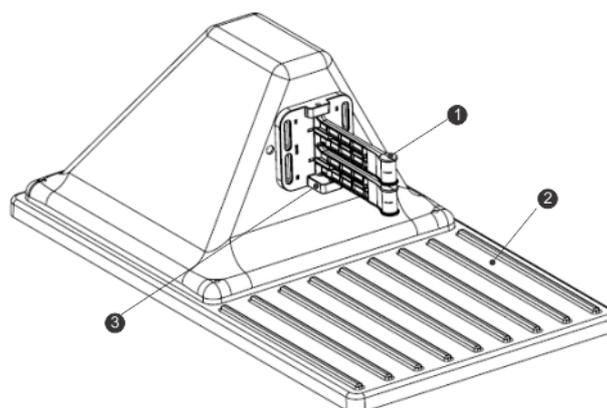


Figure 10: Components of the charging station

- (1) Charge arms.
- (2) Base.

(3) Occupation sensor. This is an optional feature indicating that the charging station is occupied in charging a robot. This is useful when there are multiple robots in the field.

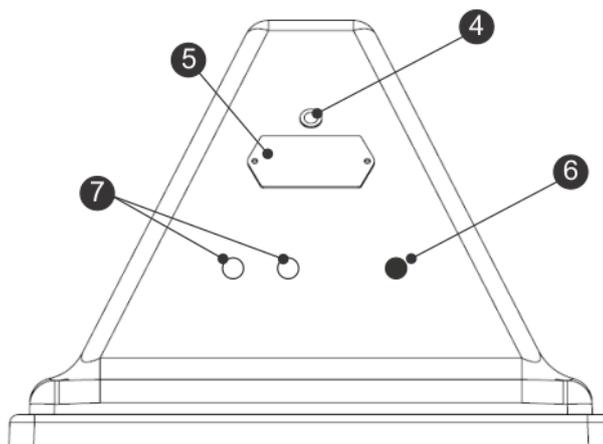


Figure 11: Rear view of the charging station

(4) LED display which indicates the current state of the station:

- **Green - blinking:** station is operating normally.
- **Red - blinking:** no peripheral wire can be detected.

This could be because the wire has been cut or that it is too long.

- **Red - steady:** indicates a problem.

This could be due to the wire being too short, less than 200m, or there is a problem with the electronics.

(5) Identification label.

(6) Input for power cable.

(7) Inputs for peripheral cables.

Technical details

Details of the charging station can be seen on the identification label.

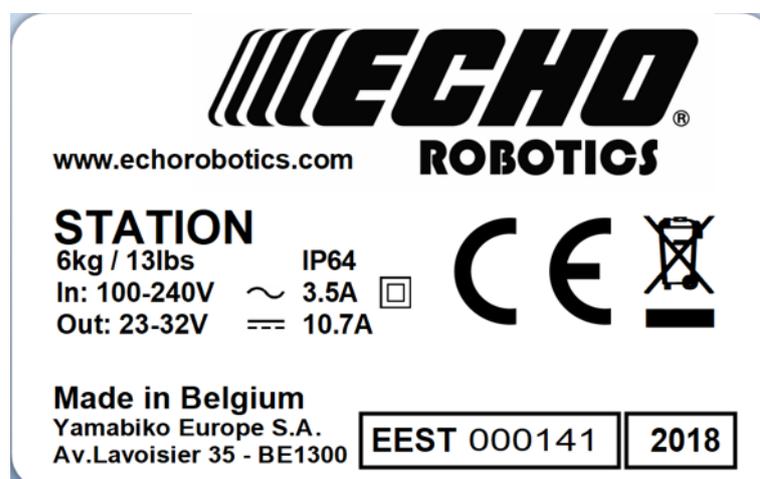


Figure 12: Charging station identification label



Warning: Always unplug the charging station before opening it.

In those situations where there is no plug, remove the fuse from the charging station.

4.3 The station positioning beacon

The station positioning beacon is a device that emits a UWB (Ultra Wide Band) signal, which is detected by the robot. This enables the robot to locate the charging station to a very high level of accuracy (<200mm). (See [returning to the charging station](#) (page 25).)

The station positioning beacon is normally installed in the charging station, but can be installed in a separate location. This may be necessary if the detection of the charging station is not sufficiently accurate due to obstacles or its specific location.

5 Sensors

Turfmow 1000 is equipped with a comprehensive set of sensors that ensure its safe operation. These sensors ensure that the robot can detect, and react if an obstacle lies in its path or if a small object is in danger of being damaged by the cutting blades.

Stop button

The stop button is easily visible, situated on the top of the robot (see [Figure 2: Top view of robot components](#) (page 11)). Hitting it will cause the robot to stop moving and cutting.

The stop button also acts as a lid, which when lifted, provides access to the robot's control user interface. An instruction must be issued using this control interface in order to restart the robot.

Obstacle detection sonars

The robot is equipped with a set of 5 sonar sensors to detect obstacles. These sensors transmit a constant sonar signal (40kHz). When these hit an obstacle the reflected waves are received by the sensors and the speed of the robot is reduced to 200mm/s (less than 1km/h).

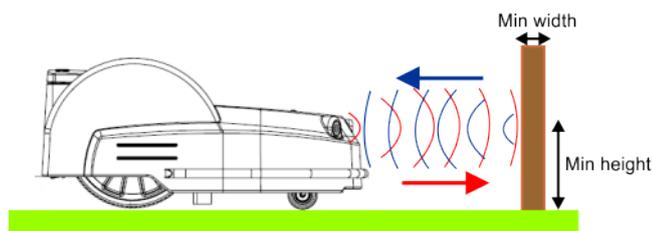


Figure 13: Detection of obstacles by sonar sensors

The robot gently touches the obstacle at low-speed. The robot moves backwards and chooses a random direction between 60° and 120°.

These sensors can detect objects that are:

- at least 400mm high
- at least 70mm wide (from all angles).



Note: If the surface of the obstacle reflects the sonar waves towards the sky, they should be covered with large bubble wrap.

Bumper

The bumper is a pressure sensor which senses when the robot touches an obstacle. The robot will be moving at a slow speed because the sonar detectors will have already detected the obstacle. When the bumper touches the obstacle, the robot will move backwards and then rotate through an angle until it can avoid the obstacle.

Lift and body displacement sensors

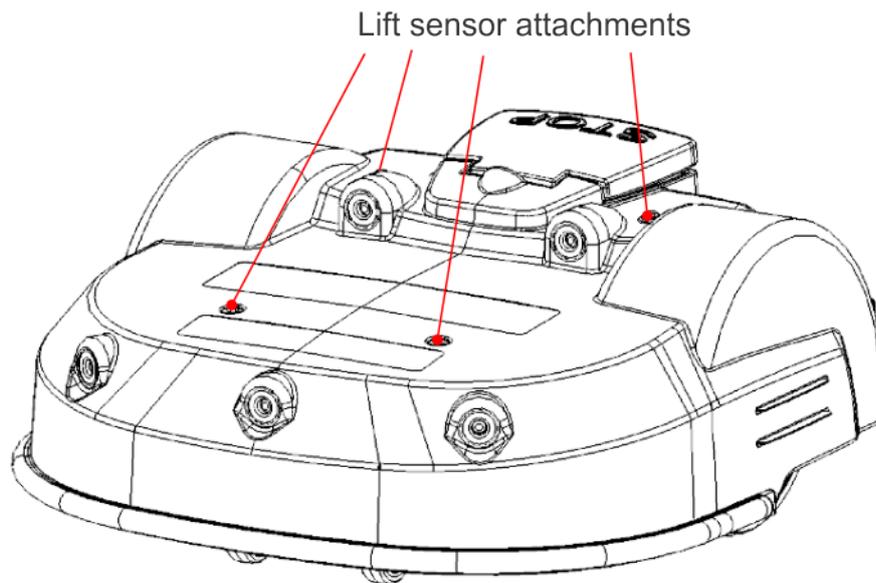


Figure 14: Location of the lift sensor attachments

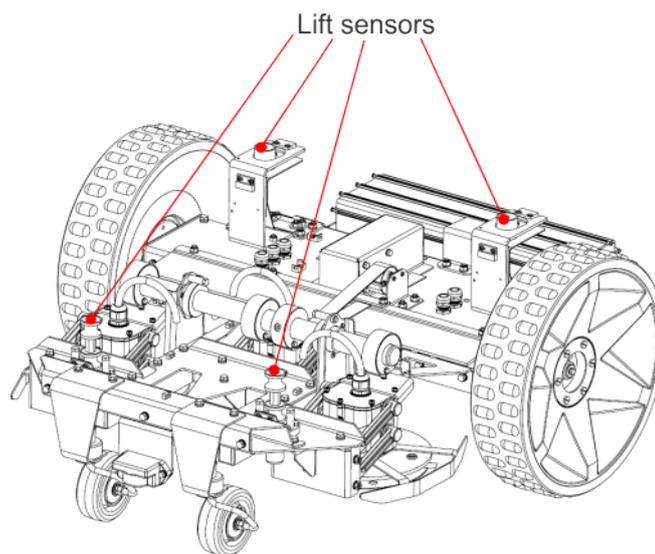


Figure 15: Lift sensors

Lift sensors are attached to the body of the robot at 4 points. If the robot touches a low object which pushes the bodywork up or if someone tries to lift the body work, the lift sensors will react. The robot will stop mowing and move backwards. If this movement frees the obstacle from the body, the robot will perform a manoeuvre to avoid the object and continue mowing. If not, after 10 seconds the robot will register an alarm and remain in safe mode (stationary) until the obstacle is removed.

Coil

The induction coil detects the intensity of the magnetic field that is generated within the peripheral wire. The maximum intensity is located on the wire which causes the robot to stop, rotate and then continue mowing in a new direction.

The location of the coil can be seen as item **(11)** in [Figure 3: Bottom view of robot components](#) (page 12).

Station positioning beacon

The station positioning beacon is a transceiver that emits an Ultra Wide Band (UWB) signal. A receiver is located in the robot. It provides an accurate mechanism for finding the charging station (and other locations). It is normally installed within the charging station but can be located elsewhere.

For more details see [Installing the positioning beacon](#) (page 63).

Tilt/Rollover sensor

The tilt sensor detects the angle of the slope on which the robot is mowing. If this angle exceeds 30° (58%), an alarm will be raised and the robot will stop moving.

The rollover sensor detects whether the robot has been tipped upside down or whether someone is trying to start the motor when the robot is upside down.

Show

Temperature sensor

The temperature sensor measures the ambient temperature and will prevent the robot from operating if this temperature is too low. The minimum temperature at which the robot can operate is set as an [operating parameter](#) (page 110).

6 How Turfmow 1000 works

The robot works in a number of 'states'. Within these states it is programmed to operate in a number of 'modes'.

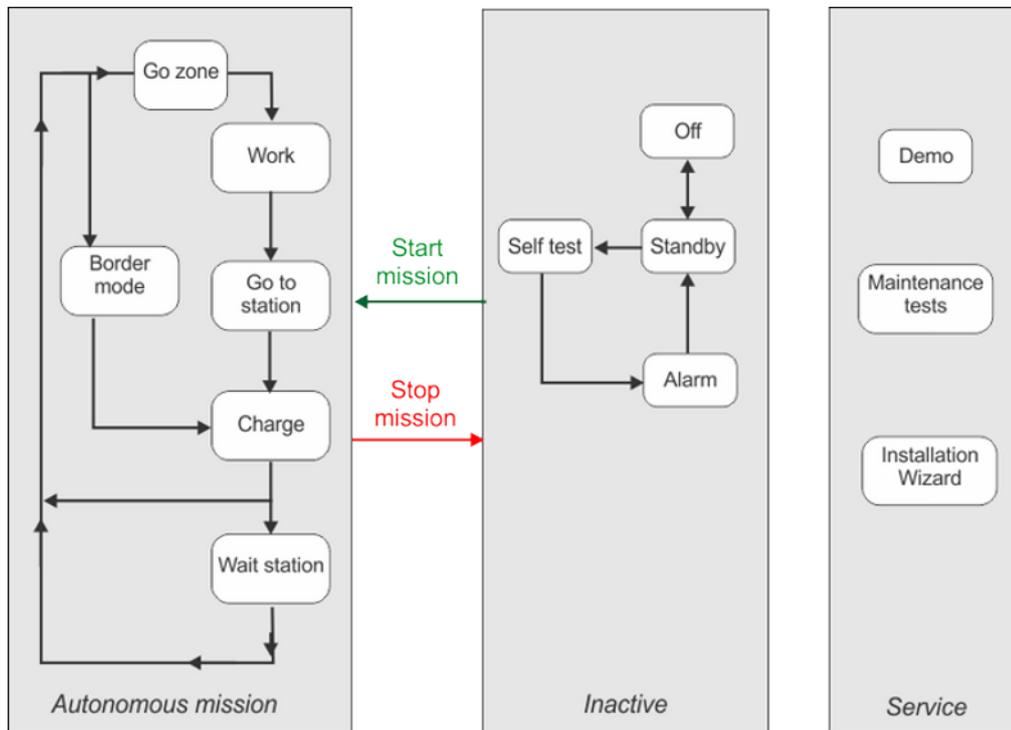


Figure 16: Operating states

Autonomous mission (page 22): In this state the robot operates in cycles in which it works, (cutting the grass), or is in the charging station to charge the battery or for a rest period.

Inactive state (page 35): The robot can enter an inactive state if there is a condition that causes the mowing mission (state) to be halted.

The robot will return to the mowing state when the problem has been resolved and a specific command has been issued to tell the robot to resume the autonomous mowing state.

The **service state** (page 36) is one that can be initiated by technicians whenever special operational modes are required.

6.1 Autonomous mission state

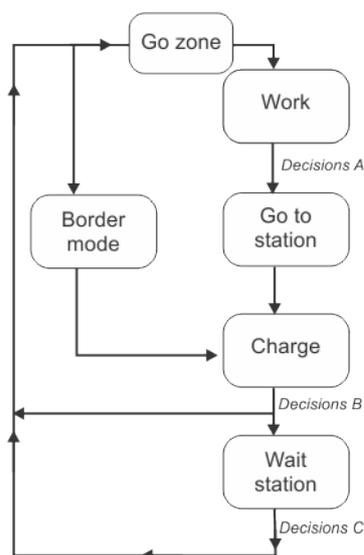


Figure 17: Autonomous mission state

Work

In this mode the robot mows the grass in a random fashion. For more details see [Work mode](#) (page 23).

Go to station

At a certain moment, which depends on the program and the current conditions, the robot will make the decision to move to the charging station. For more details see [Go to charging station mode](#) (page 25).

Charge

In this mode, the robot connects to the charging station and charges the battery. For more details see [Charge mode](#) (page 29).

Wait station

When the battery has been charged, the robot may remain at the charging station, depending on the program and the current conditions. For more details see [Wait in charging station mode](#) (page 30).

Border mode

In this mode the robot mows the border of the field. For more details see [Border mode](#) (page 30).

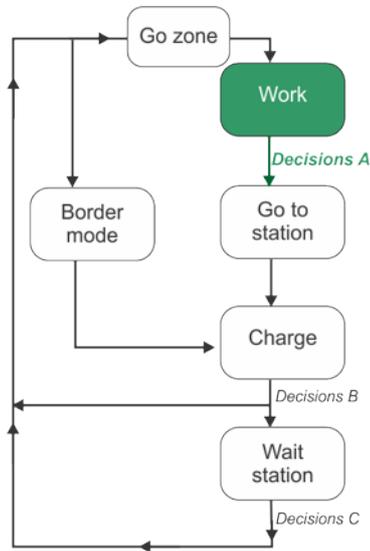
Go zone

In this mode the robot goes through a set of maneuvers before entering the work mode. For more details see [Go zone mode](#) (page 31).



Note: Programmed instructions can be over-ridden by instructions activated from the [user interface](#) (page 96).

6.1.1 Work mode



rect 102,19,183,61 [Go zone mode](#) (page 31)

Figure 18: Work mode

When in work mode mows the grass in the field (inside the peripheral wire). It executes a random movement over the field to ensure that the whole field is covered and that the robot's wheels do not leave traces on the grass.

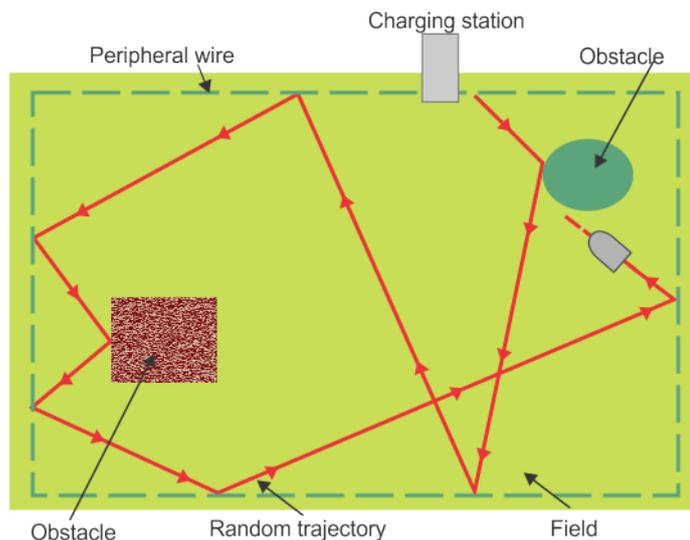


Figure 19: Random movement within the peripheral wire

The charging station emits a signal that generates an electro-magnetic field within the area bounded by the peripheral wire. The robot is equipped with a coil that senses the magnetic field.

The strength of the electro-magnetic field is greatest at the boundary and as the robot arrives at the wire, it slows down. It then passes over the wire and the coil senses a change in phase. This causes the robot to stop, reverse a little, turn through a random bounce angle and then

continue in a new direction. This angle is typically between 108° and 172° , and will depend on the settings defined in the software. The minimum and maximum bounce angles are set in the [Technician's menu](#) (page 114) in the user interface.

When mowing normally the robot moves at a speed of about . In areas where the grass is longer, the robot will automatically adapt its mowing mode by slowing down.

The robot can detect an obstacle (permanent or transitory) through a set of [sonar sensors](#) (page 18). Detection causes the robot to slow down and gently touch the obstacle, as indicated by the pressure sensors on the bumper. The robot will reverse and then rotate through a random angle in order to proceed with the mowing.

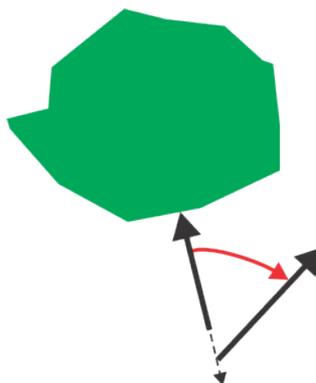


Figure 20: Robot maneuvers around an obstacle

Decisions A

At a certain moment, the robot will take the decision to return to the charging station. This could be because:

- The battery needs charging,
- The programmed mowing time has ended,

(In the case of multi-field installations, this corresponds to the mowing schedule for the parcel in which the robot is currently mowing.)

- An (external) command has been issued from the [user interface](#) (page 96),
- The temperature is too low.

See [Go to charging station mode](#) (page 25).

6.1.2 Go to charging station mode

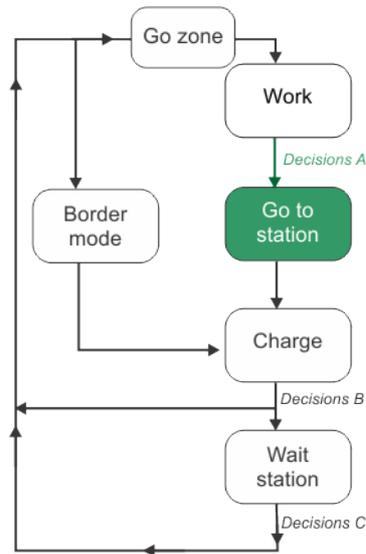


Figure 21: Go to station mode

Whilst working, the robot checks the current conditions and its programmed instructions. These conditions could be:

- The battery needs charging,
- The programmed mowing time has ended,

(In the case of multi-field installations, this corresponds to the mowing schedule for the parcel in which the robot is currently mowing.)

- An (external) command has been issued from the *user interface* (page 96),
- The temperature is too low.

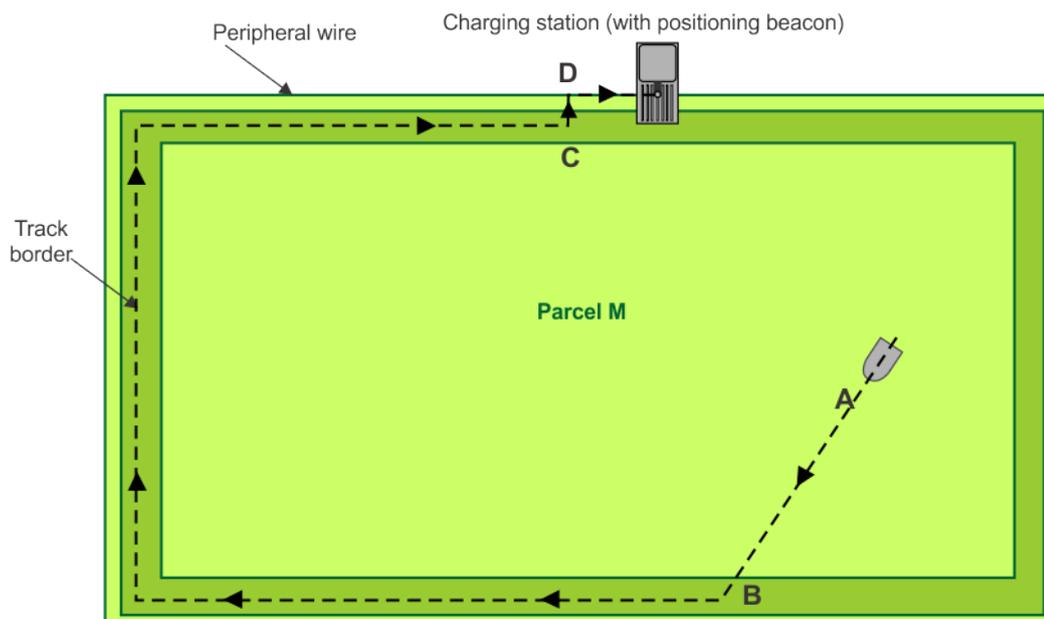
As a consequence, at a certain moment, it will decide to return to its charging station. The maneuvers used to return to the station depend on the type of installation.

- *Single mowing field with positioning beacon* (page 25)
- *Multiple mowing fields with positioning beacon* (page 26)
- *Single mowing field with station loop* (page 27)
- *Multiple mowing fields with station loop* (page 28)

6.1.2.1 Single mowing field with positioning beacon

This chapter describes how the robot returns to the charging station from a single mowing area using a positioning beacon to locate the station.

 **Note:** The positioning beacon is normally located in the charging station, but it may be mounted separately.



At a certain point (**A**), the robot will decide it needs to return to the charging station. It will then proceed to the nearest point **B** that lies within the "track border" (page 201).

The robot then follows the track border until it reaches point **C** where it is at a certain distance from the charging station.

At point **C**, the robot will turn through 90° and move directly to point **D**, which is on the wire. This maneuver is termed the "loopstep" (page 200).

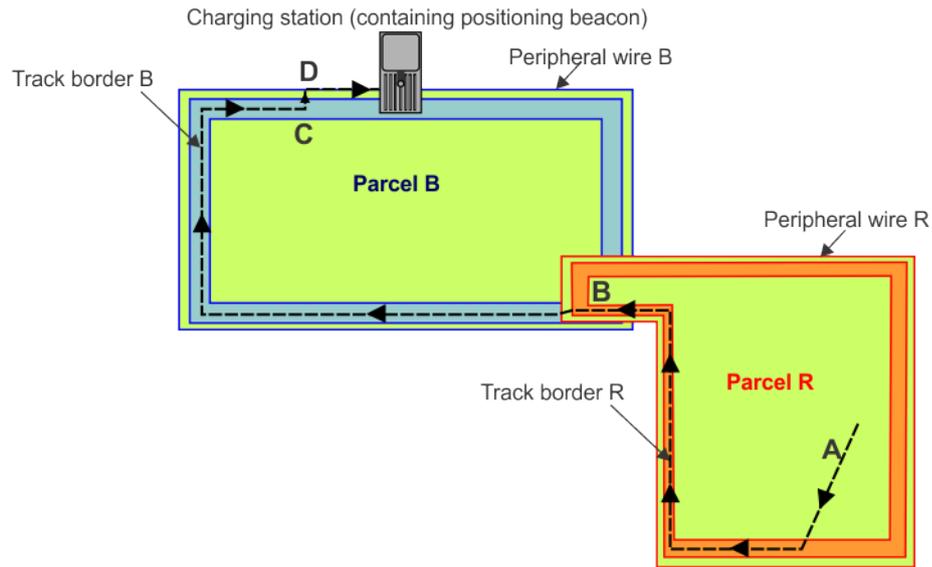
The robot will turn again through 90° and move along the peripheral wire towards the charging station. This manoeuvre is termed the "trackwire" (page 202).

Once the robot has arrived at the charging station, it enters *Charge mode* (page 29).

6.1.2.2 Multiple mowing fields with positioning beacon

This chapter describes how the robot returns to the charging station, through a series of mowing fields, using a positioning beacon to locate the station.

 **Note:** The positioning beacon is normally located in the charging station, but it may be mounted separately.



At point **A**, the robot decides it needs to return to the charging station. It moves towards the track border in "Parcel R" and then follows "Track border R" until it reaches point **B**, which is where the two fields overlap.

It then follows "Track border B" until it reaches point **C**. At this point it turns through 90° , executing the [loopstep](#) (page 200) to turn towards "Peripheral wire B" at point **D**. When it reaches the wire at point **E**, it turns through 90° again and [follows the wire](#) (page 202) to arrive at the charging station.

Once the robot has arrived at the charging station, it enters [Charge mode](#) (page 29).

6.1.2.3 Single mowing field with station loop

This chapter describes how the robot returns to the charging station from a single mowing area using a [station loop](#) (page 201) to locate the station. This is illustrated in the figure below.

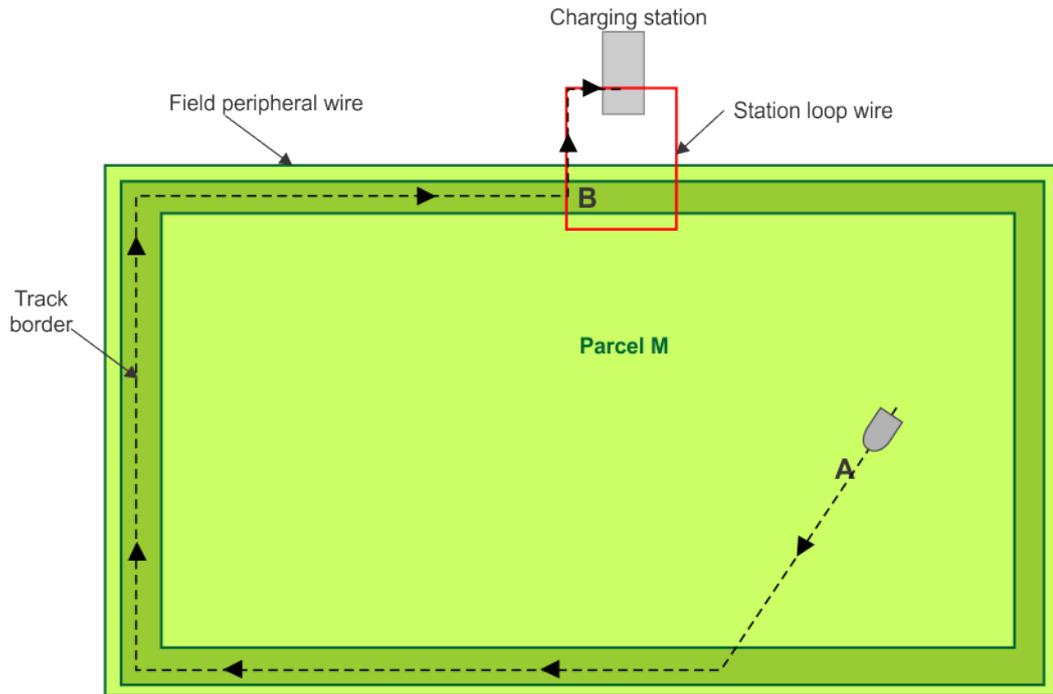


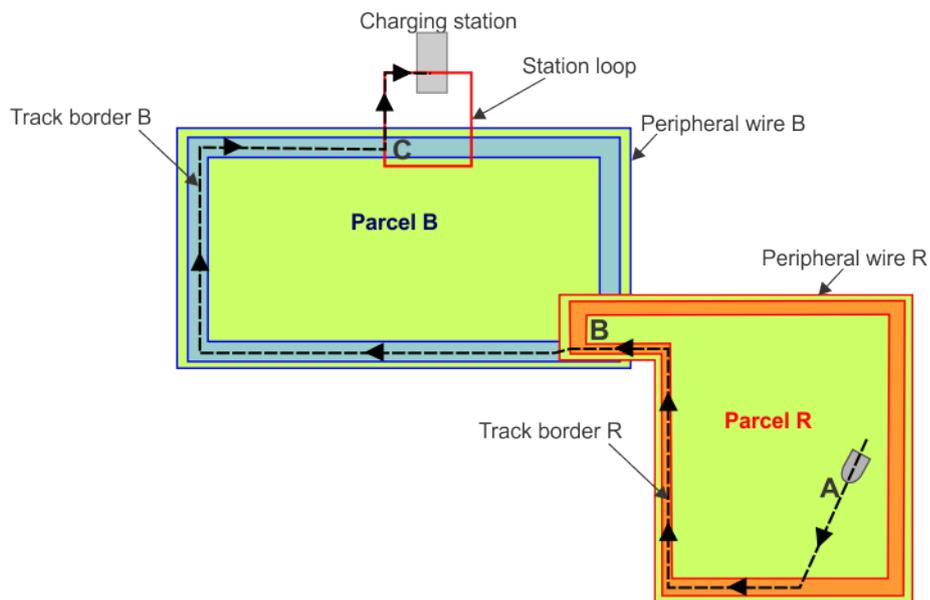
Figure 22: Return to station using a station loop

At point **A**, the robot decides to return to the charging station. It then moves towards the **track border** (page 201) and follows the track border of the single mowing field until it reaches point **B**, which is where the two wires overlap. It then follows the station loop wire until it arrives at the charging station.

Once the robot has arrived at the charging station, it enters *Charge mode* (page 29).

6.1.2.4 Multiple mowing fields with station loop

This chapter describes how the robot returns to the charging station, through a series of mowing fields, using a **station loop** (page 201) to locate the station.



At point **A**, the robot decides it needs to return to the charging station. It moves towards the track border in "Parcel R" and then follows "Track border R" until it reaches point **B**, which is where the two fields overlap.

It then follows "Track border B" until it reaches point **C**, which is where the station loop wire and "Peripheral wire B" overlap. It then follows the station loop wire until it reaches the charging station.

Once the robot has arrived at the charging station, it enters *Charge mode* (page 29).

6.1.3 Charge mode

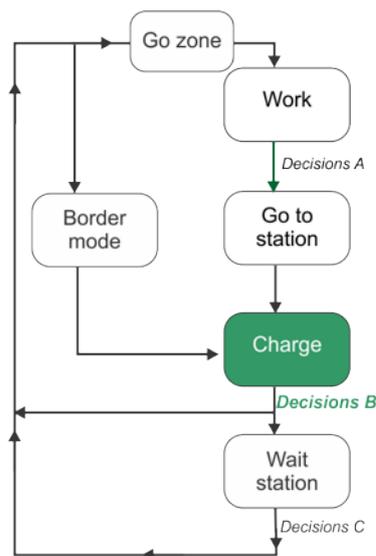


Figure 23: Charge mode

When the robot arrives at the charging station, the robot will connect to the charging points and the battery will be charged.

Decisions B

The robot will stay at the charging station until:

- the battery is fully charged,
- an instruction is issued.

The operations that will be performed depends on how the robot has been programmed and external conditions.

The robot will *wait in station* if :

- rest periods have been scheduled,
- it has been programmed to stay in the station (using the command "Charge & stay"),
- the temperature is too low,

Otherwise it will continue with the scheduled mowing program.

The robot will go into *border mode* (page 30) if programmed to do so.

6.1.4 Wait in charging station mode

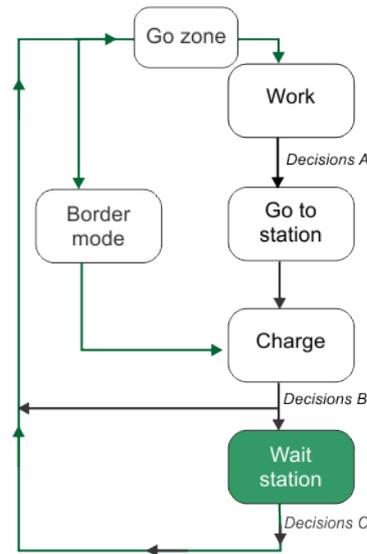


Figure 24: Wait in station mode

Decisions C

The robot will stay in the charging station once the battery has been charged until:

- the normal program needs to commence,
- a specific command is issued.

6.1.5 Border mode

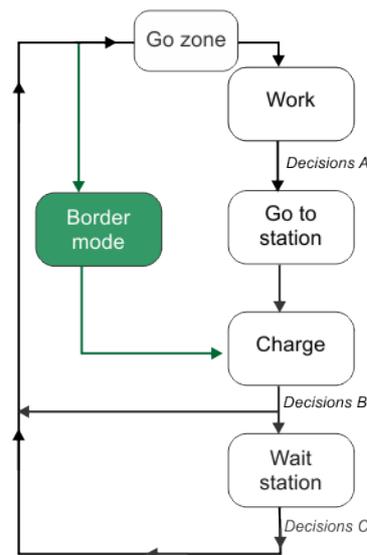


Figure 25: Border mode



Note: Border mode only operates when the installation configuration uses a single mowing field and a positioning beacon to locate the charging station.

When the robot is operating in border mode, it moves directly over the peripheral wire.

The robot may well be programmed to operate in border mode after it has left the charging station and before it starts mowing with the random movements of the work mode.

The number of times per week the border mode is implemented is set as an *operating parameter* (page 104).

6.1.6 Go zone mode

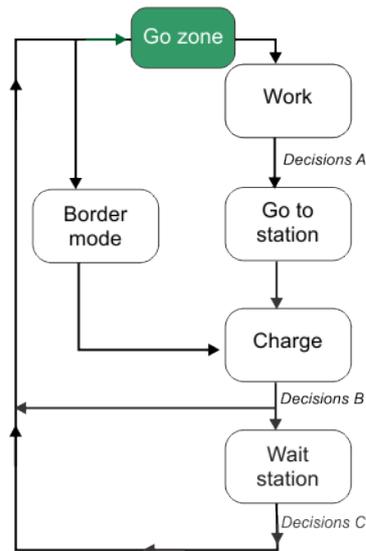


Figure 26: Go zone mode

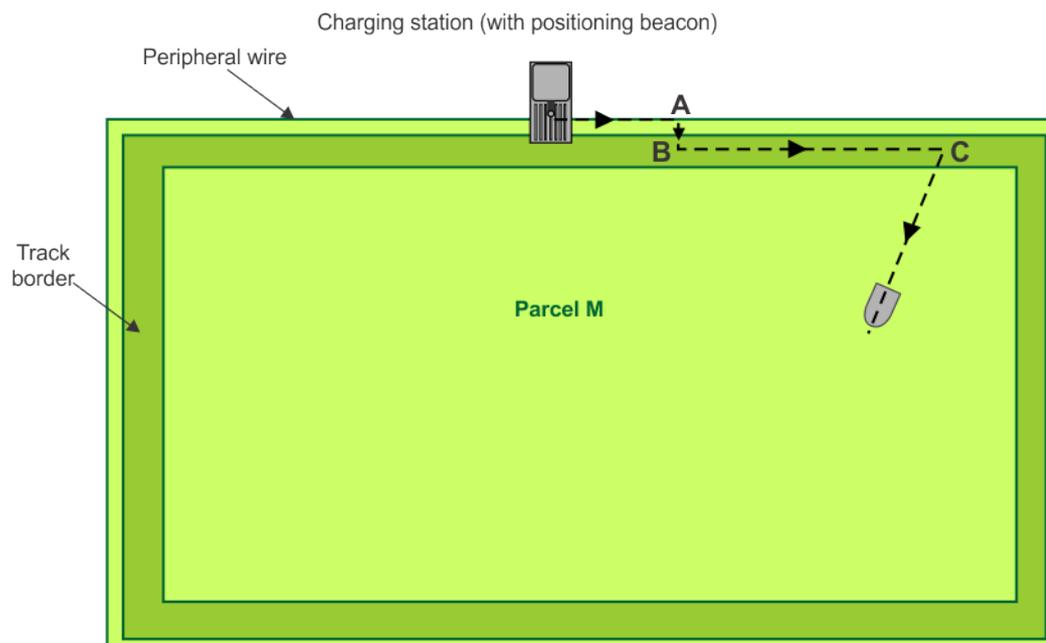
The robot will leave the charging station either because the mowing schedule demands it, or a specific command has been issued.

Go zone mode describes the maneuvers the robot makes to leave the station and start mowing. These depend on the type of installation configuration.

- *Single field with positioning beacon* (page 31).
- *Multiple mowing fields with positioning beacon* (page 32).
- *Single mowing field with station loop* (page 33).
- *Multiple mowing fields with station loop* (page 34).

6.1.6.1 Single field with positioning beacon

In this configuration, there is only one wire and one parcel (field to be mowed). The robot will therefor just move into the field to start mowing.



The robot leaves the station and follows the wire ([trackwire movement](#) (page 202)) until it reaches point **A**. At point **A** it executes the [loopstep](#) (page 200) move, turning through 90° and moving into the [trackborder](#) (page 201). At point **B** the robot turns again and follows the track border until it reaches point **C**. The robot then turns through a random angle and moves into the field to start mowing.

The parameters specifying how the robot leaves the station are defined in the [Access parameters](#) (page 200) and the [StartZone](#) (page 200) parameters *for the station*.

6.1.6.2 Multiple mowing fields with positioning beacon

In this configuration there are multiple wires, each defining a parcel (area to be mowed).

Before leaving the station the robot must decide in which parcel to start mowing. This will depend on:

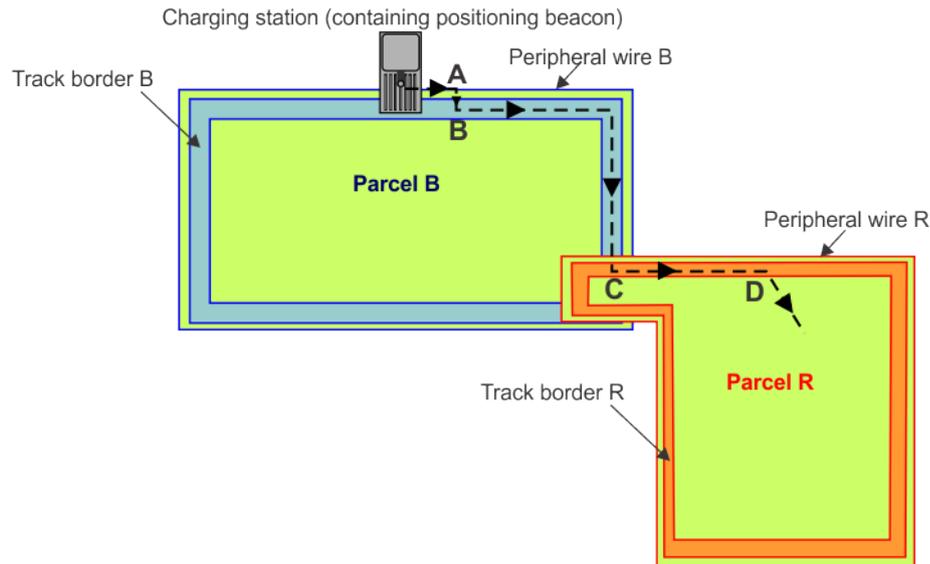
- The defined mowing schedule for each parcel.

If the schedule dictates that a specific parcel must be mowed at this time, the robot will start mowing in that parcel.

- The percentage values assigned to each parcel.

If there are no schedule constraints, the robot will choose the parcel based on the percentage values. Over a period of time the robot ensures that it starts in each parcel according to the defined proportions.

The figure below illustrates the example of when the robot starts mowing in "Parcel R".



In all cases the robot will leave the station and follow the wire for a certain distance until it reaches point **A**. It will then execute the loopstep and turn through a right angle and take up its position in the track border of the first parcel (point **B**). These distances are specified in the **Access parameters** for the station.

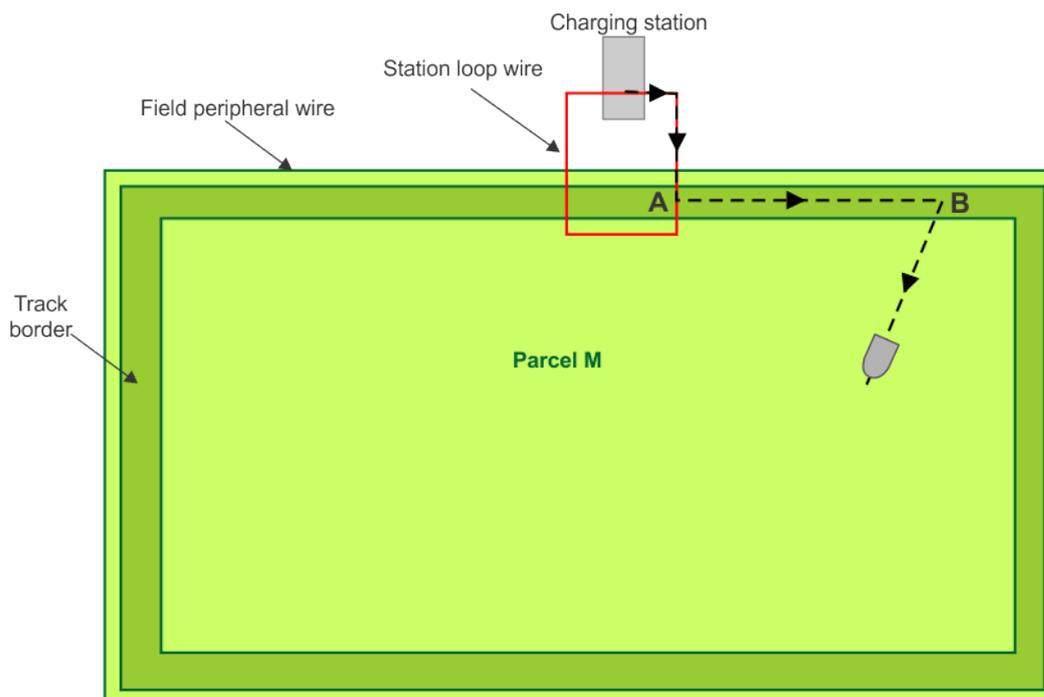
It will then travel along "Track border B", until it arrives at point **C**, which is where the two mowing fields overlap.

Once in "Parcel R", it will travel for a certain distance along the track border in this parcel until it reaches point **D**, when it will turn into the field and start mowing.

These distances are specified in the **StartZone** parameters *for the parcel*.

6.1.6.3 Single mowing field with station loop

This configuration contains two wires, one defining the field to be mowed and the other defining the **station loop** (page 201). No mowing takes place within the station loop; it is just used to guide the robot into and out of the charging station.



When the robot leaves the station it follows the station loop wire, until it reaches point **A**. This is a pre-defined distance within the main field peripheral wire.

At this point it will turn and follow the track border of the field to be mowed until it reaches point **B**, when it will turn into the field and start mowing. The distance traveled long the track border and the angle at which the robot turns into the field are specified in the **StartZone** parameters for the parcel to be mowed (Parcel M).

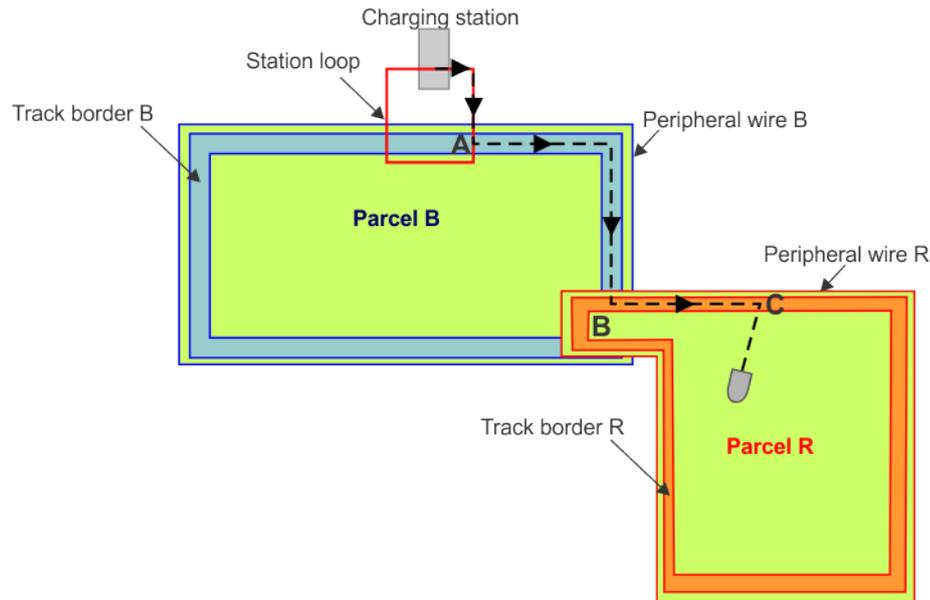
6.1.6.4 Multiple mowing fields with station loop

In this configuration there are multiple wires, each defining a parcel (area to be mowed), as well as the station loop wire. No mowing takes place within the station loop; it is just used to guide the robot into and out of the charging station.

Before leaving the station the robot must decide in which field (parcel) to start mowing. This will depend on:

- The defined mowing schedule for each parcel.
If the schedule dictates that a specific parcel must be mowed at this time, the robot will start mowing in that parcel.
- The percentage values assigned to each parcel.
If there are no schedule constraints, the robot will choose the parcel based on the percentage values. Over a period of time the robot ensures that it starts in each parcel according to the defined proportions.

The figure below illustrates the example of when the robot starts mowing in "Parcel R".



When the robot leaves the station it follows the station loop wire, until it reaches point **A**. This is a pre-defined distance within the main field peripheral wire.

At this point it will turn and follow the track border of the field connected to the station loop until it reaches point **B**, which is where the two mowing fields overlap.

Once in "Parcel R", it will travel for a certain distance along the track border in this parcel until it reaches point **C**, when it will turn into the field and start mowing.

The distance the robot travels along the track border before starting to mow and the angle it turns through are specified in the **StartZone** parameters for the parcel in which the mowing starts (Parcel R in this example).

6.2 Inactive state

Some condition may arise which causes the robot to halt its autonomous mowing mission and enter an inactive state until the active mowing mission can be resumed.

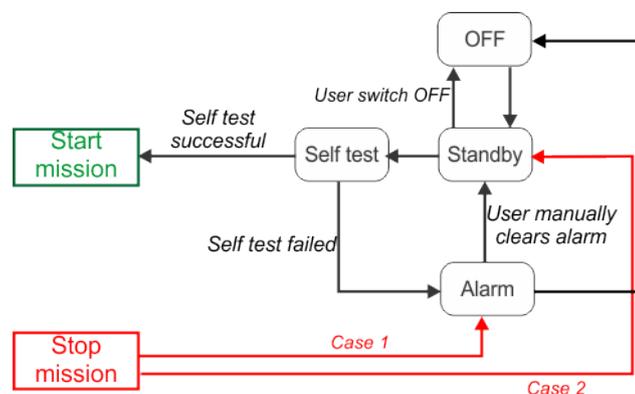


Figure 27: Inactive modes

The robot will stop operating in autonomous mode and enter the inactive state because:

- **Case 1:** a problem has arisen and the robot will enter the *Alarm mode* (page 36),

- **Case 2:** the mission has been manually stopped and the robot will enter the [Standby mode](#) (page 36).

Case 1: Alarm mode

When the robot encounters a problem, such as a cutting head that is blocked, it will register an [alarm](#) (page 130) and enter the inactive state. This requires manual intervention from the user.

- When the cause for the alarm has been corrected, the user can manually clear the alarm and the robot will then enter the [Standby state](#) (page 36).
- If no intervention takes place, after some time the robot will switch itself off and enter the OFF state.

Case 2: Standby mode

The robot will enter the Standby state if,

- the autonomous mission has been stopped due to an external command,
- an alarm situation has been corrected and the alarm cleared by manual intervention,
- it is manually switched ON.

The robot will leave the Standby state when a command is issued. It will then enter the [Self test mode](#) (page 36) before recommencing any activity.

Self test mode

Whenever the robot has been in the Standby mode it will perform a self test, to check the integrity of the entire system (including electronics, sensors, mechanics and software).

- When the result of the self test is successful, it will resume the autonomous working state.
- If the result of the self test is NOT successful, it will register an alarm. This will then require intervention to [clear the alarm](#) (page 130).

OFF mode

The robot will be in the OFF mode when:

- it has been manually switched OFF,
- an alarm situation has not been corrected after a certain period of time. The amount of time depends on the level of charge in the battery.

An intervention is required to switch the machine ON again.

6.3 Service state

Demo mode

In Demo mode the robot will operate without taking the peripheral wire into account. This can be used to demonstrate the performance of the machine before the wire has been installed.

Demo mode is activated from the [Technician's menu](#) (page 114).

Maintenance test

A set of maintenance tests are available from the [Service menu](#) (page 121) in the [Technician's menu](#) (page 114).

Install Wizard

This is used to set installation parameters. See [Configuration](#) (page 73).



Note: The Installation Wizard can only be used for a mono-field installation using a positioning beacon.

7 Installation

The figure below illustrates the basic components of an installation.

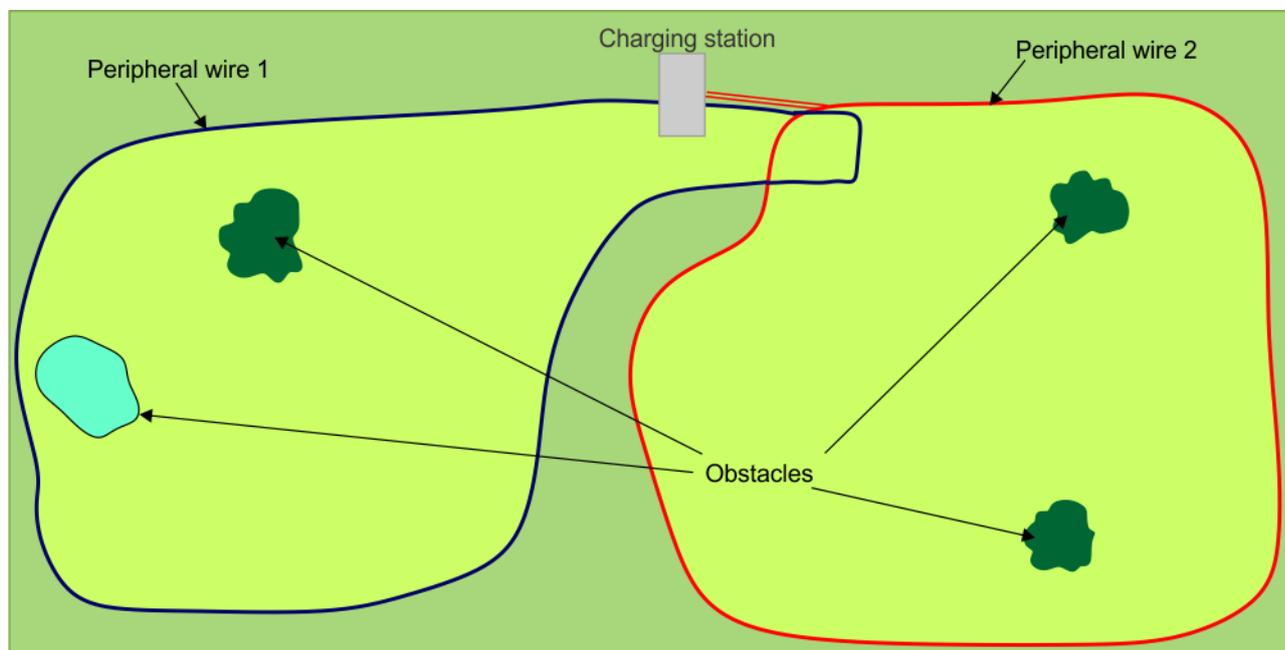


Figure 28: Components of an installation

An area to be mowed (parcel), which is contained within the complete site, is defined by a peripheral wire. There can be more than one peripheral wire, thus defining multiple fields as shown in the example below. For more information on the specific terminology and concepts see [using multiple fields](#) (page 60).

A specific example of a multi-field installation is where an additional wire is installed around the charging station to guide the robot back to the station. See [Return to station with a station loop](#) (page 41).

The charging station can also be located using a station positioning beacon. The positioning beacon is most commonly placed within the charging station, but may be installed separately.

The peripheral wire(s) define the limits to which the robot will mow. The charging station generates a signal in the peripheral wire that creates an electro-magnetic field enabling the robot to detect the field.

[Obstacles](#) (page 52) must be avoided. This may be achieved by movements executed by the robot when a sensor has detected the obstacle. In some cases however this is not possible, and the only way to avoid obstacles is to create [islands](#) (page 58) and [pseudo islands](#) (page 59).

The robot will return to the charging station when the battery needs charging or when the programmed mowing process is complete. The positioning beacon aids the robot in returning to the charging station. It is also possible to use a [second loop field to guide the robot back to the charging station](#) (page 60).

See [How Turfmow 1000 works](#) (page 21) for details about all the various operating modes and how the robot transitions from one mode to another.

General installation procedure

The general installation procedure consists of the following steps:

1. Choose the best location for the charging station and position it.
2. Decide how the peripheral wire is to be laid taking into account the characteristics of the site and the obstacles.
3. Install the peripheral wire(s) and connect them to the charging station.
4. Configure the installation.

7.1 The charging station

There are two methods to enable the robot to return to the charging station when necessary. These are:

- to use a positioning beacon that emits a signal detected by the robot,
- to use an additional wire termed the "station loop" to guide the robot back to the station along the wire.

Some of the topics below refer to just one of the methods.

This chapter covers the following topics:

- [Criteria determining the position of the charging station](#) (page 39).
- [Station return and exit with a positioning beacon](#) (page 40).
- [Return to station with a station loop](#) (page 41)
- [Dimensions associated with the charging station](#) (page 42).
- [Critical distances for a straight wire](#) (page 42).
- [Placement of the charging station](#) (page 44).
- [Charging station electronic board](#) (page 44).
- [Installing a channel board outside of the charging station](#) (page 46).
- [Installing an inductor in the charging station](#) (page 46).
- [Selection of charging station type \(on the positioning beacon board\)](#) (page 47).

7.1.1 Criteria determining the position of the charging station

An important first step in the installation procedure is to decide where the charging station is to be located.

- The position must suit the situation.
- There should be no risk of flooding after heavy rain.
- Obstacles must be more than 6m away from the charging station. See also [special considerations for water features](#) (page 57).
- The station should sit on flat ground and the entry and exit of robot should be along flat ground. For more information see [Slopes](#) (page 71).
- The station should be positioned on a straight section of the peripheral wire with defined minimum free distances on both the incoming and outgoing sides.



Note: The charging station needs to be connected to an available power supply.

Note: The charging station may only be connected to a supply circuit protected by a residual current device (RCD) with a tripping current of not more than 30mA,

7.1.2 Station return and exit with a positioning beacon

An overview of the return to station manoeuvres for different types of installation can be found in [return to station in a single mowing field](#) (page 25) and [return to station with multiple mowing fields](#) (page 26).

An overview of the manoeuvres to exit the station for different types of installation can be found in [exit station for a single mowing field](#) (page 31) and [exit station for multiple mowing fields](#) (page 32).

The figure below illustrates the parameters used for the robot to enter and leave the station and start mowing.

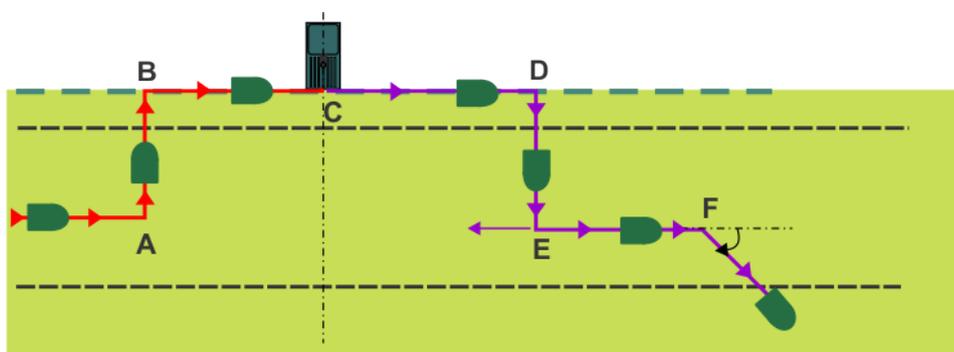


Figure 29: Station parameters

Station entry parameters

The direction in which the robot approaches the station along the trackborder is defined in **Access parameters > Direction**. In the example shown above this is **Clockwise**.

When the robot reaches point **A** it turns through 90° and makes the loopstep towards the wire (**B**). It then travels along the wire until it reaches the charging station (**C**). The distance between **A** (or **B**) and **C** is defined by the **Access parameters > Station entry (min and max)** parameter.

Note: If no positioning signal is detected after the robot has traveled 120% of the total wire length, it stops and issues an alarm.

When the robot detects the voltage (32V) on the arm of charging station, it stops.

Station exit parameters

When the robot leaves the station it travels along the wire again until it reaches point **D**, where it again turns through 90° to enter the trackborder at point **E**. The distance between **C** and **D** (or **E**) is defined by the **Access parameters > Min/Max Exit dist** parameter.

At point **E**, it can take one of two directions (Clockwise or CounterClockwise) to turn into the trackborder. This choice is set using the **Start Zone > Direction** parameter. In the example above this is Clockwise.

The robot then moves along the trackborder to point **F** where it turns into the field to start mowing. The distance between points **E** and **F** is set by the **Start Zone > Distance** parameter. The limits on the angle taken to turn into the field is set by the **Start Zone > Angle** parameter.

 **Note:** If the total trackwire distance run along the wire is longer than 29m, the robot stops and issues an alarm.

7.1.3 Return to station with a station loop

A station loop is an additional wire close to the charging station as shown in the figure below.

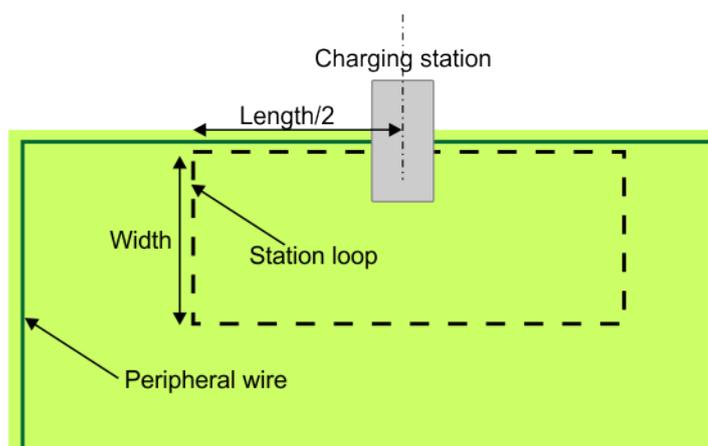


Figure 30: Return to station loop

When the robot needs to return to the charging station, it follows the track border along the peripheral wire of the field(s) it is mowing. When the robot detects the station loop wire, it moves along the wire until it arrives at the station.

The approximate dimensions of the return loop are

- **Length/2** is **2.5m maximum**
- **Width** is **Maximum track border width + 0.5m**

For an example of this installation setup see [Return to station with a station loop](#) (page 88).

 **Note:** Because the length of this loop is less than 200m it is necessary to [install an inductor in the circuit](#) (page 46).

7.1.4 Dimensions associated with the charging station

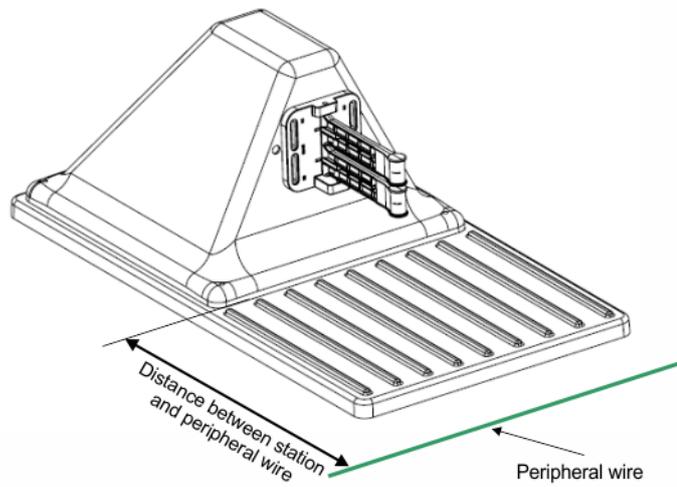


Figure 31: Distance between the charging station and the peripheral wire

Distance between the charging station and the peripheral wire: **0.57m**

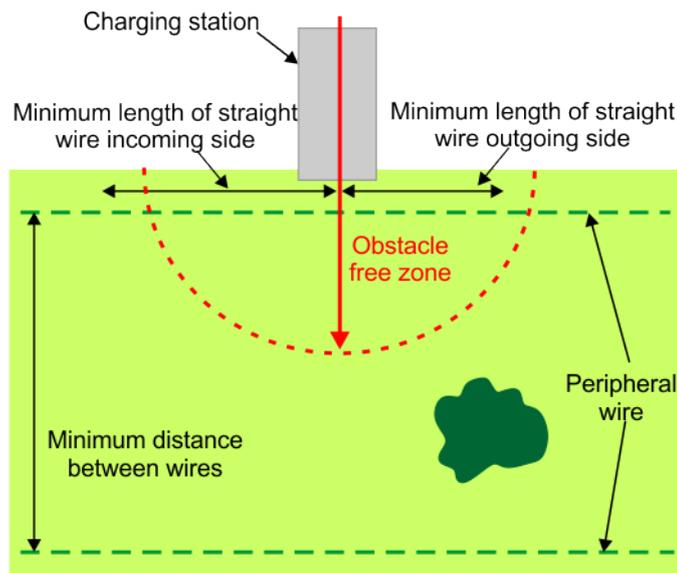


Figure 32: Dimensions associated with the charging station

7.1.5 Critical distances for a straight wire

Note: These distances apply to the situation where a positioning beacon is used to detect the charging station.

Minimum length of straight peripheral wire on incoming side.	3m
Minimum length of straight peripheral wire on outgoing side.	1m
Radius of obstacle-free zone.	12m

Minimum distance between peripheral wires.

15m

Critical distances for an S-Shaped wire (Case 1)

The figure below illustrates the case where the robot can not detect the positioning signal until after it has passed point A. Point A represents the minimum distance on the vertical section of the wire required for the robot to perform the loopstep manoeuvre.

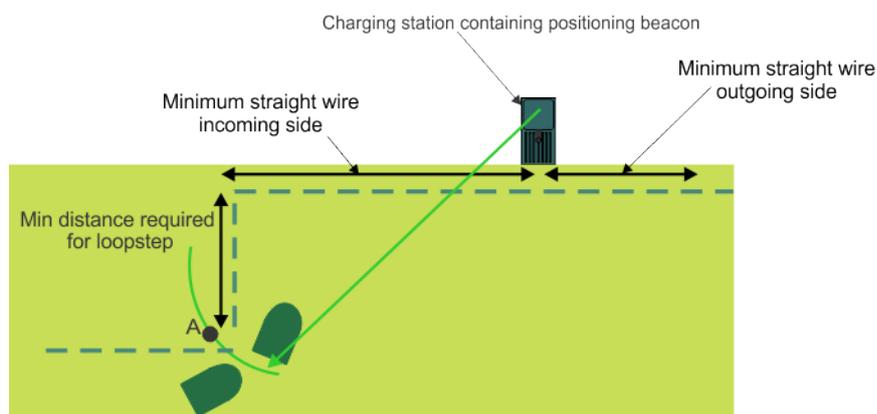


Figure 33: S-shaped wire (Case 1)

In this case:

- Minimum length of straight wire on the *incoming* side is: **8m**
- Minimum length of straight wire on the *outgoing* side is: **1m**

Critical distances for an S-Shaped wire (Case 2)

The figure below illustrates the case where the robot *can detect the positioning signal before* it reaches point A, (which is the minimum distance on the vertical section of the wire required for the robot to perform the loopstep manoeuvre).

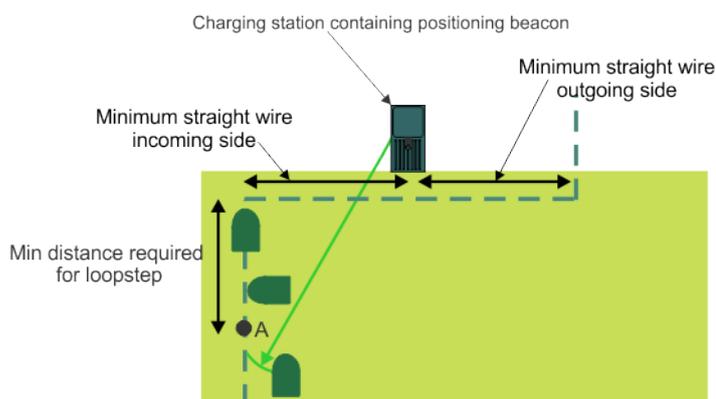


Figure 34: S-shaped wire (Case 2)

In this case:

- the minimum length of straight wire leading *into* the charging station is: **2m**
- the minimum length of straight wire leading *out of* the charging station is: **1m**

7.1.6 Placement of the charging station

The position of the charging station must ensure that *when the robot is in place*:

- The height of the arms has been set to make good contact between the charging station and the contacts on the robot.
- The angle of the charge arms is at 45°.



Figure 35: Correct positioning of the charging station and the robot

7.1.7 Charging station electronic board

The charging station must contain a board for each peripheral wire (channel) that is included in the installation.

 **Note:** It is also possible to [install a signal channel board in an external box](#) (page 46).

Each board contains the following components.

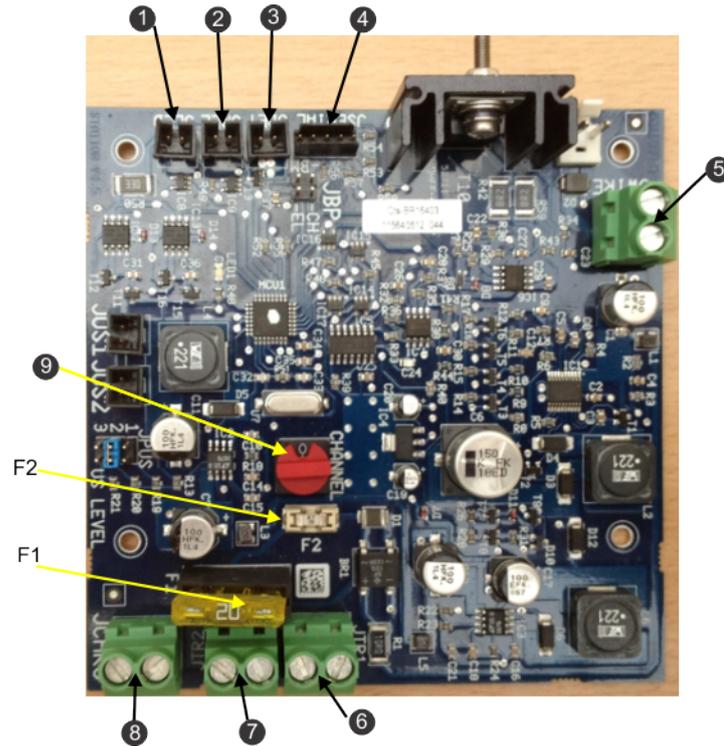


Figure 36: Components on the charging station board

- (1) JLED**
Pilot LED
- (2) JREL**
Relay connection (optional)
- (3) JDET**
Presence detection (optional)
- (4) JSERIAL**
PC interface for updates
- (5) JWIRE**
Peripheral wire
- (6) JTR1**
DC supply (-)
- (7) JTR2**
DC supply (+)
- (8) JCHRG**
32 V contact arm
- F1**
20 A fuse (mains)
- F2**
1 A fuse (electronic board)
- (9) Magnetic signal channel selection switch**
 - Channels 0, 1, 2, 3, 4, 5, 9 are available.
 - The default factory selection is channel 0.

- Channel 9 is reserved for a station used for charging only and which does not generate a signal.

7.1.8 Installing a channel board outside of the charging station

When using multiple wires (fields), if a wire is located at a significant distance from the charging station, it may be necessary to install a channel board closer to the field rather than in the charging station. This can save on the total length of wire required. For an example of this see [Complex garden and with station loop](#) (page 90)

It may also be necessary to install an external channel board, near the charging station, if there is insufficient space in the charging station.

A specific box is provided for this. Product number YB-062-00015-3A.

Simply connect the two ends of the peripheral wire to the connections shown below.

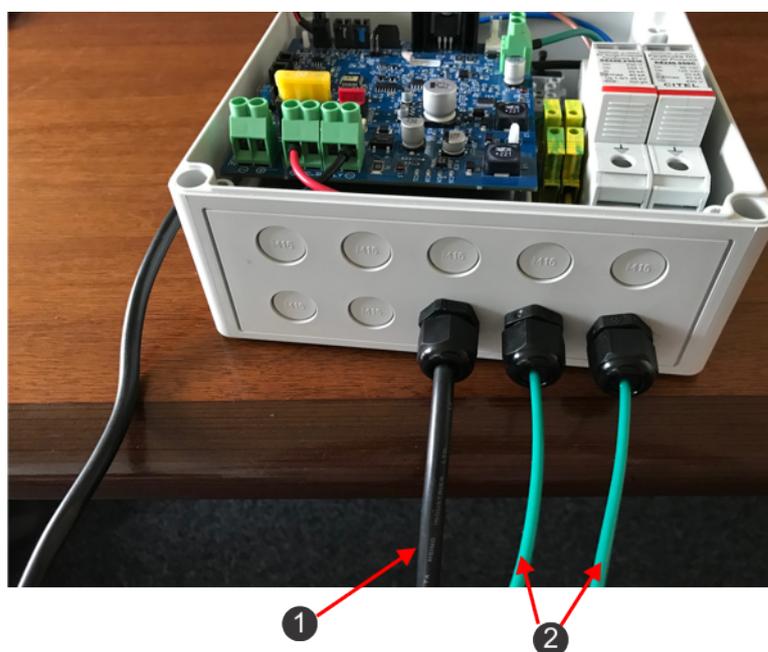


Figure 37: External channel board

- (1) Mains connection
- (2) Peripheral wire connections

7.1.9 Installing an inductor in the charging station

If the total length of the peripheral wire for a field is less than 200m, it is necessary to install an inductor in the charging station. This is especially important when using a small loop to return the robot to the charging station.

Use Product number YB-039-00009 in the catalog.

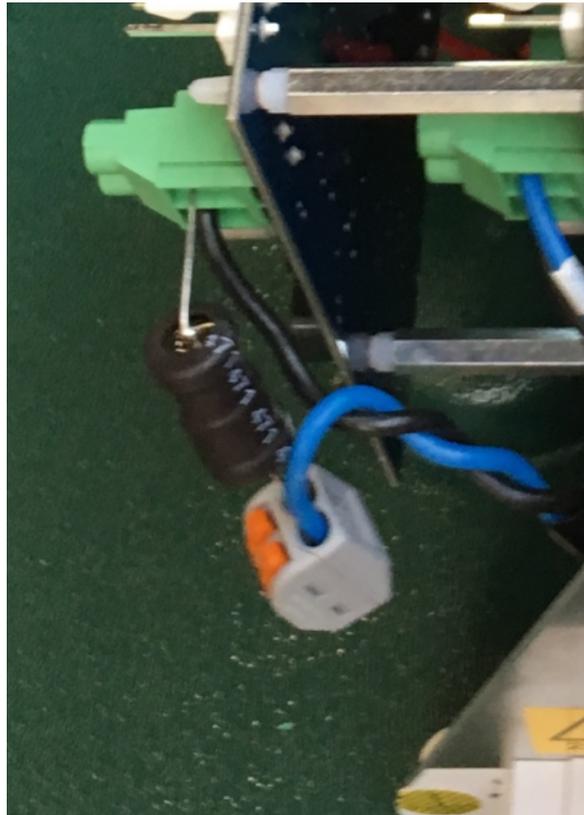


Figure 38: Inductor

The inductor must be placed in series with the peripheral wire.

One end must be connected to the station board. The other end is connected to the peripheral wire.

7.1.10 Selection of charging station type (on the positioning beacon board)

The figure below shows the bank of 8 switches on the positioning beacon board, and the direction used for ON and OFF.



Figure 39: Charging station type switches

Switch	1	2	3	4	5	6	7	8
Purpose	Not used	Not used	TM2000 station	Ball Picker station	TM1000 station	Charge	Drop station	Not used

Switch	1	2	3	4	5	6	7	8
ON	Always	Never	TM2000 accepted	Ball Picker accepted	TM1000 accepted	YES	YES	Never
OFF	Never	Always	TM2000 NOT accepted	Ball Picker NOT accepted	TM1000 NOT accepted	NO	NO	Always

7.2 Installing the peripheral wire

This chapter describes the installation requirements and considerations for the peripheral wire.

 **Note:** Specific considerations are required when installing multiple wires (fields).

The peripheral wire is shown in [Figure 28: Components of an installation](#) (page 38).

The boundary of the area to be mowed lies within the complete site. The distance between the peripheral wire and this boundary will vary, depending on the characteristics of the site.

The peripheral wire starts and ends at the charging station. Echo EU recommends laying the wire in a clockwise direction around the field.

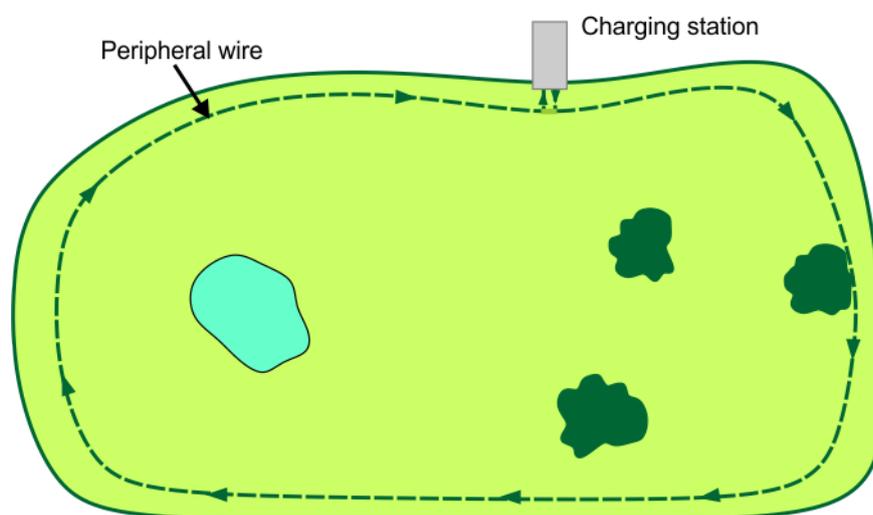


Figure 40: Peripheral wire laid in a clockwise direction

The peripheral wire needs to take [obstacles](#) (page 52) into account. Some obstacles can be detected by the sonar sensors, but others require deviations in the peripheral wire or the use of islands or pseudo-islands.

General Site considerations

See also [Narrow straits](#) (page 50) and [long lanes](#) (page 51).

Minimum length

Minimum length of the peripheral wire: **200m**

 **Note:** If a minimum length of 200m is not possible, it is necessary to [add an inductor in series with the wire](#) (page 46).

Maximum length

Maximum length of the peripheral wire: **1200m**

A second charging station is recommended:

- when the total length of peripheral wire (including islands and pseudo-islands) exceeds 750m ,
- when there are more than 5 obstacles on the track border on the way back to the charging station,

Wire dimensions associated with the charging station

Details of these are set out in the [chapter on the charging station](#) (page 39).

Recommended Depth

50 to 70mm

Minimum depth

This should be 20mm. However:

- The cable should never be able to come to the surface where it could be damaged.
- It should be deep enough in locations exposed to heavy duty applications (e.g. in front of goals on football pitches).

Maximum depth

It is not recommended to exceed 70mm.

Critical angles

Angles must be wider than 90°. Acute angles may trap robots when mowing.

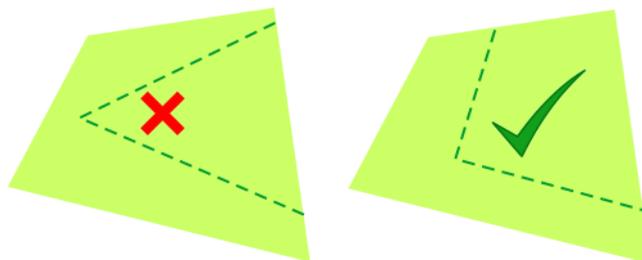


Figure 41: Acute angles

 **Note:** Angles must be rounded with a minimum radius of **1m**.

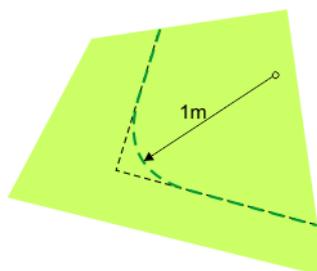
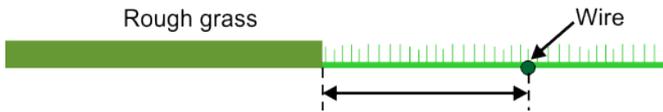
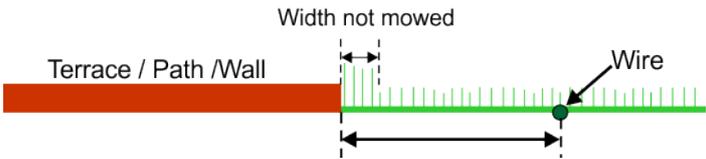
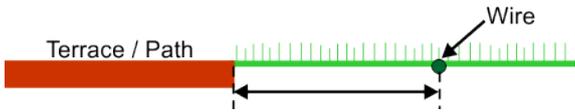
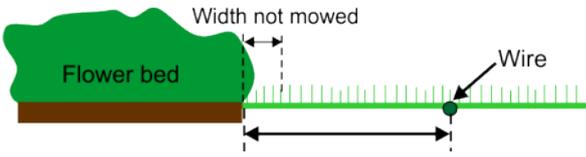


Figure 42: Rounding angles

Distances between the peripheral wire and boundary of the area to be mowed

The peripheral wire is set within the boundary of the area to be mowed (field) as shown in [Figure 28: Components of an installation](#) (page 38).

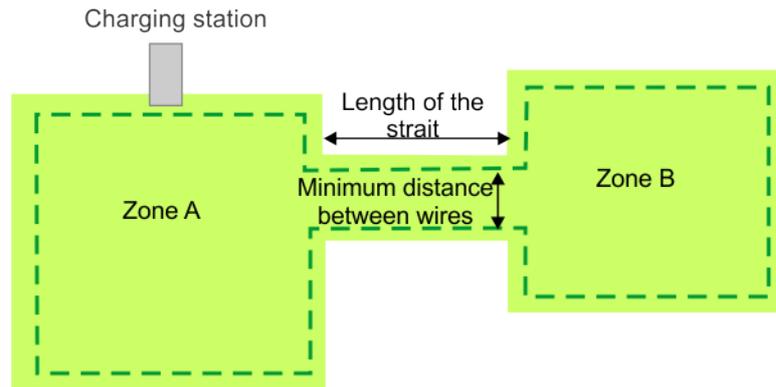
The distance between the peripheral wire and the boundary of the area to be mowed depends on the nature of the surfaces around the field.

 <p>Figure 43: Rough grass that does not need to be mowed.</p>	<p>Distance between rough grass and the peripheral wire 320mm Width of grass not mowed 0mm</p>
 <p>Figure 44: Raised hard landscaping</p>	<p>Distance between raised hard landscaping and the peripheral wire 650mm Width of grass not mowed 330mm</p>
 <p>Figure 45: Hard landscaping level with grass</p>	<p>Distance between the hard landscaping and the peripheral wire 200mm Width of grass not mowed 0mm</p>
 <p>Figure 46: Lawn-level planting</p>	<p>Distance between lawn-level planting and the peripheral wire 500mm Width of grass not mowed 180mm</p>

Note: The values given above apply if the value of the parameter "[Wire crossing distance](#)" (page 128) is set to the default value of 0.2m.

Sites containing narrow straits

The handling of sites which contain a narrow strait require special consideration.

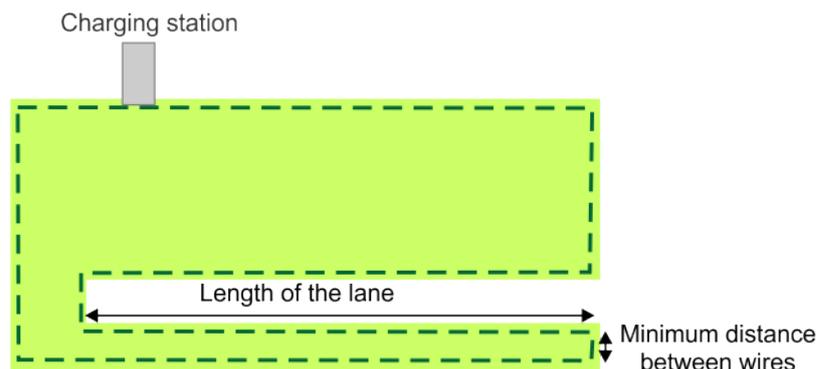

Figure 47: Site with narrow strait

There is a required minimum width of the strait, the value of which depends on the length of the strait. If this minimum width is not available, when the robot is in Zone B it will not be able to pass through the strait and return to the charging station. In this case you need to install an additional charging station in Zone B.

The table below presents the "Minimum distance between wires" required to enable the robot to follow its track border from Zone B through the strait and return to the charging station in Zone A.

Length of the strait	Minimum distance between wires
< 1m	3.5m
1m<Length of strait<5m	4.0m
5m<Length of strait<15m	4.5m

Sites with long lanes


Figure 48: Site with long isolated lane

A long isolated lane represents an area where the intensity of the magnetic field between the wires is high. There is a risk that the robot will not be able to detect where the track border is and be unable to return to the charging station. This will result eventually in a flat battery.

Length of the lane	Minimum distance between wires
>15m	10.0m

Wire installation good practice

Note: It is essential to use the wire supplied by Echo EU.

Begin setting up the wire from the charging station.

It is recommended to lay the main wire in a clockwise direction and the wire of an island in the *opposite* (counter-clockwise) direction.

The peripheral wire cannot be crossed and cannot form loops.

7.2.1 Dealing with obstacles

Obstacles are objects that the robot must avoid. They can be detected by the [sonar sensors](#) (page 18). In some cases however it is necessary to use [islands or pseudo-islands](#) (page 52).

Note: The peripheral wire can be used to accommodate a *maximum* of 5 islands. If there are more than 5 obstacles use pseudo-islands

Detection of obstacles by sonar sensors

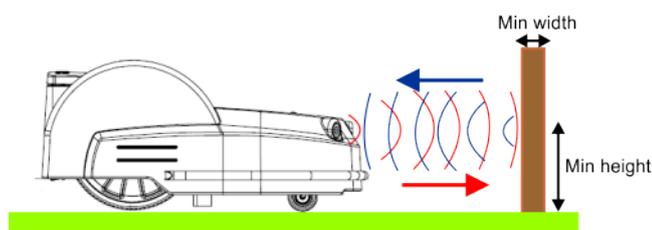


Figure 49: Detection of obstacles by sonar sensors

When the sensors detect an object, the robot slows down, moves forward until it touches the obstacle, gently reverses and then turns through an angle to continue mowing.

Note: The detection of obstacles relies on the constant operation of all 5 sonars. If a sonar fails an alarm is raised and the robot works at low speed after the failure of any sonar.

The sonar sensors can only detect an object if its **Min height** is 400mm and its **Min width** or diameter is 70mm. It may therefore be necessary to add additional protection which the sensors can detect.

The treatment of obstacles depends on their [type](#) (page 54) and their location.

When to use islands or pseudo islands

Note: Whenever possible it is preferable to ensure that obstacles can be detected by the sensors. (See [Types of obstacles](#) (page 54).)

Obstacles can also be accommodated by creating islands or pseudo islands. The method used depends on

- the distance between the obstacle and the charging station (1),
- the distance between the obstacle and the peripheral wire (2),

- the distance between the obstacles (3),
- the size of the obstacle (4).

These distances are illustrated in the figure below.

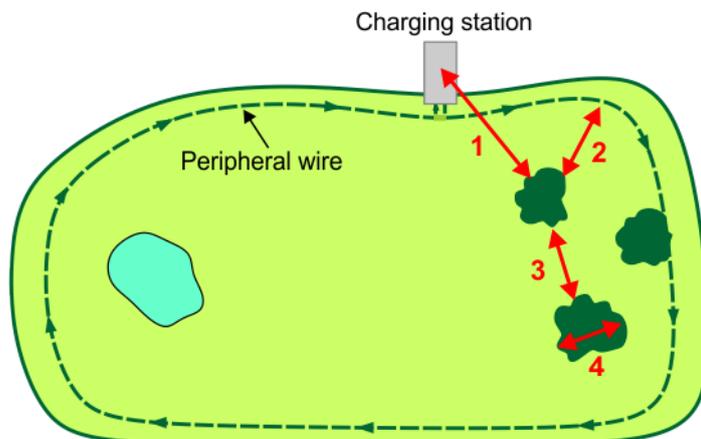


Figure 50: Location of obstacles

(1) Distance between the obstacle and the charging station

when this is *MORE* than 15m -> use an *island* (page 58).
 when this is *LESS* than 15m -> use a *pseudo-island* (page 59).

(2) Distance between the obstacle and the peripheral wire

when this is *MORE* than 5m -> use an *island* (page 58).
 when this is *LESS* than 5m -> use a *pseudo-island* (page 59).
 when this is *LESS* than (1m) -> see *Obstacles near the boundary to be mowed* (page 53).

(3) Distance between the obstacles

when this is *LESS* than 5m -> use an *island* (page 58).
 when this is *MORE* than 5m -> use a *pseudo-island* (page 59).

(4) Size of the obstacle

when the side or the diameter of the obstacle is *LESS* than 5m -> use an *island* (page 58).
 when the side of the diameter of the obstacle is *MORE* than 5m -> use a *pseudo-island* (page 59).

Obstacles near the boundary to be mowed

If an obstacle is less than 1m from the boundary the wire must go around the obstacle.



Figure 51: Obstacle less than 1m from the border

If the distance between the obstacle and the boundary is greater than 1m, but less than 5m, use a *pseudo-island* (page 59)

7.2.1.1 Types of obstacles

Obstacles that must be accommodated include:

- Trees and other planted areas (flowerbeds).
- Sculptures.
- Garden items such as swings, climbing frames, trampolines...
- Paths and terraces.
- Ponds and swimming pools.

Trees



Figure 52: Trees with roots that go straight down into the ground

Large trees with roots that go straight down into the ground, without surface roots, can generally be detected by the sensors.



Figure 53: Trees surrounded by a level zone

When the trees are surrounded by a level zone, the best solution is to fill the cavity with soil or wood chips to level off the ground.



Figure 54: Large trees with surface roots



Important: When the trees have surface roots, an [island](#) (page 58) or [pseudo island](#) (page 59) must be used.



Figure 55: Sapling

Trees with very small trunks need to be protected with poles that the sensors can detect.

Garden items



Figure 56: Swing

The sonar waves from swing supports are likely to be reflected to the sky. Protection poles would be too dangerous for children, so the solution is to use an island or pseudo-island.



Figure 57: Trampoline

The robot can detect the horizontal mattress on a trampoline if it is at a height of more than **400mm**. The trampoline footage can trap cutting heads and damage heads and blades. Possible solutions are:

- use an island/pseudo-island,
- set protection planks around the footage of the trampoline,
- use protection poles. The maximum distance between poles is 400mm.

Sculptures

This will of course depend on the size and the type of sculpture.

If the sonar sensors cannot detect the sculpture from some directions, put protection poles around the sculpture. If this is not acceptable for aesthetic reasons, the sculptures should be treated as an island or a pseudo-island depending on their location.

Water

The treatment of water features such as ponds or pools requires special considerations. They must be accommodated using islands or pseudo-islands depending on the conditions. See [When to use islands or pseudo islands](#) (page 52).

Important: The water amplifies the electromagnetic signal. The robot is attracted towards higher signal levels, which represents a major risk!

To avoid any incident next to water:

- Take an additional 1m reserve between the wire and the hazardous area.
- If the ground slopes down towards the water, or is slippery, or can become wet or flooded, take additional appropriate reserve.
- If the required reserve distance is not available, install a barrier such as a row of protection poles.

See [Figure 58: Critical factors associated with water](#) (page 57).

Remember: The charging station must be located *at least 15m* from the water's edge.

The figure below summarizes some critical factors associated with the placement of the charging station and the peripheral wire around a water feature.

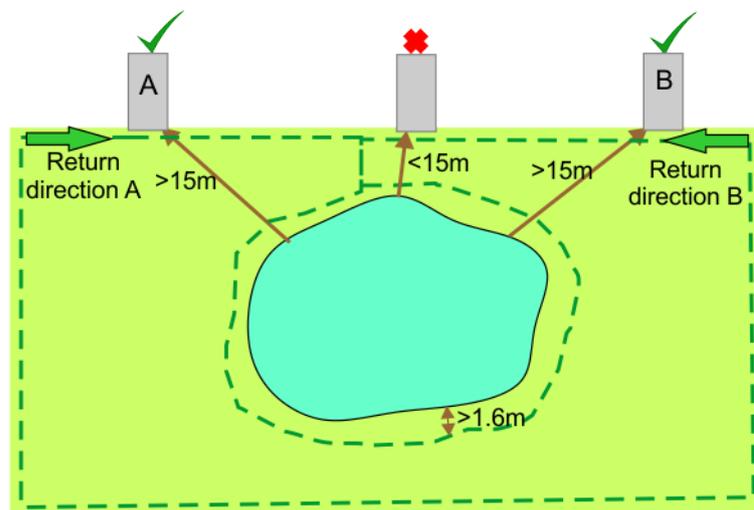


Figure 58: Critical factors associated with water

In the situation illustrated above, two possible locations for a charging station have been shown. *The robot should return to the station from the direction away from the water.* So if the charging station is located in point A, the robot must return to it in a *clockwise* direction. If the charging station is located in point B, the robot must return to it from a *counter-clockwise* direction.

Paths

Paths that cross the field to be mowed, should be level with the grass.

7.2.1.2 Islands

Islands are loops in the peripheral wire around permanent obstacles.

Note: A maximum of 5 islands can be installed!

This is to save time while returning to the charging station AND to avoid bouncing off from island to island.

Islands can be created when the obstacle is:

- more than 5m from the peripheral wire
- more than 15m from the charging station
- more than 5m from another island or pseudo-island
- less than 5m in dimension or diameter

If these conditions cannot be satisfied see [Dealing with obstacles](#) (page 52).

The peripheral wire is taken around the obstacle and the approach and return wires laid next to each other.

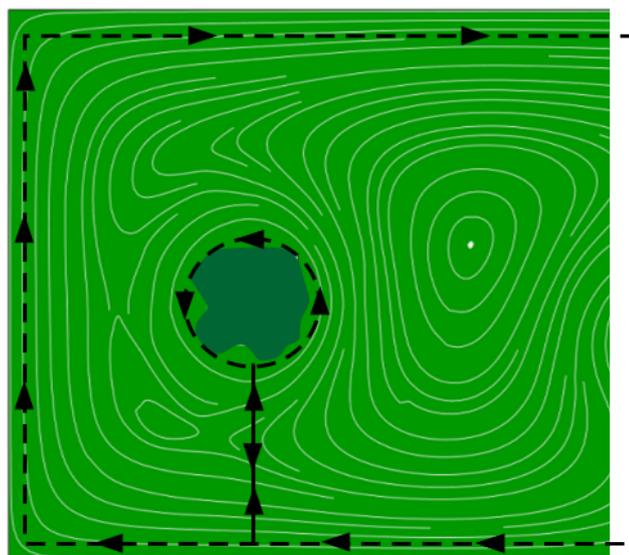


Figure 59: Route of the peripheral wire around an island

Note: The wire must be laid around an island in the opposite direction to which it is laid around the field.

It is recommended that, the peripheral wire is laid in a *clockwise* direction from the charging station. The wire must then go towards the obstacle and around it in an *counter-clockwise* direction.

Note: The wires must not cross.

Lay the two wires next one to each other (10 mm apart), or attach them with cable straps at a distance of 100 mm. There is no need to twist the two wires together

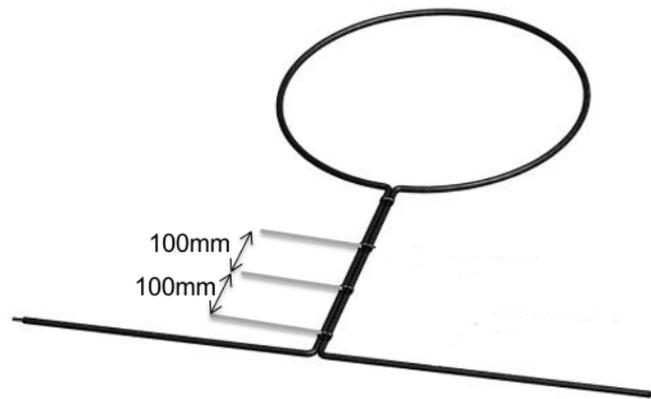


Figure 60: Wiring for an island

The robot will move across the pair of wires.

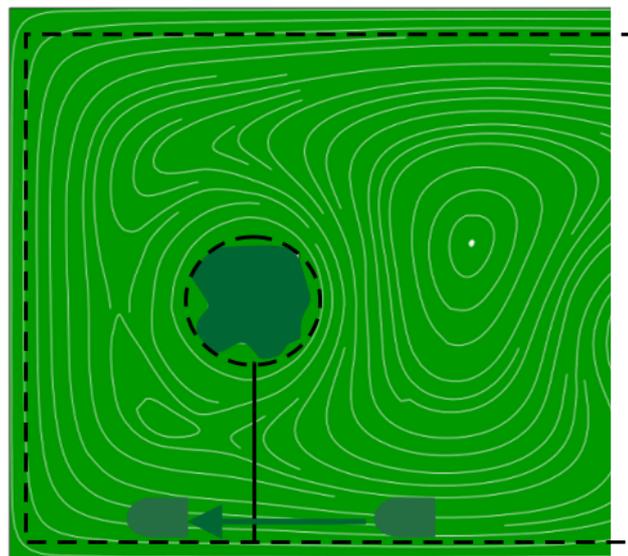


Figure 61: Robot route

7.2.1.3 Pseudo-islands

Pseudo-islands are loops in the peripheral wire around permanent obstacles.

Pseudo-islands can be created when the obstacle is:

- less than 5m from the peripheral wire
- less than 15m from the charging station
- less than 5m from another island or pseudo-island

 **Note:** A pseudo-island can also be used if the maximum of 5 islands have been installed. See [Dealing with obstacles](#) (page 52).

The peripheral wire is laid around the obstacle, maintaining a specific distance between the approach and the return wires.

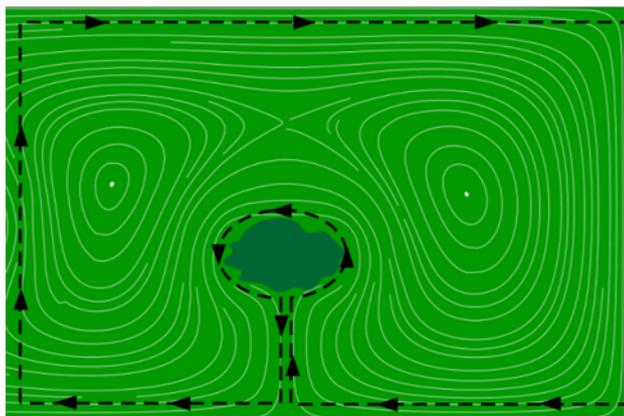


Figure 62: Route of the peripheral wire around a pseudo-island



Note: The wire must be laid around a pseudo-island in the opposite direction to which it is laid around the field.

It is recommended that, the peripheral wire is laid around the field in a *clockwise* direction from the charging station. The wire must then go towards the obstacle and around it in a *counter-clockwise* direction.

The distance between the approach and the return wires must be between 400mm and 600mm.

The robot will move around the obstacle as shown in the figure below.

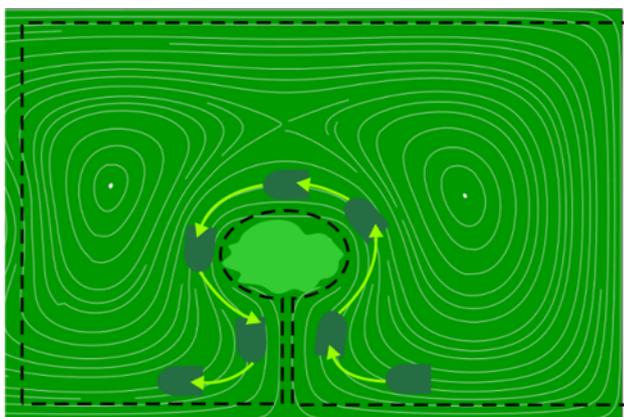


Figure 63: Robot route around a pseudo island

7.3 Installing multi-fields

It is possible to connect several peripheral wire loops to a single station.

- Each field is defined by a peripheral wire loop that starts and ends at the station.
- Each peripheral wire loop is assigned to a different signal channel in the charging station.
- The charging station must contain one signal channel board for every wire required.
- Each wire (field) contains a single *parcel*. Multiple parcels can be created within a single field.
- Each wire loop must overlap with the neighboring one.

- Each pair of wires/parcels which overlap must be designated as neighboring parcels.

Multi-fields can be used

- to manage large complex mowing areas,
- to provide a means to return the robot to the charge station without the need for the positioning beacon.

The elements of a multi-field installation are shown in the figure below.

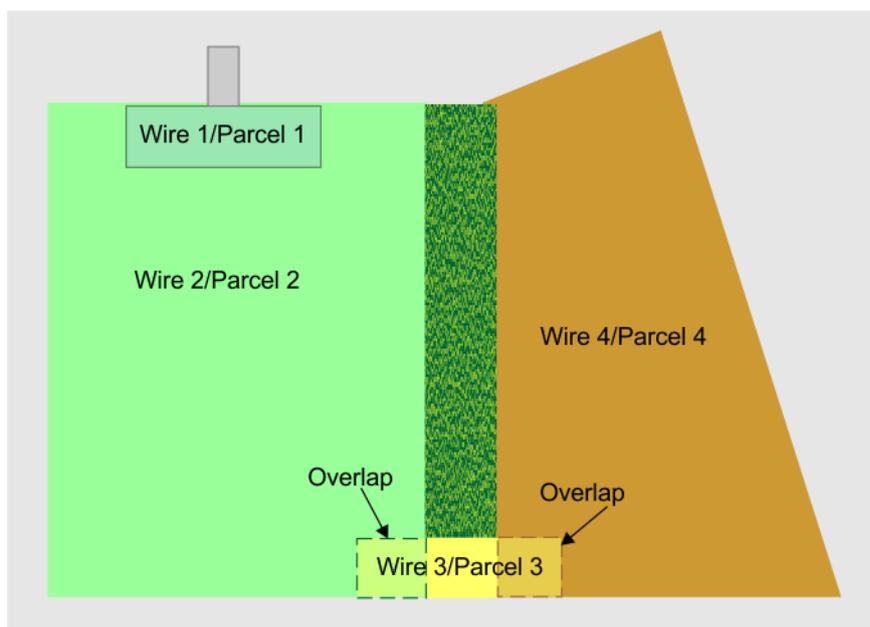


Figure 64: Multi-field installation

Wire 1/Parcel 1 is the small loop to which the charging station is connected. In this example it lies within Wire 2/Parcel 2. When in this field the robot will not use the track border and will just follow the wire to enter the station.

Wire 2/Parcel 2 is a neighbor of Wire 1/Parcel 1. Wire 3/Parcel 3 is a neighbor of Wire 3/Parcel 3. It is also a neighbor of Wire 4/Parcel 4.

Wire 3/Parcel 3 is a transition zone used to connect the main mowing areas of Wires 1 and 2.

The proportion of time that the robot spends mowing in Wires 1 and 4 is determined by the percentage values assigned to the corresponding parcels. For Wires 1 and 3 the percentage can be set to 0.

For examples of multi-field installations and their configuration details see [Return to station with a station loop](#) (page 88) and [Complex garden and with station loop](#) (page 90).

Overlaps

An overlap is an area that lies within 2 fields and is used for the robot to transition from one field to another.

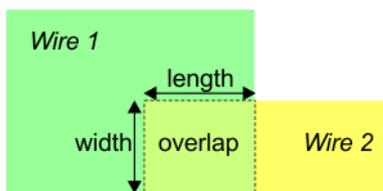


Figure 65: Dimensions of overlaps

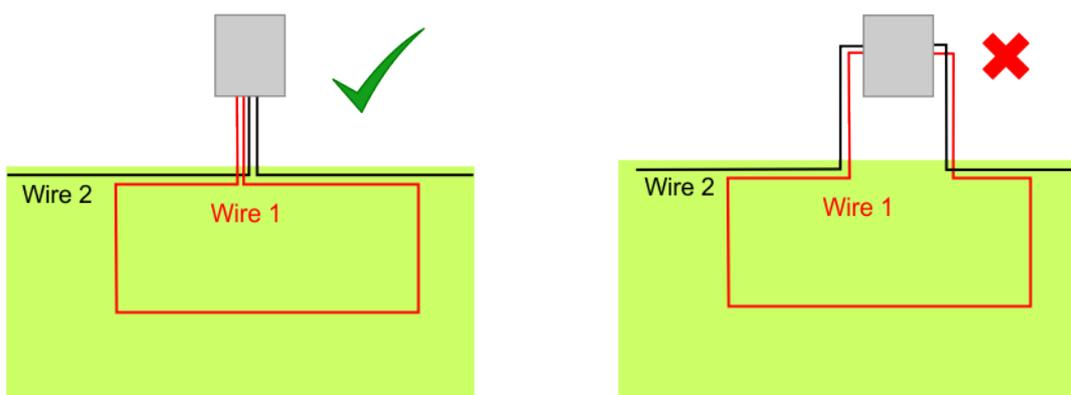
- The length of the overlap must be *more than 3m*.
- The width of the overlap must be *more than 2.5m*.

Installing the peripheral wires

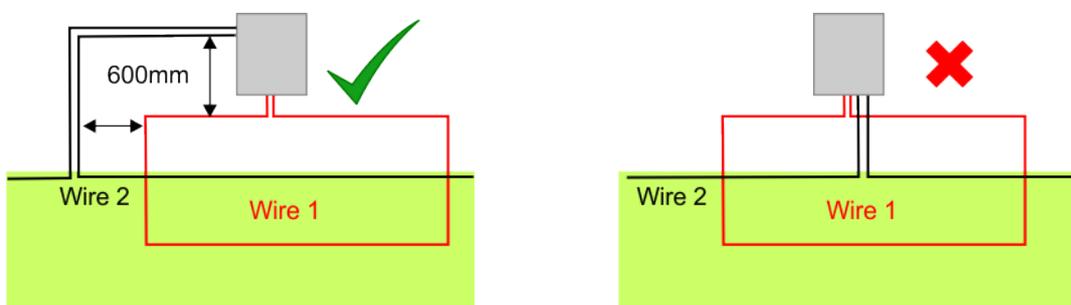
! **Important:** The installation of the peripheral wire should take into account all the principles set out in [Installing the peripheral wire](#) (page 48).

When connecting multiple wires to the charging station there are specific conditions that must be respected.

Rule 1 *The start and finish wires should lie next to each other when they enter the station.* There should be no gaps in the loops. The correct and incorrect method of cabling is shown below.



Rule 2 *The wires should not cross.* The wires for one field should be taken around the other field. The distance between them must be 600mm. If wires do cross, they must cross each other at right angles (90°).



7.4 Installing the positioning beacon

The positioning beacon is a device that emits an UWB (Ultra Wide Band) signal, which is detected by the robot, and which enables it to locate the charging station to a high degree of accuracy. It represents reliable state-of-the-art technology termed, Real Time Location System (RTLS), that is insensitive to weather conditions.

The figure below shows various components of the positioning beacon board. For details of the switches to set the positioning beacon see [Selection of charging station type \(on the positioning beacon board\)](#) (page 47).

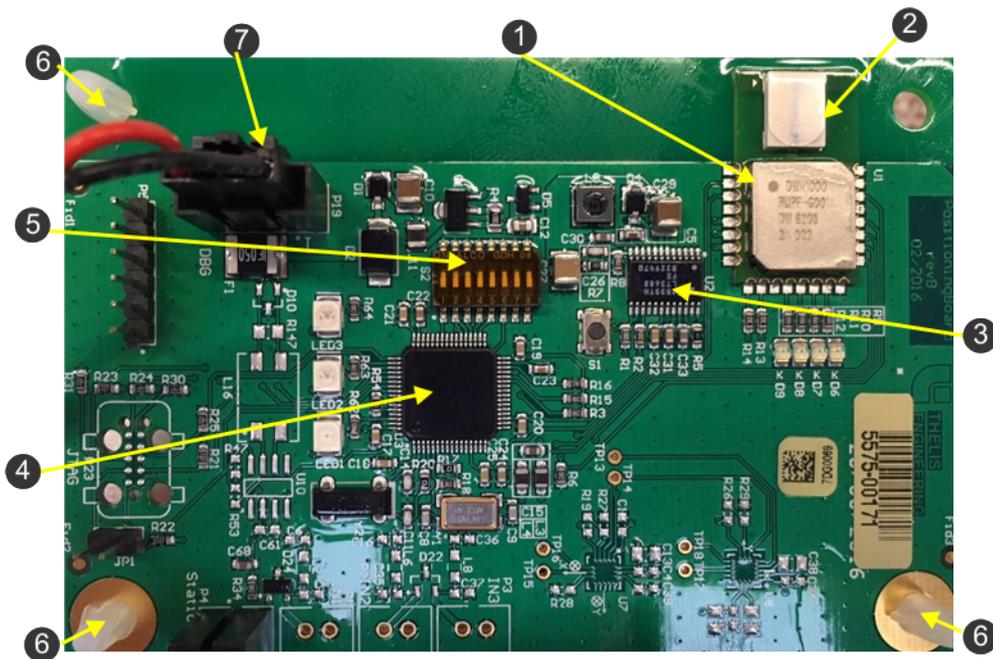


Figure 66: Components on the positioning signal board

- 1: Single chip UWB transceiver.
- 2: Antenna
- 3: Inertial Motion Unit (IMU)
- 4: CPU
- 5: Switch to set the positioning beacon
- 6: Set of three support brackets
- 7: Power cable connector

The positioning beacon board can be:

- [Installed in the charging station](#) (page 64). This is the most common configuration.
- [Installed in a separate external location](#) (page 66).

See also: [Changing the positioning board and components](#) (page 68)

7.4.1 Installing the positioning board in the charging station

The positioning beacon board is most commonly installed inside the charging station, as shown in the figure below.



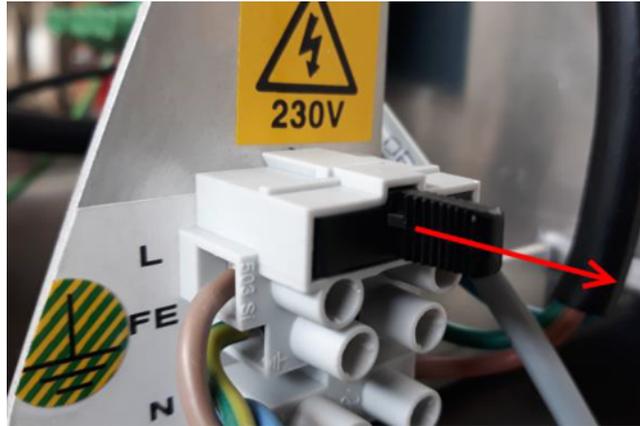
Figure 67: Location of the positioning board in the charging station

To install a positioning beacon board in the charging station

1. Disconnect the power from the charging station.
 - If the charging station is connected to the mains using a power cable, unplug the cable.
 - If the station is connected directly to an electrical cabinet, first remove the station cover (see below) and then remove the fuse inside the station.
2. Remove the cover from the charging station. Undo the 4 (8mm) nuts connecting the cover to the base.



3. If the station is connected directly to an electrical cabinet, remove the fuse.



4. Verify that all the LEDs indicate that there is no power connected.
5. The board must be located on the three supports shown in [Figure 66: Components on the positioning signal board](#) (page 63).

 **Note:** One of these should be a metal grounded support. See [Upgrade the positioning board supports](#) (page 69).

6. Connect the power cable to the wire board. Ensure the wire is properly screwed and secured.



7. Take the cable behind the wire and positioning boards and push the other end into the socket on the positioning board.



7.4.2 Installing the positioning board outside of the charging station

Depending on the layout of the site, there are situations when the positioning beacon inside a station might not be seen properly by the robot. In such situations the problems can be resolved by locating the positioning beacon outside of the charging station. Typical cases are:

- When the station is located around a corner, and the robot can not detect the beacon to start the wire track manoeuvre before it reaches the corner.

This can be resolved by locating the positioning beacon on the first wall the robot meets when it is tracking the border.

- When the positioning beacon is in a station that is located on an elevation point. In this case it may be that the radio waves are emitted at a height at which the robot cannot detect them.

This can be resolved by locating the positioning beacon at a point low enough for the robot to detect it.

In all cases, the recommended installation height is below 1m.

For any specific installation requirements, or to set it at a higher level, please contact the After-Sales department.

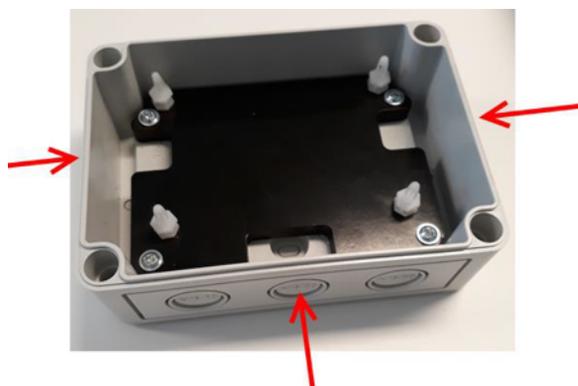
To install the positioning beacon outside of the charging station

To carry out this installation you need :

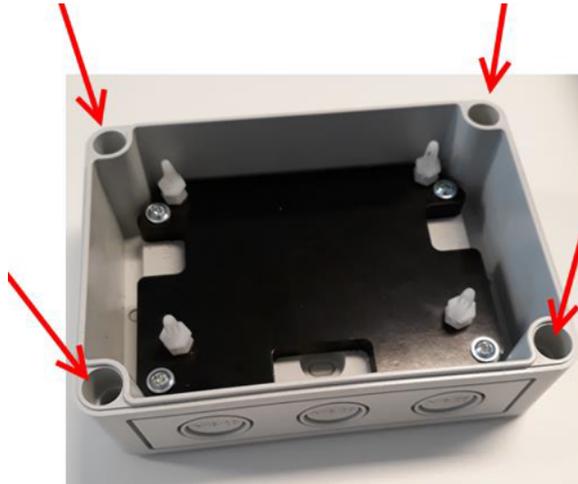
- A positioning beacon board.
- A box to house the positioning beacon board. (Product number YB-062-00011)
- An offset cable.

1. Attach the gland of the offset cable to one of the three holes indicated by in the figure below.

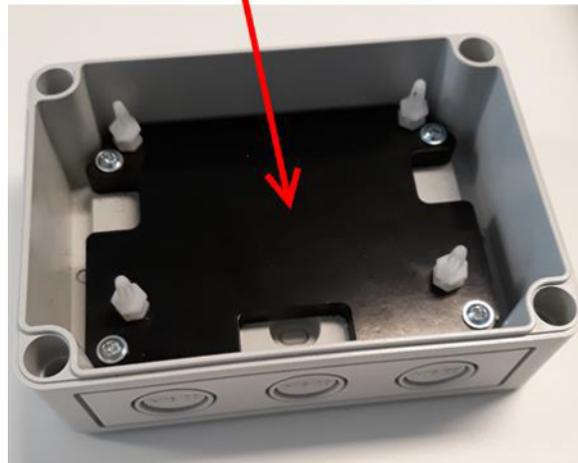
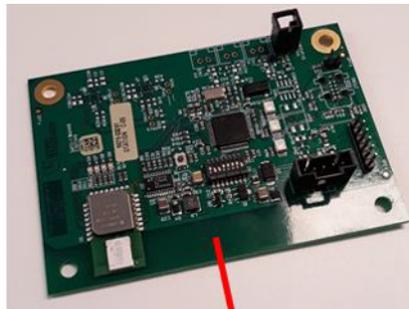
Note: The selected hole must be on the bottom of the box when it is fixed in position.



2. Mark the position of the four holes for the mounting screws on the mount support.



3. Locate the positioning board in the box, by gently pressing it onto the four plastic spacers.



4. Pass the cable through the cable gland. Make sure that the cable gland is properly tightened.
5. Connect the cable to the socket on the positioning board.



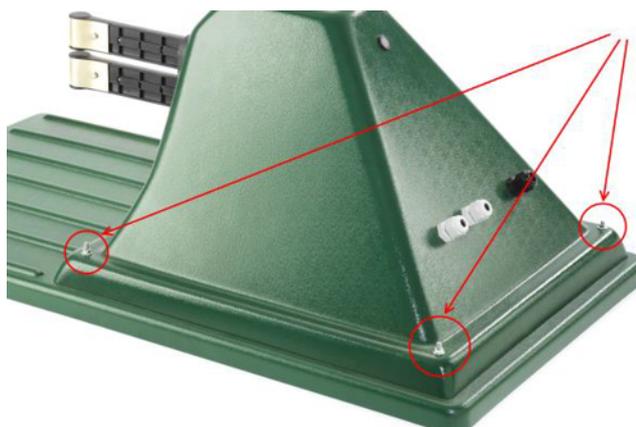
6. Attach the box to its support using the appropriate screw. (Diam. 4.0-4.5mm / head 7.5-8.0mm)
7. Connect the other end of the cable to the power supply.
8. Configure the settings. (Use the [technician's menu](#) (page 114) **Infrastructure > Stations.**)

7.4.3 Changing the positioning board and components

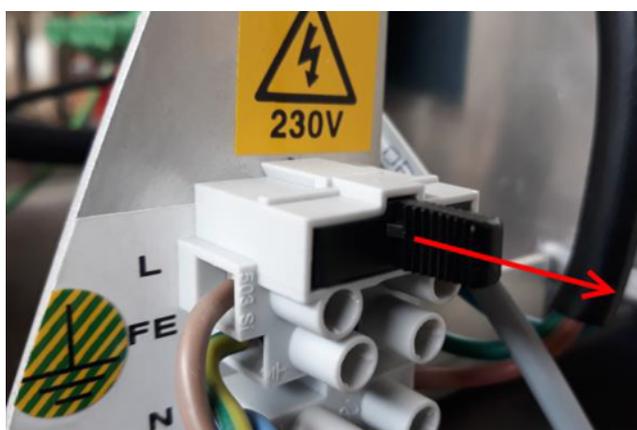
This document describes how to upgrade the positioning board and its components.

Before carrying out any of these procedures, you need to disconnect and open the charge station.

1. Disconnect the power from the charging station.
 - If the charging station is connected to the mains using a power cable, unplug the cable.
 - If the station is connected directly to an electrical cabinet, first remove the station cover (see below) and then remove the fuse inside the station.
2. Remove the cover from the charging station. Undo the 4 (8mm) nuts connecting the cover to the base.



3. If the station is connected directly to an electrical cabinet, remove the fuse.



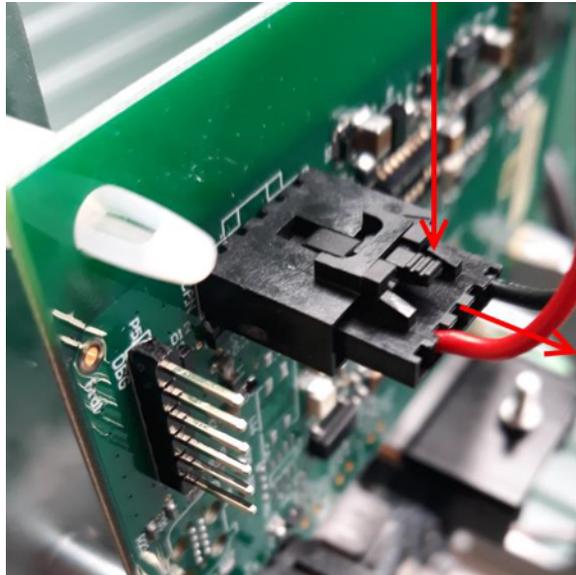
4. Verify that all the LEDs indicate that there is no power connected.

Changing the beacon positioning board

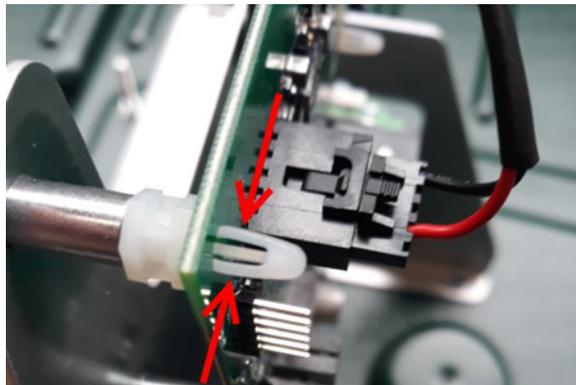
As modifications are made to the beacon positioning board it may be necessary to replace it.

To change the positioning beacon board

1. Disconnect the power cable from the positioning board. Gently press the locking guard, then pull the cable out of the socket.



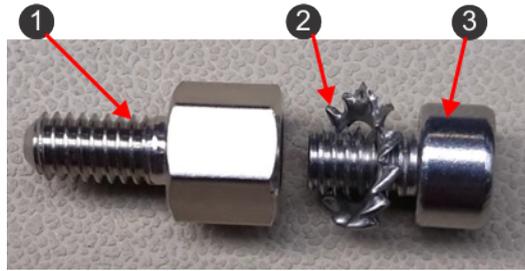
2. Remove the three plastic braces by gently pressing them with your fingers and unscrewing the socket cap hex screw (3mm, nut 7mm).



3. Remove the board from the mounting bracket.
4. Position the new board in front of the braces.
5. Push gently until it clicks.
6. Screw the hex nut.
7. Re-connect the power cable of the positioning board into its socket by gently pushing it until it clicks.
8. Replace the station cover.
9. Configure the settings. (Use the [technician's menu](#) (page 114) **Infrastructure** > **Stations**.)

Upgrade the positioning board supports

Initially the beacon positioning board was mounted in the station with a set of plastic supports. It is recommended that one of the supports is a metal connector with an electrical connection to ground. This is shown below and consists of the following components.



- (1) Hex M/F spacer screw (P/N: YB-012-00009-0A)
- (2) Locking washer (P/N: YB-701-04000-0A).
- (3) Hex cap socket screw (P/N: YB-506-04006-0A)

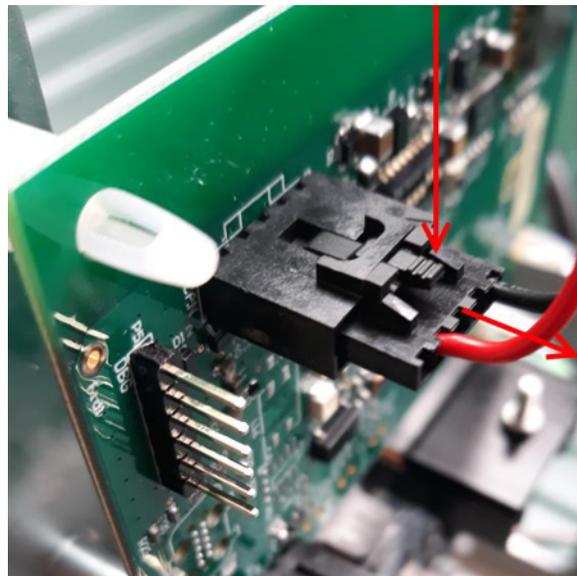
Remove the bottom left plastic support; and replace it with a metallic connection.

Replace the power cable between the positioning board and the wire board

The power cable connects power from the connection on the wire board to the connection on the positioning board. Early positioning boards were supplied with a four-position power cable. New boards are powered through a five-position cable.

To change the power cable

1. Disconnect the power cable from the beacon positioning board. Press the locking guard down gently and remove the cable from the socket as shown below.



2. Disconnect the power cable from the wire board.



3. Connect the new cable to the wire board. Ensure the wire is properly screwed and secured.
4. Take the cable behind the wire and positioning boards and connect the other end into the socket on the positioning board.

7.5 Slopes



Note: A situation where the entire site is on a severe slope is not suitable for Echo EU robots.

The maximum slope that can be tolerated on a site is 30% (17°).

Peripheral wire

If the sloping part of the site is well away from the peripheral wire, no special measures are required.

If the slope is near the peripheral wire, the robot should return to charging station by descending the slope.

Charging station

If the entire site is sloping - the station should be located at the top or the bottom - not on the slope. It is preferable to locate the station at the top of the slope rather than the bottom, to avoid problems with flooding. The robot has no “brake” in charge mode, and could easily slide off its contacts on sloping ground.



Figure 68: Location of charging station on sloping site

The station should sit on flat ground. The longitudinal slope (by which the robot enters the station) should be 0%.



Figure 69: Longitudinal slope of the charging station

The transversal slope should be a maximum of 10% (6 °).

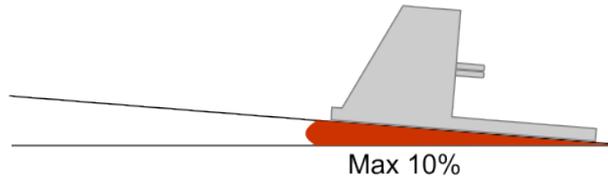


Figure 70: Transversal slope of the charging station

7.6 Installing the wheel brushes

The wheel brushes are fixed to the body behind the rear wheels.

The installation kit contains the following items.



- 2x brushes
 - 2x brackets
 - 2x 5 screws
 - 2x 5 flat washers
 - 2x 5 crinkled washers
1. Turn the body so that it is lying on its rear.
 2. Remove the three black covers that cover the fixation holes.



3. Position the brushes on the brackets as shown in the figure below, aligning the slots in the brush with the screw holes in the bracket.



4. Screw the brushes onto the bracket, inserting the flat washer next to the brush and the crinkled washer below the screw head. Use a torque of 12Nm.
5. Screw the bracket onto the body, inserting the flat washer next to the bracket and the crinkled washer next to the screw head. Use a torque of 7.5 Nm + Loctite 2701.

7.7 Configuration

In order for the robot to operate correctly, certain installation parameters must be defined.

The configuration parameters depends on the type of installation.

Mono-field installation

These can be set using:

- The [Install wizard](#) (page 73) if using a positioning beacon.
- The [menus in the interface](#) (page 78) if using a return to station loop.

Multi-field installation

In this case the configuration parameters are set using the [menus in the interface](#) (page 78).

7.7.1 Configuration using the wizard

This section describes the installation parameters set by the wizard, and how to define them.



Note: The install wizard can only be used under the following conditions:

- when a positioning beacon is being used to locate the charging station,
- when the return to the charging station is along a straight wire,
- when the installation contains only one field,
- when the site does not contain a narrow lane.

Configuration parameters set by the wizard

The installation parameters that can be detected and set are:

- The positioning beacon parameters so that the robot can communicate with the station where it needs to go to be charged.
- The parameters that control the robot's return to the charging station. These include the dimensions of the "trackborder", and those required for the robot to perform the "loopstep".
- Parameters controlling the robots departure from the charging station (Go zone). These include the distance for which the robot must follow the wire, then the distance that the robot must follow the trackborder before starting to mow.

Note: Information about current values for these parameters can be seen in the [Technician's menu](#) (page 114).

To configure the installation using the wizard

1. Before using the Install Wizard it is necessary to locate the robot at the position shown in the figure below.

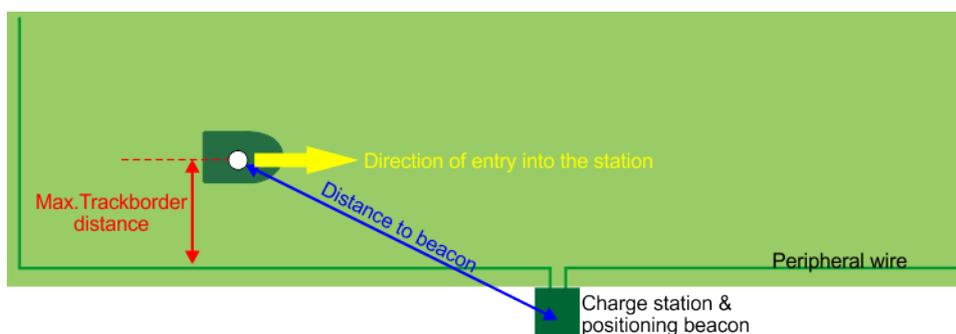
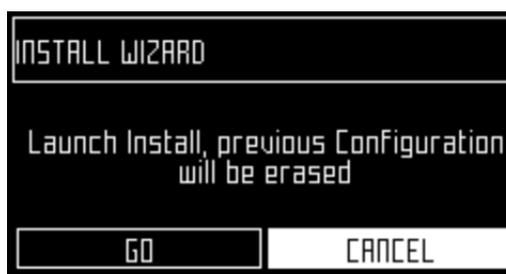


Figure 71: Placement of the robot before using the Install Wizard

The robot must be:

- Inside the peripheral wire.
 - At a distance that corresponds to the maximum dimension of the trackborder in the direction that is *perpendicular to the peripheral wire*. This should not be more than 3m.
 - At a distance that lies within the range of the positioning beacon. A distance of 5m is suggested.
 - Facing in the direction in which it will enter the charging station.
2. Open the cover and launch the Install Wizard.

Press **9** to access the technicians menu. Scroll to **Launch Wizard**, then press .



3. Select **Go** and press .

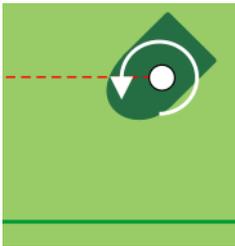
4. The first stage of the process is to search for the signal on the peripheral wire as set using the rotating switch inside the charging station. It will request confirmation that the robot has been positioned *inside* the wire. With **Next** highlighted, press .
5. The next stage is to search for the positioning beacon in the installed charging station. The wizard will request confirmation that the robot has been located *in range of the station*. With **Next** highlighted, press .

 **Note:** If multiple stations are found, you need to select the one required.

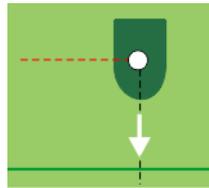
6. The wizard will now request confirmation that the robot is *at the position where it can take the wire to return to station*. This is the "Max. Trackborder distance" shown in the figure above and represents the distance required for the loopstep. With **Next** highlighted, press .
7. Confirmation is requested that the robot is *parallel to the wire towards the station*, i.e. facing the correct direction in which to enter the charging station. With **Next** highlighted, press .
8. Close the cover.

The robot will now:

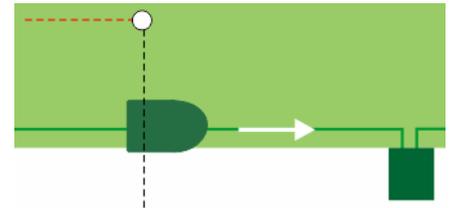
- (a) rotate on the spot, making approximately 1.2 turns,
- (b) turn towards the wire,
- (c) move towards the charging station.



(a) Robot rotates on the spot



(b) Turn towards the wire to perform the loopstep



(c) Move towards the station

9. When the robot has arrived at the station, open the lid. The screen will display the proposed parameters for leaving the station.



Wire. Max. Exit Dist. and **Wire. Min. Exit Dist.** are the minimum and maximum distances for which the robot will follow the wire (trackwire movement) when leaving the station. They are illustrated in the figure below.

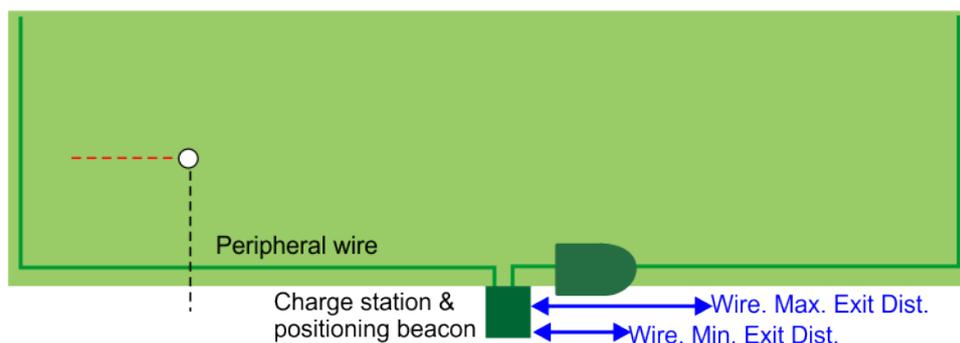


Figure 72: Minimum and Maximum distances for the trackwire movement leaving the station

10. Edit the values if necessary, then highlight **Confirm** and press .
11. The wizard will then ask you on which side of the robot the charging station is located. Press the Left or the Right button accordingly the press .
12. The wizard will then ask "Do you need to define a start zone?" If you don't define a start zone, the robot just follows the wire, then does the loopstep, then starts mowing. If you answer YES, the screen will then display the proposed parameters for following the trackwire border after the trackwire movement.



Max.Distance and **Min.Distance** are illustrated in the figure below.

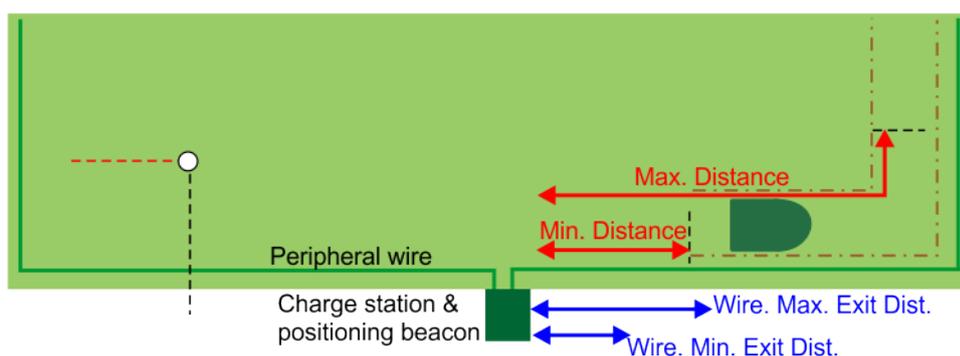


Figure 73: Start zone parameters determined by the wizard

13. Edit the values if necessary then highlight **Confirm** and press .
14. You will now see the message "The Mower will attempt to reach its initial position". Highlight **Next** and close the lid.

The robot will now perform a number of manoeuvres to return to its starting point.

Note: It will NOT use the distance parameters set for leaving the station during these manoeuvres.

The movements are illustrated in the figure below.

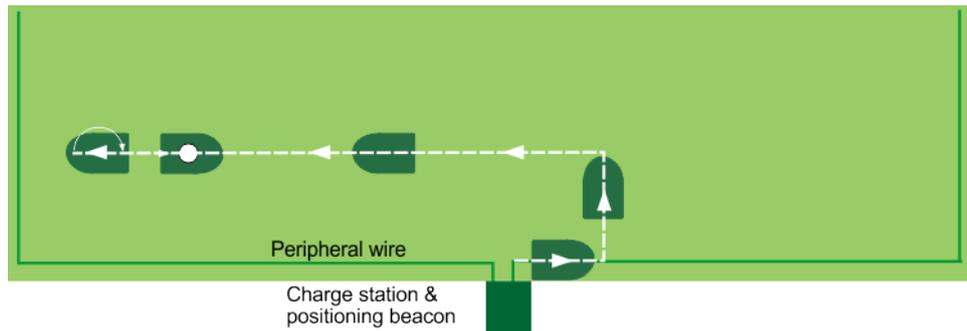


Figure 74: Movement of the robot back to the starting point

- The robot moves out of the station along the wire for about 50cm.
 - It then turns through a right angle away from the wire.
 - It turns through another right angle to go in the direction of the starting point.
 - It continues past the starting point for about 2m.
 - It then turns through 180° and returns to the starting point, facing in the original direction.
15. Open the lid. The screen displays the proposed entry station parameters.

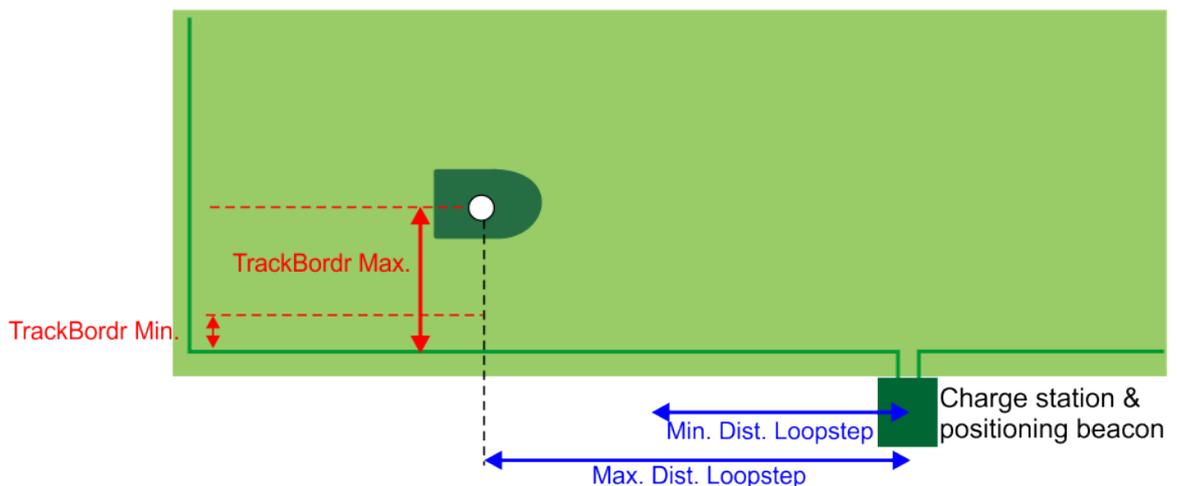
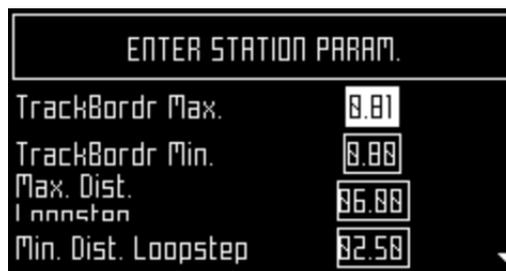


Figure 75: Parameters determined by the wizard

16. Edit the values if necessary.
17. Use the to highlight **Confirm** and press .

The operation of the wizard is complete.

7.7.2 Configuration using the menus

Once the peripheral wire(s) and the station have been set in place, the installation needs to be configured.

All configuration settings are defined in the [Technician's menu](#) (page 114).

General configuration procedure using a positioning beacon

- Open the technician's menu.
- Select **Infrastructure > Peripheral wires** and create the required number of wires for the installation.
- For each wire assign the channel number and check the reverse phase.
- Select **Infrastructure > Parcels**.
- Define the properties of the parcel that is associated with each wire.
- Create new parcels if necessary.
- If the installation is a multi-field installation, define the start zone parameters for a parcel.
- Select **Infrastructure > Stations**.
- Select **Start Discovery** to detect the station and positioning beacon.
- Select the station that has been found and set the required properties.
- Define a set of Access parameters for the station.
- If the installation is a mono-field installation, define the Start zone parameters for the station.

General configuration procedure using a station loop

- Open the technician's menu.
- Select **Infrastructure > Peripheral wires** and create the required number of wires for the installation.
- For each wire assign the channel number and check the reverse phase.
- Select **Infrastructure > Parcels**.
- Define the properties of the parcel that is associated with each wire.
- Create new parcels if necessary.
- If the installation is a multi-field installation, define the start zone parameters for a parcel.
- Select **Infrastructure > Stations**.
- Select **Create new station**.
- Select **Connected to parcels** and connect the station to the loop parcel.
- Select **Station Inside Parcel's Wire** and specify whether the station is on the inside or the outside of the station loop wire.

See also the examples:

- [Return to station with a station loop](#) (page 88).
- [Complex garden and with station loop](#) (page 90).
- [Mono-field with two start zones](#) (page 87)

7.7.2.1 Access parameters

Access parameters define how the robot enters and leaves the station.

Note: Access parameters only need to be defined if the robot is using a positioning beacon to return to the charging station.

Note: A set of access parameters must be defined for each station and each wire.

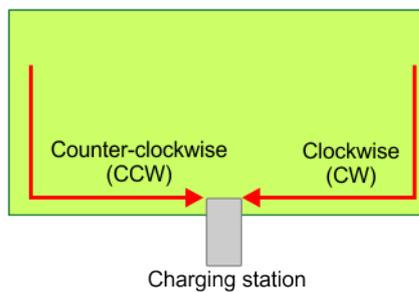
Wire

The id of the peripheral wire to which the parameters apply.

Direction

Defines the direction in which the robot will return to the station. This also represents a characteristic of the parameters set.

The Direction can be Clockwise (CW) or CounterClockWise (CCW).



Station entry min / Station entry max

These define the point at where the robot will leave the trackborder, turn through 90° (taking the loopstep) and move towards the wire. The robot will choose a random distance that lies between the minimum and maximum values.

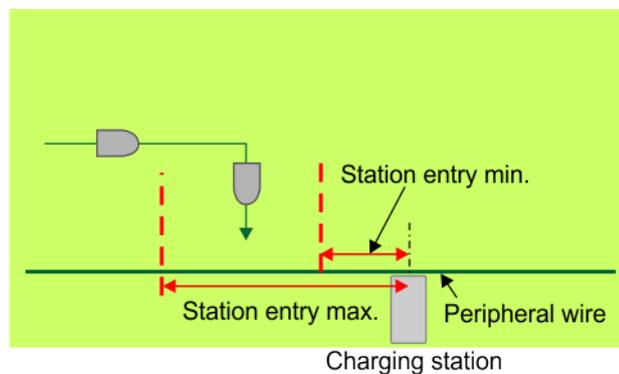


Figure 76: Minimum and Maximum Station entry distances

Dist. before alarm

This is the maximum distance that the robot should travel along the wire in the direction of the station before it issues an alarm. The value is set at 29m and in most cases this does not need to be modified. It may be necessary to modify this value if the positioning beacon is not located in the charging station.

Min exit dist. / Max exit dist.

This defines the distance the robot will travel along the wire before turning though 90° (taking the loopstep) and entering the track border. The robot will choose a random distance that lies between the minimum and maximum values.

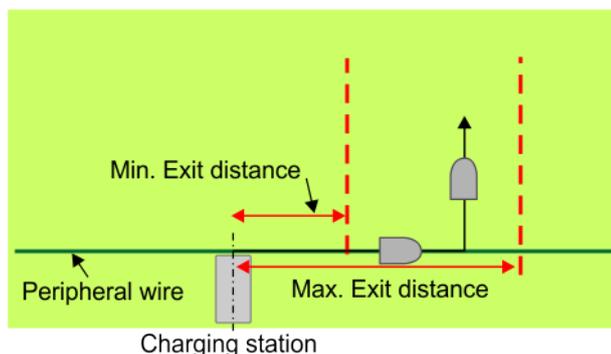


Figure 77: Minimum and Maximum Exit Distances

7.7.2.2 Start zones

Start zones define where and how the robot starts mowing.

- A start zone is defined for a *parcel*.
- A start zone can be defined for a *station that contains a positioning beacon*.
- Multiple start zones can be defined for the same wire/parcel. See [Mono-field with two start zones](#) (page 87).

The Start Zone screen displays the following.

List of defined start zones

For each one the line below shows some characteristics of the zone.

Create new start zone ►

Enables you to create a new zone with all the properties listed below.

Start zone properties

Following from

This option appears if you are defining a start zone for station with a positioning beacon. It specifies the parcel in which the start zone is implemented.

For a multi-field installation, you can specify the specific parcel.

Default means coming from any other parcel.

Coming from

This option appears if you are defining a start zone for parcel.

It defines the parcel *preceding* the one in which the start zone will be implemented.

Percentage

The proportion of times this start zone will be used.

Edit percentage ►

Allows you to edit the percentages applied to different parcels.

If only one parcel is defined this value must be set to 100%.

Do not edit the percentage until more than one start zone has been defined.

Direction ►

This specifies the direction the robot will take to move along the track border after having left the station. This can be Clockwise (CW) or CounterClockWise (CCW).

If the charging station has a positioning beacon, the robot tracks the wire, then takes the loopstep. (These parameters are defines in the [Access parameter set](#) (page 78)). It then takes the specified direction into the track border as shown in the figure below.

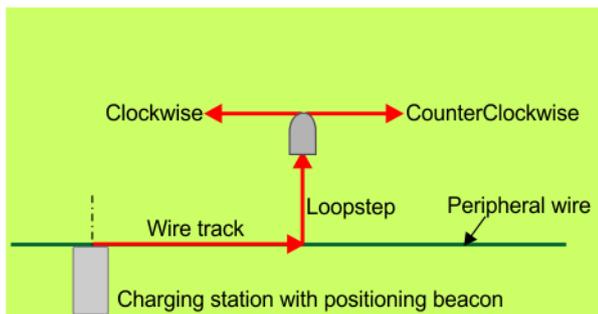
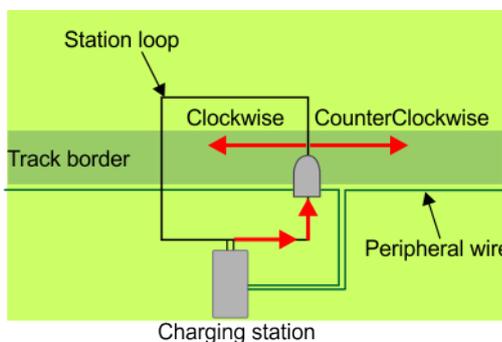


Figure 78: Start zone direction from station with positioning beacon

When the robot leaves the station, it follows the station loop until it for a pre-defined distance until it arrives in the track border of a mowing field. It then takes the specified direction.



Distance Min. / Distance Max.

This is the distance that the robot will travel along the track border after leaving the station before starting mowing. A random value between the minimum and maximum values will be selected.

If you don't want to set a starting zone, set the Distance Min. / Distance Max. values to 0. Distance Min. and Distance Max. are measured from:

- The charge station, if the start zone is located in the same parcel as the charging station as shown in [Figure 79: Minimum and Maximum Start zone distances measured from charging station](#) (page 81). This will be the case if the charging station contains a positioning beacon.
- The point where the robot enters the parcel, if this differs from the one in which the station is located. See [Figure 80: Minimum and Maximum Start zone distances from entry into parcel](#) (page 82).

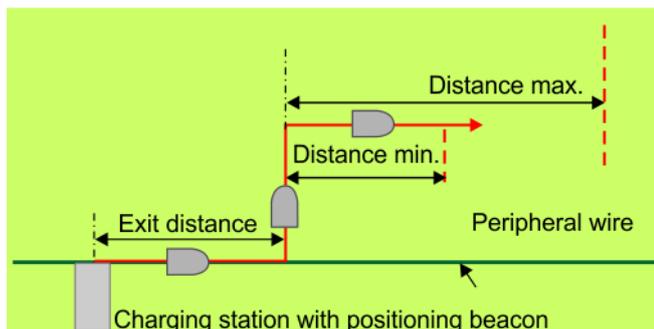


Figure 79: Minimum and Maximum Start zone distances measured from charging station

If the start zone is located in a different parcel than the one containing the charging station, the distances are measured from the entry point into the parcel. This is shown in the figure below.

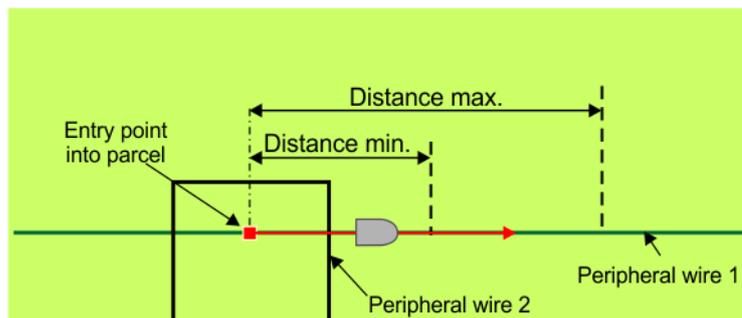


Figure 80: Minimum and Maximum Start zone distances from entry into parcel

Angle Min. / Angle Max.

The angle that the robot will turn through to take it into the field to start mowing. Minimum and maximum values are defined and the robot will choose a random value between the defined limits.

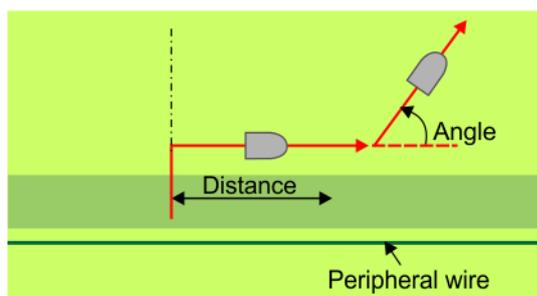


Figure 81: Start Zone Angle

Delete StartZone

Allows you to delete the start zone.

7.8 Installation examples

This section contains some useful examples of installations.

- [Football fields](#) (page 82).
- [Mono-field with two start zones](#) (page 87).
- [Return to station with a station loop](#) (page 88).
- [Complex garden and with station loop](#) (page 90).

7.8.1 Football fields

This section presents some good practice and examples of installations of the peripheral wire and charging stations for football fields.

7.8.1.1 Peripheral wire

Wire around the whole field

In the example shown below the peripheral wire surrounds the entire field. This configuration requires that the goal nets are lifted up before mowing.

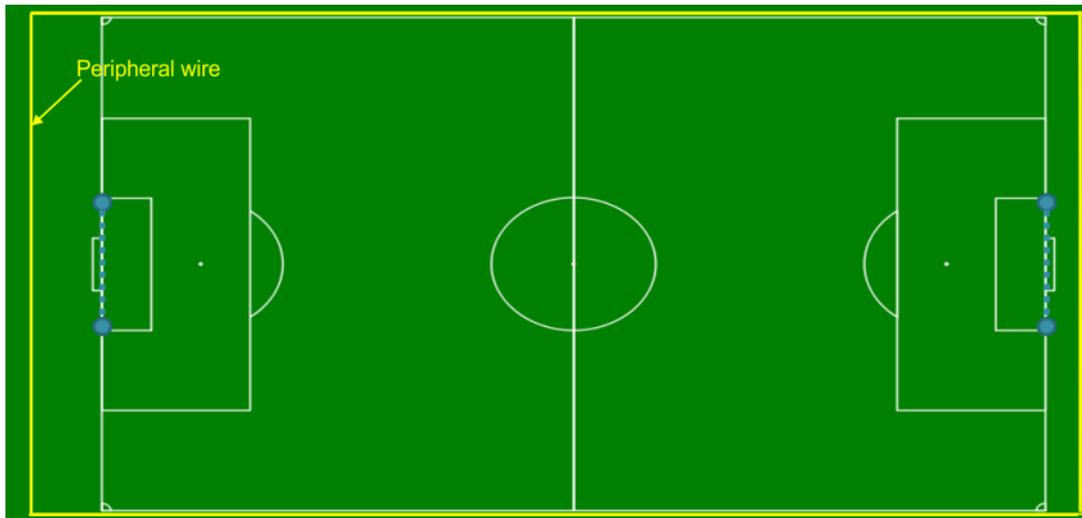


Figure 82: Wire around whole field

Peripheral wire in front of goals

In the example shown below, the peripheral wire loops in front of the goals. This means that the goal nets can remain in position whenever the robot is mowing.

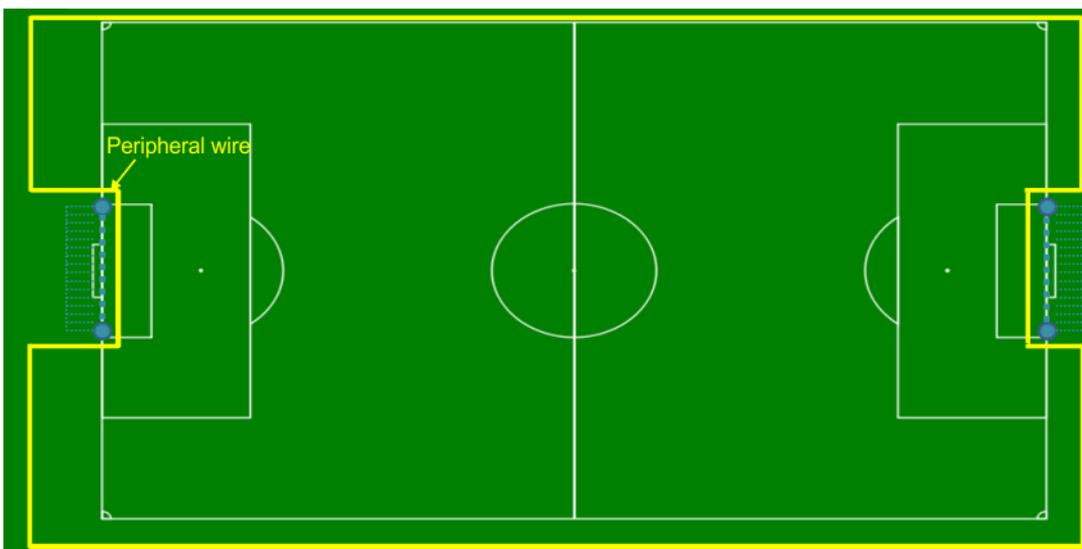


Figure 83: Peripheral wire in front of goals

7.8.1.2 Charging station beside the field without a handrail

In this case, the charging station can be installed at any suitable position.

Note: In this example it is assumed that the charging station contains a positioning beacon.

The return to the station will be S-shaped and can be clockwise or counter-clockwise.

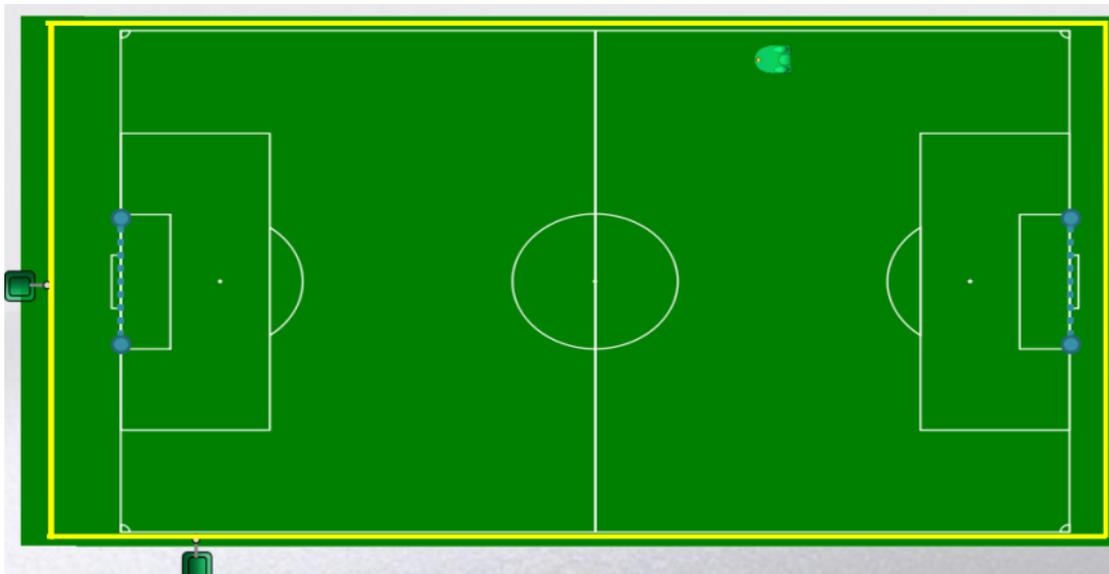


Figure 84: Charging station beside the field without a handrail

Configuration parameters

This example assumes the use of a positioning beacon.

The essential configuration parameters for this installation are given below. For details on all the configuration parameters see the [Technician's menu](#) (page 114).

1. Press **9** on the interface screen for a few seconds to obtain the technician's menu.
2. Select **Infrastructure > Peripheral wires**
3. On the "Wire Settings" screen, select the first entry in the list **Wire CH{X}**, the default wire. This is the only wire required. Rename it if required.
4. Select **Signal channel** and assign the channel number for the field as [set using the rotating switch in the charging station](#) (page 44).
5. Check the distance value shown in the title of the user screen. This should be *positive*. If it is not, select **Reverse phase** and check the button ON.
6. Press **X** twice to return to the Infrastructure menu.
7. Select **Parcels** and then select the parcel associated with the single wire.
8. Select **Use trackborder** and check the button ON.
9. Select **Return direction** and choose whether you want the robot to return in a clockwise or counterclockwise direction.
10. Press **X** to return to the Infrastructure menu.
11. Select **Stations** and select the station that is broadcasting the required ID (shown on the station sticker).
12. Select **Connected to parcels**. In this situation, the station must be attached to Wire1 Parcel 1.
13. Set the station entry distances. Select **Access param. > Station entry min/max**. Recommended values are 5m min and 10m max.

14. Set the station exit distances. Select **Access param. > Min / Max exit dist.** Recommended values are 5m min and 10m max.

7.8.1.3 Charging station behind panels/ fence

With positioning beacon

In this case the charging station is located behind the fence in a large enclosure. The figure below shows the layout of the peripheral wire and the route taken by the robot to enter and leave the station.

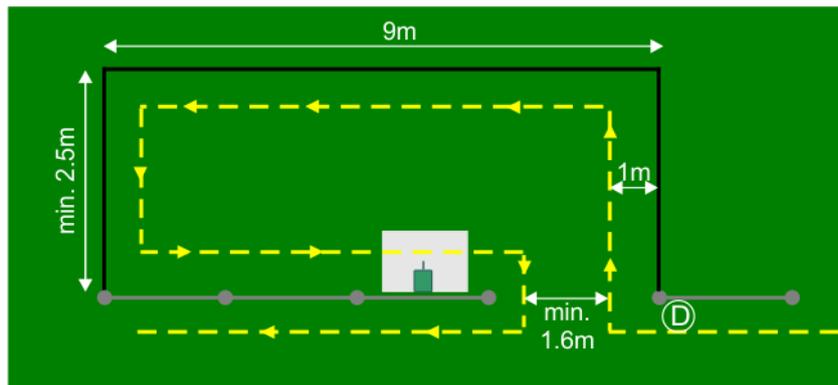


Figure 85: Charging station in large enclosure behind fence

The robot detects the charging station at point (D) and moves onto the wire. It then travels along the wire until it reaches the charging station.

Note: The maximum distance between the point (D) and charging station is 28m! If the distance is longer than this, the robot will stop and issue a "No contact" alarm.

The configuration is:

- S shaped return
- counter-clockwise return,
- the exit station parameters must be configured to comply with the conditions shown above.

With station loop

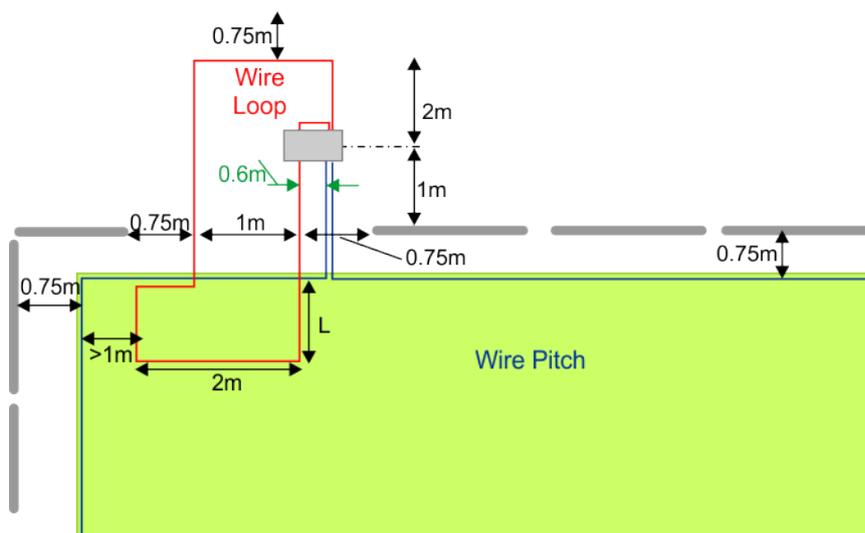


Figure 86: Charging station in behind fence with station loop

7.8.1.4 Charging station in an enclosure sheltered by the field fence

An illustration of this situation is shown in the figure below. The lower part of the fence has been cut to allow the robot to enter the enclosure. The entrance to the enclosure is narrow; being just the distance between two fence poles.



Figure 87: Charging station in narrow enclosure protected by the fence

The dimensions of such an enclosure are critical and are shown in the figure below. The robot must be able to enter the enclosure, dock at the charging station then turn around inside the enclosure in order to leave.

- Select **Infrastructure** > **Peripheral wires** > **Wire CH{X}**.
2. Set the signal channel.

Select **Signal channel**. Enter the number of the switch *set using the rotating switch in the charging station* (page 44).
 3. Check the distance value displayed at the top of the screen. This value should be *positive*. If it is not, select **Reverse phase** and check the button ON.
 4. Press **X** twice to return to the Infrastructure menu.
 5. Select **Parcels** and then select the parcel associated with the single wire.
 6. Select **Return direction** and choose whether you want the robot to return in a clockwise or counterclockwise direction.
 7. Enable the use of the trackborder. Select **Use trackborder** and select YES
 8. Press **X** to return to the Infrastructure menu.
 9. Select **Stations** and select the station that is broadcasting the required ID (shown on the station sticker).
 10. Specify the parcel where the station is located.

Select **Infrastructure** > **Stations** > **Station {ID}** > **Connected to parcel**. In this situation, the station must be attached to Field 1 Parcel 1.
 11. Set the station entry distances. Select **Access param.** > **Station entry min/max**. Recommended values are 5m min and 10m max.
 12. Set the station entry distances.

Select **Access param.** > **Station entry min/max**. Recommended values are 5m min and 10m max.
 13. Set the station exit distances. Select **Access param.** > **Min / Max exit dist**. Recommended values are 5m min and 10m max.
 14. Add Start zone 1. Select **StartZones** > **Create new start zone** .
 15. For the parameter **Following from** select "Default".
 16. For the **Direction** select CW (Clockwise).
 17. For the **Distance** select a value between 2m and 5m.
 18. Add Start zone 2. Select **StartZones** > **Create new start zone** .
 19. For the parameter **Following from** select "Default".
 20. For the **Direction** select CW (Clockwise).
 21. For the **Distance** select a value between 2m and 5m.
 22. Set values for **Angle min.** and **Angle min.** to ensure that the robot does not leave this area immediately.
 23. Select **Edit percentage** . Set the start zone percentage for start zone 1 to 80%. Set the start zone percentage for start zone 1 to 20%.

7.8.3 Return to station with a station loop

This example describes how to set up a special loop to return the robot to the station. When using this configuration it is not necessary to use a positioning beacon.

In this example

- there is just one wire that defines the area to be mowed; this wire is named "Lawn"
- the additional wire to return to the station is named "Loop".

The wire "Lawn" is configured for the robot to mow normally. When it returns to the charging station it will follow the trackborder until it reaches the station "Loop" wire. It will then follow the wire until it reaches the station.

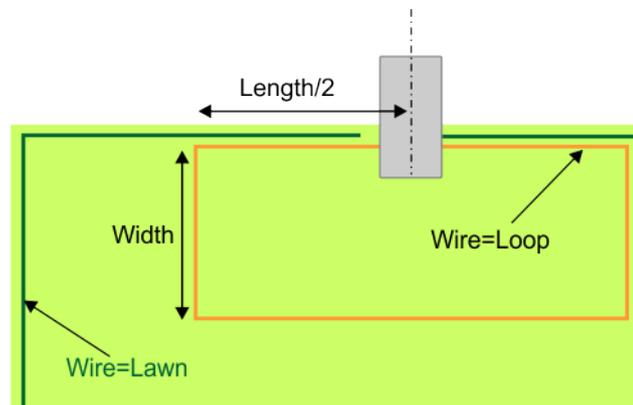


Figure 90: Dimensions of the station loop

- The distance between the station and the end of the station loop (**Length/2**) is **2.5m maximum**. The total length of the loop is **5m**.
- The **Width** of the loop is **Maximum track border width + 0.5m**
This therefor represents an absolute maximum width of **3.0m**
- The depth of the loop wire *within the field to be mowed* (D1) must be **0.25m**

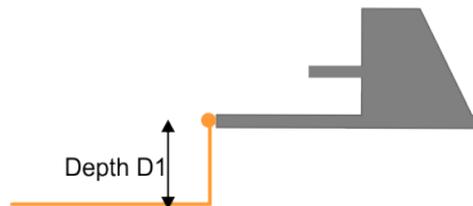


Figure 91: Depth of loop wire within the field to be mowed

- If the station is located *outside of the field* to be mowed, the depth of the loop wire (D2) can be a maximum depth of **0.07m**.

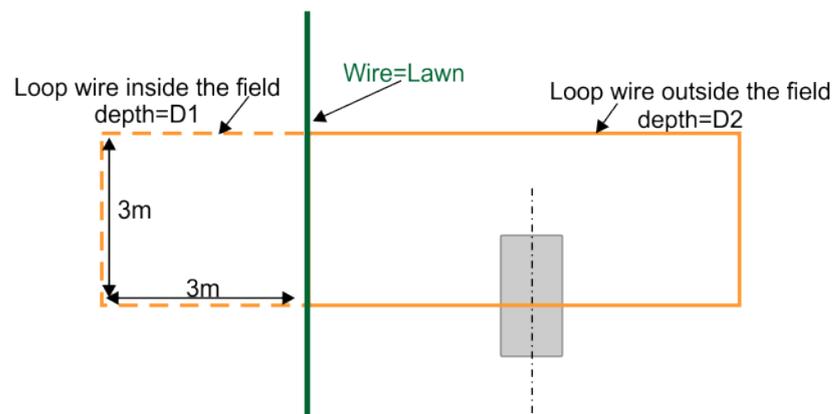


Figure 92: Depth of loop wire outside of the field to be mowed

When installing the wire for the "lawn" loop all the conditions described in [Installing the peripheral wire](#) (page 48) must be respected. This includes the conditions required for multi-fields.

Configuration

Configuration of this installation must be done using the menus. The instructions given below are the minimum set of configuration parameters that must be set for this type of installation. For information on all the configuration parameters available see the [Technician's menu](#) (page 114).

1. Press **9** on the interface screen for a few seconds to obtain the technician's menu.
2. Select **Infrastructure > Peripheral wires**
3. On the "Wire settings" screen, select the first entry in the list **Wire CH{X} ▶**.
4. Rename this Wire to **LOOP**.
5. Select **Signal channel** and assign the channel number for the station loop.
6. Check the value shown at the top of the screen. This should be *positive*. If it is not, select **Reverse phase** and check the button ON.
7. Press **✕** twice to return to the Infrastructure menu.
8. Select **Parcels** and then select the parcel associated with the LOOP wire.
9. Select **Return direction** and choose whether you want the robot to return in a clockwise or counterclockwise direction.
10. Disable the use of the trackborder. Select **Use trackborder** and check the button OFF. This ensures that when the robot is in this field, it will just follow the wire to reach the station.
11. Press **✕** twice to return to the Infrastructure menu.
12. Select **Create new wire ▶**.
13. Select the newly created wire and press .
14. Rename this field to **LAWN**.
15. Select **Signal channel** and assign the channel number for the large field to be mowed.
16. Check the value shown at the top of the screen. This should be *positive*. If it is not, select **Reverse phase** and check the button ON.
17. Press **✕** twice to return to the Infrastructure menu.
18. Select **Parcels** and then select the parcel associated with the LAWN wire.
19. Set the **Return direction** to the same as above.
20. Select **Use trackborder** and check the button ON. This ensures that when the robot is in this field, it will follow the trackborder until it reaches the LOOP field.
21. Select **Neighboring parcels ▶**. Check the button next to the LOOP parcel.
22. Press **✕** to exit this menu.
23. Select **Edit parcels percentage ▶**. Set the value to 100% for the lawn parcel.
24. Press **✕** to return to the Infrastructure menu.
25. Select **Infrastructure > Stations ▶ > Create new station ▶**.
26. A name is generated that you can modify if you want.
27. Select **Connected to parcels▶**. A list of parcels is presented. Select the parcel inside the LOOP wire and check the button ON.
28. Select **Station inside parcel's wire**. Check the button ON if the station is inside the LOOP wire. In the example shown above it is *outside* the wire.

7.8.4 Complex garden and with station loop

This example illustrates an installation using multi-fields in a complex garden arrangement with an additional loop to return the robot to the charging station.

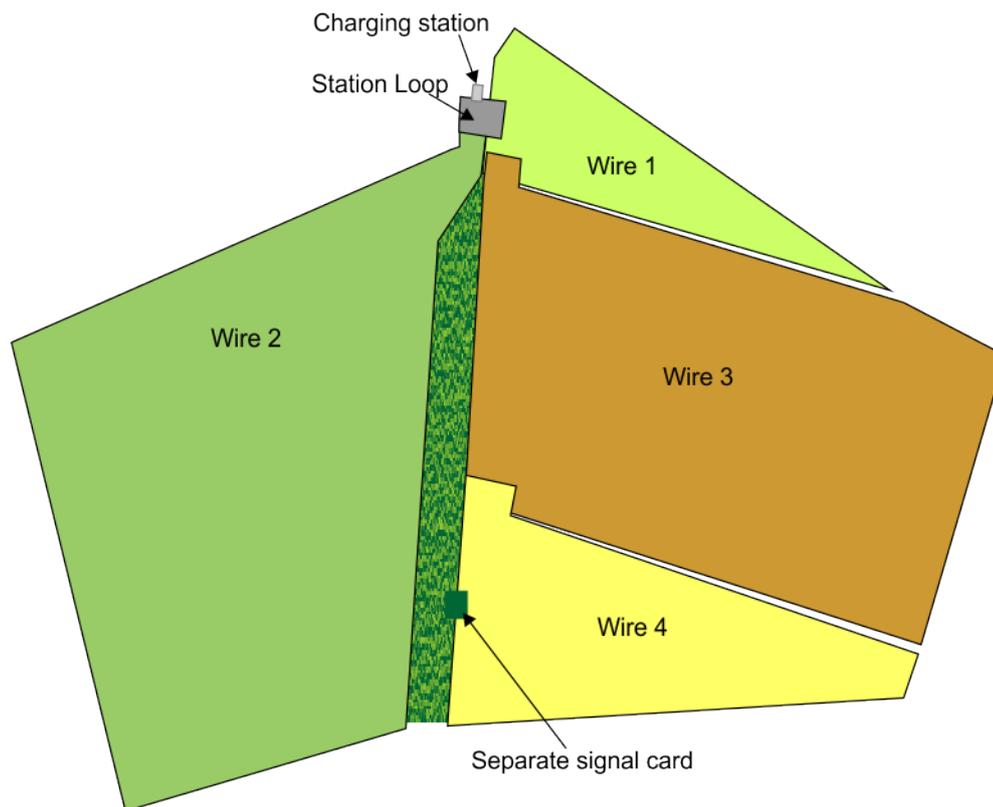


Figure 93: Multi-field installation for a complex garden

The details of this installation are listed below:

- The station is connected to a station return loop.
- The station return loop overlaps with Wire 1 and Wire 2.
- Wire 1 overlaps with Wire 3.
- Wire 3 overlaps with Wire 4.
- Wire 4 is a considerable distance from the charging station. To economize on the length of wire to return from this field to the charging station an additional box has been installed next to Wire 4 to house a signal channel board.

Configuration

The essential configuration parameters for this installation are given below.

For details on all the configuration parameters see the [Technician's menu](#) (page 114).

1. Press **9** on the interface screen for a few seconds to obtain the technician's menu.
2. Select **Infrastructure > Peripheral wires**.
3. On the "Wire settings" screen, select the first entry in the list **Wire CH{X}** ►.
4. Rename this Wire to **LOOP**.
5. Select **Signal channel** and assign the channel number for the small station loop.
6. Check the value shown at the top of the screen. This should be *positive*. If it is not, select **Reverse phase** and check the button ON.
7. Press **X** to return to the "Wire Settings" screen.
8. Select **Create new wire** ► and create four more wire (Wires 1-4). Assign the required channel number to each and check the phase value.
9. Press **X** to return to the Infrastructure menu.

10. Select **Parcels**.
11. Select the parcel associated with the LOOP wire.
12. Select **Use trackborder** and check the button OFF. This ensures that when the robot is in this field, it will just follow the wire to reach the station.
13. Select **Neighboring parcels ▶** and check the buttons next to Wire 1 and Wire 2.
14. Press **✕** to return to the Parcels list.
15. Select each of the other parcels in turn. In all of these cases set **Use trackborder** to ON.
16. For Wire 3 parcel, select **Neighboring parcels ▶** and check the button next to Wire 4.
17. Press **✕** to return to the Parcels list.
18. Select **Edit parcels percentage ▶**. Set the value for the LOOP parcel to 0%. Set the values for the other parcels as required based on the relative sizes of the fields.
19. Select the newly created field and press .
20. Press **✕** to return to the Infrastructure men.
21. Select **Stations ▶ > Create new station ▶**.
22. A name is generated which you can modify if required.
23. Select **Connected to parcels▶**. A list of parcels is presented. Select the parcel inside the LOOP field and check the button ON.
24. Select **Station inside parcel's wire**. Check the button ON if the station is inside the LOOP wire.

8 Using your robot

Before using the robot refer to the [Safety measures](#) (page 93).

There are a number of [security icons](#) (page 94) on the robot and it is important that you understand what each of them means and respect all of them.

To ensure optimal operation of your robot, it is important that it is [well maintained and serviced](#) (page 162).

[The user interface](#) (page 96) enables you to manage the operation of your robot.

8.1 Safety measures

 **Note:** Before starting your robot, check that the area to be mowed is free from obstacles such as toys, tools, garden waste, pebbles, ... These could damage your robot or cause a breakdown.



Slopes: Never leave your robot on a slope.



Charging the battery: The battery must always be charged *using the charging station*. Any other power source (car battery charger, ...) can cause damage and loss of warranty coverage. Never connect an external electrical element to the battery cable.



Sealed parts: Your robot contains components that are sensitive to electrostatic discharge. Do not attempt to access sealed parts.

 **Important:** If you notice unusual behavior or wear (cutting blades worn, missing screw or nut, defective cable, ...), stop the machine and contact an authorized technician.



 **Warning:** Always unplug the charging station before opening it.
In those situations where there is no plug, remove the fuse from the charging station.

 **Important:** when manipulating the robot or the charging station:

- Do not overreach yourself and keep your balance at all times.

- Take care of your footing on slopes.
- Always walk, never run.

Important: Always wear substantial footwear and long trousers while operating the machine.

Note: The operator or user is responsible for accidents or hazards occurring to other people or their property.

Note: Never pick up or carry the robot while the motor is running.

Note: Do not leave the machine to operate unattended if you know there are pets, children or people in the vicinity.

Note: Never operate the machine and/or its peripherals with defective guards or shields, or without safety devices.

Note: Avoid using the machine in bad weather conditions especially when there is a risk of lightning.

8.2 Safety notices

The symbols shown below appear on the machine.



Each of them is described below.

	<p>Warning: This automatic machine can be dangerous if misused. Warnings and safety instructions on the machine and described in this manual must be followed exactly to ensure its safe use.</p>
	<p>Instructions: Read this manual carefully before using this machine.</p> <p>Echo EU declines any responsibility if this machine is used by persons who are not familiar with how it works or with the contents of this manual.</p>

	<p>Handling the machine: <i>Never place hands or feet under or near the machine when it is operation.</i></p>
	<p>Stop the machine: Always stop the machine and wait for the cutting blades to stop before handling the machine.</p> <p>Operate the disabling device (ON/OFF switch) before working on or lifting the machine.</p>

	<p>Handling the machine: <i>Never place hands or feet under or near the machine when it is operation.</i></p>
	<p>Keep a safe distance: Always keep a safe distance from the machine when operating.</p>

	<p>Beware of projectiles: Keep a safe distance from the machine when it is operation. Clippings and other objects such as branches and pebbles that lie in the path of the machine may be ejected with force causing injury.</p>
	<p>Do not ride the machine: Do not ride on the machine. Never use the machine as a means of transportation. Do not stand or sit on the machine or load objects onto it or the charging station.</p>

	<p>Animals: Keep animals away from the robot when it is operating.</p>
	<p>Supervise children: This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.</p>

	<p>Water: Cleaning with water systems can cause damage.</p>
	<p>Gloves: Protective gloves must be worn when handling the robot, especially the cutting system.</p>

	<p>Keyboard: The robot is protected by an access PIN code.</p>
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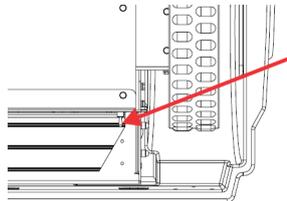
Lock: The robot is equipped with an anti-theft system.

8.3 The user interface

A smart box, which contains the on-board computer to manage the operations of your robot, is located under the Stop button lid.



Note: The robot needs to be switched ON before you can use any of the functions available from the interface.



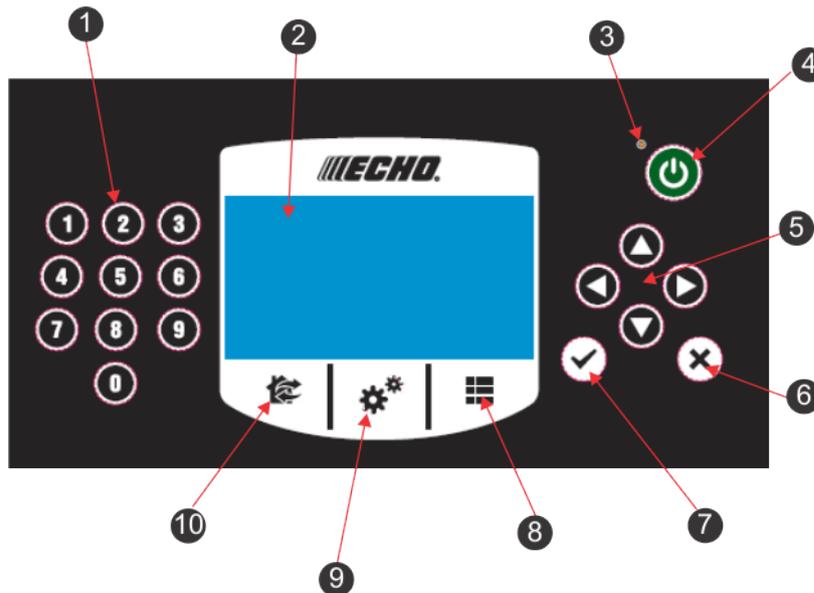


Figure 94: Components of the user interface

The configuration interface consists of the following components:

(1) The numeric buttons

These are used to select menu choices and enter numeric values.

(2) LED screen

Displays current situation. See [The LED screen](#) (page 98).

(3) LED

Light indicating that the user interface is switched ON.

(4) ON button

Switches the user interface on.

(5) The Navigation buttons

The arrow buttons allow you to highlight menu options.

(6) The Back button

Exits a menu and returns you to the previous level.

(7) The Accept button

Accepts an operation or setting.

(8) Service menu button

Provides a number of commands used most commonly by the service personnel. See [The Service Settings menu](#) (page 107)

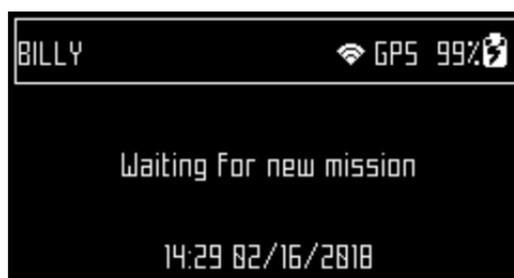
(9) Settings menu button

Allows you to define operational settings. See [The Settings menu](#) (page 100).

(10) Action menu button

Allows you to issue a number of operating instructions. See [The Actions menu](#) (page 99).

The LED screen



Name

The name of the robot. [To change the robot name](#) (page 111).

WiFi /Mobile connection

 indicates that the robot is connected as WiFi client. When it is blinking it is trying to connect. When it is steady, it is connected.

WiFi Access Point (AP)

 indicates that the robot is configured as WiFi access point and is waiting for a client to connect.

GPS

Indicates that the robot can detect at least 4 satellites and that it knows its current location.

If the GPS indication is blinking it indicates that the robot cannot detect enough satellites.

[To see the number of satellites detected](#) (page 111).

Battery charge level

Percentage of battery charge.

Message

Shows the current status of the robot or [error message](#) (page 130).

8.3.1 Using the interface

The user interface allows you to perform the following operations.

Operational

[To define a weekly mowing schedule](#) (page 101).

[To enable/disable specific cutting heads](#) (page 103).

[To set the number of times the border mode is used each week](#) (page 104).

[To adjust the cutting height of the blades](#) (page 105).

[To temporarily block the operation of the robot](#) (page 106). This is useful if the field area is in use during the time when the robot is scheduled to be mowing. The robot will remain inactive until the system is unblocked.

[To set the robot's maximum working speed.](#) (page 110).

[To set the robot's minimum operating temperature](#) (page 110).

Connectivity

[To set up the connectivity for the robot](#) (page 108)

[To connect the robot as a WiFi client](#) (page 110). This operation allows you to monitor the state of the robot and to upload new software.

[To setup the robot as a WiFi network Access Point.](#) (page 120)

Settings

[To set the time zone and the language used for the menus](#) (page 107).

[To change the name of the robot](#) (page 111).

[To view a number of characteristics of the robot](#) (page 111).

[To enable a PIN code](#) (page 112).

[To set up a secure anti-theft zone in which the robot can operate](#) (page 113).

8.3.2 The Actions menu

The operations provided in this menu depend on the current state of the machine.

- [when the robot is in the field](#) (page 99).
- [when the robot is at the charging station](#) (page 100).

Operations when the robot is in the field

These operations can be performed on the robot when it is *not* in the charging station.

 **Important:** Always stop the robot first by hitting the big red stop button.

These operations would be performed if the robot has been stopped during its normal operation schedule, or if it has stopped because an alarm has been raised. If an alarm has been raised, you need to correct the problem before executing the operations. See [Troubleshooting \(Error messages\)](#) (page 130).

1 Go charge

Return to the charging station, charge the battery and then resume mowing.

2 Charge & stay

Return to the charging station and stay there until a new instruction is issued.

3 Mow

Continue the mowing schedule after an interruption.

4 Border

Execute [border mode](#) (page 30) and then return to the charging station.

 **Note:** This option is only available for a single field installation with a positioning beacon.

To execute the operations

1. Click .
2. Press the up  and down  arrows to highlight the required command, or press the numeric key that appears in front of the command.
3. Press .
4. Close the lid.



Note: If the lid is not closed within 10 seconds, the operation is canceled and you will need to repeat this procedure.



Note: If the operation does not start even if the lid appears to be closed see [Correcting lid closure problems](#) (page 189).

Operations when the robot is at the charging station

Use these operations to override the regular operating schedule.

1 Mow now

Leave the charging station and continue mowing.

2 Mow after charge

Remain in the charging station until the battery is charged and then start mowing.

3 Stay in station after charge

Stay in the charging station until a new command is issued.

4 Border

Mow in [border mode](#) (page 30) and then return to the charging station.



Note: This option is only available for a single field installation with a positioning beacon.

4. Mow now on ...

Leave the charging station and continue mowing in a specific parcel. A list of parcel appears in which you can choose the required one.



Note: This option only appears for a multi-field installation.



To execute the operations

1. Click
2. Press the up and down arrows to highlight the required command, or press the numeric key that appears in front of the command.
3. Press .
4. Close the lid.



Note: If the lid is not closed within 10 seconds, the operation is canceled and you will need to repeat this procedure.



Note: If the operation does not start even if the lid appears to be closed see [Correcting lid closure problems](#) (page 189).

8.3.3 The Settings menu

These commands enable you to define settings that control the operation of the robot.

Schedule ►

Sets [the weekly mowing schedule](#) (page 101).

Cutting heads ▶

Enable/disable specific cutting heads (page 103).

Border ▶

Sets the *number of times the border mode is used each week* (page 104).

Note: This option is only available for a single field installation which uses a positioning beacon to locate the charging station.

Cutting height ▶

Adjusts *the cutting height of the blades* (page 105).

System locking ▶

Implements *a PIN code before a command can be executed* (page 106).

Schedule ▶

This command enables you define the times during the week when the robot will mow the grass.

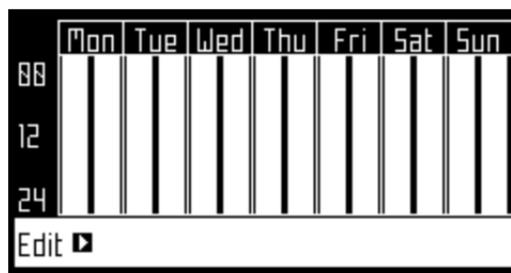
- A mowing schedule can be defined for each day of the week.
- A number of mowing periods can be defined for each day and each parcel.
- Each defined period can be active (implemented) or inactive (ignored).
- A schedule for one day, and for one parcel, can be copied to other days of the week.
- The complete schedule can be ignored and the robot set to work at all times.

To define a mowing schedule

Note: By default when the robot is delivered, the schedule is set to work continuously.

1. Press .
2. Press the up and down arrows to highlight **Schedule**, then press .

A screen like the one below will appear. In the example below, there are two columns for each day because there are two parcels that have been defined. This shows the current schedule, where the white blocks represent the time when the robot will be operating in one parcel.



Note: By default all the time periods will appear white, meaning the robot will work continuously.

3. Use the arrow keys to highlight **Edit** and press .

The following screen appears.



4. To edit the schedule, highlight the parcel and press .
5. Use the left and right arrows to select the required day of the week, then press .



6. Use the down arrows to select the required period in the day, and press .



7. Use the numeric keyboard to enter the start and end time values where the cursor is flashing then press .



8. Press the down arrow key to select the active check box.
 9. Press to activate the defined session.
- In the figure above, Period 1 is active, Period 2 is inactive.
10. Repeat the process for all the days and the time periods required.

Note: You can [copy the defined schedule to another day](#) (page 103).

11. Press **X** to return to the "Parcel Schedule" screen shown above.

- Use the arrows to select **Follow sched.**. Press to check the button ON to ensure that the robot follows the defined schedule. When unchecked, the robot will ignore the timetable and work continuously.

To copy the schedule from one day to another

- Follow the procedure above to define the mowing schedule for one day.
- When all the required periods have been defined, use the down key to highlight **Copy**. Press .

The following screen appears.

COPY						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
<input type="checkbox"/>						
1	2	3	4	5	6	7

- Press the number key that corresponds to *the day to which the schedule is to be copied*. More than one day can be selected.

COPY						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				
1	2	3	4	5	6	7

- Press .
- Press **X** to return to the overview of the schedule.

To ignore the mowing schedule

- Press .
- Highlight **Edit**.
- Press .
- Use the arrow keys to highlight **Follow sched.** and press to uncheck the button.

Cutting heads ►

The robot is supplied with 3 cutting heads which, under normal conditions, should all be used. When there is a problem with a cutting head, this menu allows you to disable it.

To enable/disable specific cutting heads

- Press .
- Press the up and down arrows to highlight **Cutting heads** and then press .

The following screen appears.



This figure indicates that all the cutting heads are enabled.

3. Press the number key(s) that corresponds to the cutting head(s) you wish to enable/disable.



Note: Pressing **0** on the numeric keypad will select all the cutting heads.

4. Press .
5. Press to return to the main menu.

Note: To enable a disabled cutting head, repeat the procedure above, selecting the disabled head.

Border ►

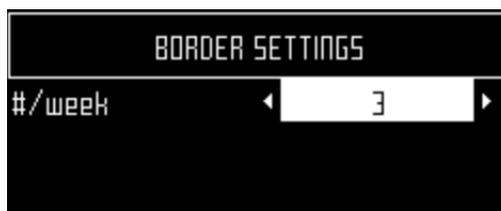
Sets the number of times the border mode is used each week. The border mode will be implemented at regular intervals during the week.

Note: This option is only available for a single field installation with a positioning beacon.

To set the number of border mode operations per week

1. Press .
2. Press the up and down arrows to highlight **Border** then press .

The following screen appears.



3. Use the left and right arrow keys to scroll to the required number of border modes per week.

4. Press
5. Press to return to the main menu.

Cutting height ►

This command sets the height of the blades. When using the robot for the first time in the season or after being switched off for several days, the grass may be too dense or too high. In this case it is recommended that you increase the mowing height for a few days before gradually reducing it again.

To set the cutting height

1. Press .
2. Press the up and down arrows to highlight **Cutting height** then press .

The following screen appears, which shows the current height at which the heads are set.



Note: If this value is negative, it implies that a reset of the parameters has taken place and that the blade height values need to be re-calibrated. See [The Service menu](#) (page 121).

3. Press the down arrow key to highlight the **Set** value.
4. Use the left and right arrow keys to scroll to the required value.



5. Press to set the new height.

The cutting heads will be raised or lowered. When the process is complete, the screen will reappear to show the updated cutting height.



6. Press to return to the main menu.

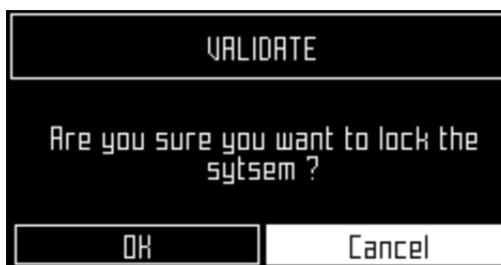
System locking ►

This command enables you to block the use of the robot. This is useful if the field area is in use during the time when the robot is scheduled to be mowing. The robot will remain inactive until the system is unblocked.

 **Note:** It is also possible to *enable a PIN code* (page 112) which must be entered before specific commands can be issued.

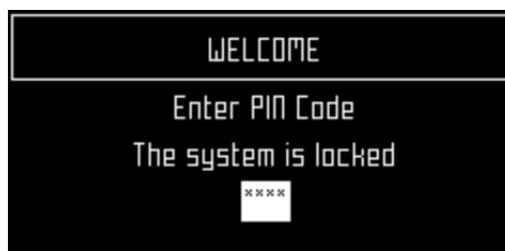
To lock the system

1. Press .
2. Press the up  and down  arrows to highlight **System locking** then press .



3. Highlight **OK** then press .

The following screen will appear and you will need to enter the robot's pin code in order to access the menus again.



To unlock the system

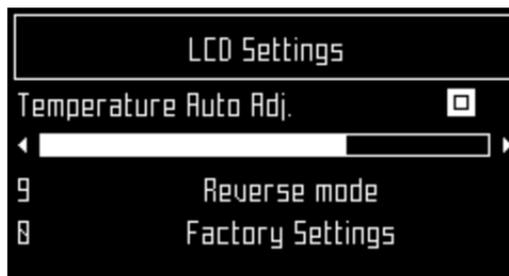
1. Enter the 4-digit PIN code.
2. Press .

The robot will then wait for a new command to be issued.

8.3.3.1 LCD settings

To modify the LCD settings

1. Press  for a few seconds.



2. Press the right and arrow buttons to change the contrast
3. Press the up and down arrows to highlight **Temperature Auto Adj.**. When this option is checked ON, the LCD contrast is automatically adjusted according to the ambient temperature. Press to check or uncheck this option.
4. Press the **9** key to invert the colors black and white.
5. Press the **0** key to revert to the factory settings.
6. Press **X** to exit this menu.

8.3.4 The Service Settings menu

This menu will be used primarily by service technicians.

Regional parameters ▶

Enables you [to set the time zone and the language used for the menus](#) (page 107).

Connections ▶

Enables you [to set up the connectivity for the robot](#) (page 108).

Operations ▶

Enables you [to set some operating conditions](#) (page 110).

Device ▶

This enables you [to define a name for the robot and to view a number of characteristics that relate to the robot](#) (page 110).

Security ▶

Enables you [to change or disable the PIN code and to set a "Geofence"](#) (page 112). A Geofence defines an area in which the robot can operate. If it moves outside of this area, a notification will be issued.

8.3.4.1 Regional parameters

This menu enables you to set the robot time zone and the language used in the menus.

Time zone

To set the time zone

1. Press .
2. Press the arrow keys to highlight **Regional parameters** then press .
3. Use the left and right arrow keys to scroll to the required time zone.



4. Press to accept the time zone.
5. Press **X** to exit the menu.

Language

To set the language

1. Press .
2. Press the arrow keys to highlight **Regional parameters** then press .
3. Press the down arrow to highlight **Language**.
4. Press .
5. Use the left and right arrow keys to highlight the required language.



6. Press to accept the language.
7. Press **X** to exit the menu.

8.3.4.2 Connections

You need to be able to connect with the robot for the following reasons:

- **To enable the robot to communicate with the portal on the web-server.** This allows you to monitor the state of the robot.
- **To update the robot software version.** The robot connects the remote server on a regular basis to check if a new software version is available. If there is, the robot starts to download it as a background task while it continues to work as usual. At the end of the next charging period, the newly downloaded software will have been installed on the robot.

See also [Mobile connection](#) (page 120)



IP address ▶

This displays the current IP address of the robot, depending on the mode in which the robot is operating.

Modes can be mobile, vpn, wifi (image01)

Mode

Allows you to set the mode in which the robot is to operate. This can be:

OFF

The robot will not be connected to a network.

Client

The robot will connect to the selected network *as a client* (page 110).

Access point

The robot will use its inbuilt modem to generate its own WiFi network to which you can connect.

Search for networks

This option appears when the robot is not connected or cannot detect a WiFi network.

SSID

This displays the name of the WiFi network to which the robot is connected, and allows you to modify it. Highlight `{network name}` and press .



A list of networks appears.

Entries in **bold** text are ones that the robot has connected to.

Entries in normal text are available but which have not been used.

[*] indicates the actual network to which the robot is connected.

[!] indicates that the network to which the robot is connected, is *not* encrypted using either WPA or WPA2 technologies. This is therefore an insecure network and the [!] indicates a warning.

[-] indicates that the network has been disabled.

To connect to a different known network (BelRobotics in the example above), highlight the network, press and select `Enable Network`.

To modify the current network, (BelRobotics Guest in the example above) highlight the network, press . The following operations are available

- `Disable Network`: disconnects the robot from this network. This will be indicated by [-] preceding the name of the network in the list.
- `Change Password`: allows you to modify the password to access the network *from this machine*.
- `Forget Network`: removes the recognition of this known network *from this robot*.

Using the robot as a client

For normal operation it is recommended that you set up the robot as a *WiFi client*. This will enable it to communicate with the portal on the web-server.

To set up the robot as a client

1. Press .
2. Highlight **Connections** and press .
3. Highlight **Mode** and set it to **Client**.

If the robot has not been connected to a WiFi network, selecting the option **Search for networks** will search for networks and present a list of those available.

4. Highlight the WiFi network required and press .
5. Enter the password for the network using the keyboard.
6. Highlight **v** and press .

8.3.4.3 Operations

This menu enables you to set a number of operating parameters: .

Min temp

Sets the lowest temperature that the robot will operate at.

 **Note:** Mowing at too low a temperature can damage the grass.

Edit parcels percentage ▶

This option enables you to view and modify the **percentage values** (page 201) assigned to each of the parcels that have been defined. The percentage value assigned to a parcel determines the proportion of times the robot will start mowing in the parcel.

To set the operating parameters

1. Press .
2. Press the arrow keys to highlight **Operations**, then press .
3. Use the up  and down  arrows to highlight the required parameter (see above).
4. Enter the required value.
5. Check the current values have been updated.
6. Press **x** to return to the main menu.

8.3.4.4 Device

This menu displays the characteristics of the device and enables you to change the robot's name.



Robot Name

By default the name of the robot corresponds to the serial number.

To change the name of the robot

1. Press .
2. Press the arrow keys to highlight **Device info** then press .
3. Highlight **Robot name** and press .
4. Highlight the back arrow to delete the current name.
5. Use the alpha-numeric keyboard to enter the new name. Highlight each character required and press  to select it.
6. Highlight **v** in the bottom row and press .
7. Press  to accept the new name.
8. Press  to return to the main menu.

Device info ▶

To see the device info

1. Press .
2. Press the arrow keys to highlight **Device** then press .
3. Highlight **Device info** and press .
4. Use the arrows ,  to scroll through the list.

Robot name

The name of the robot.

Serial number

Serial number of the robot.

Latitude

Current latitude of the robot position.

Longitude

Current longitude of the robot position.

Visible satellites

Number of satellites that the device can currently detect.

Lat [GF centre]

The current latitude of the centre of the [Geofence security zone](#) (page 113).

Long [GF centre]

The current longitude of the centre of the [Geofence security zone](#) (page 113).

Radius

Current radius of the [Geofence security zone](#) (page 113)

Dist. to beacon

Current distance in meters between the robot and the positioning beacon. A message is displayed if no positioning beacon is installed.

If this field displays "infinity", it means it is not able to detect the beacon.

Magnetic distance

The distance between the robot and the peripheral wire.

This value should be positive *when the robot is inside the peripheral wire loop*. If the distance is shown as a negative value, it is necessary to reverse the phase. See

Infrastructure > Peripheral wires > WireCH# from the [technician's menu](#) (page 114).

APN

Id. of the Access Point Network.

MAC address

MAC address.

System version ▶

To see the System version information

1. Press .
2. Press the arrow keys to highlight **Device** then press .
3. Highlight **System version** and press .
4. Use the arrows ,  to scroll through the list.

Version

Current software version in a human readable format.

Brain version

Current Artificial Intelligence (AI) version. Use this when reporting a problem.

System version

Current version of the system software. Use this when reporting a problem.

Software version

Current version of the application software. Use this when reporting a problem.

Bootloader ver.

Current bootloader version. Use this when reporting a problem.

8.3.4.5 Security

The security menu enables you to enable/disable the use of a PIN code and to define a security area in which the robot is allowed to operate.

 **Note:** By default the pin code is 0000. To obtain the menu below you need to enter 0000.

PIN code ▶

This enables you to define and implement a PIN code which must be entered before specific commands can be issued.



Enable pin code

Highlight the check box. Press to toggle the setting.

Enable PIN code OFF

Enable PIN code ON

Press to accept the new setting.

From now on certain commands will require the PIN code to be entered before they can be executed.

Change pin code

Allows you to change the pin code.

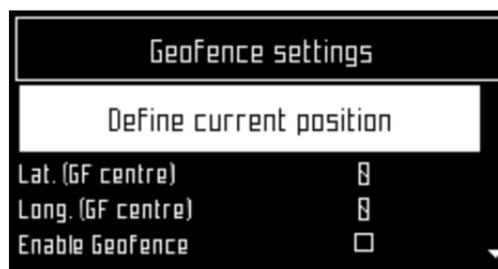
Enter the required numbers and press .

Geofence ►

A Geofence is a circular security zone in which the robot is allowed to operate. If the robot moves out of this area, a security notification will be issued. The circular area is defined by its center and a radius.

Note: This functionality is not fully supported in the current version.

The current location of the center point can be viewed in the [device settings menu](#) (page 110).



To define and implement a security zone

1. Move the robot to the required center of the security zone.
2. Press .
3. Press use the arrow keys to highlight **Security**, then press .
4. Press the arrow keys to highlight **Geofence** and press .
5. Highlight **Define current position**.

The latitude and longitude of the current position are displayed.

6. Use to highlight **Enable Geofence**.
7. Make sure this option is checked on. Use to toggle the setting.

8. Use  to highlight **Radius value**, then press .
9. Use the numeric keypad to enter the required value.
10. Press **X** to return to the main menu.

8.4 Technician's menu

To access this menu, press 9 for a number of seconds.

The following menus are provided:

1. [Infrastructure](#) ▶ (page 115)
2. [Installation wizard](#) ▶ (page 73).
3. [Mobile connection](#) ▶ (page 120) .
4. [Demonstration](#) ▶ (page 121).
5. [Service](#) ▶ (page 121).
6. [Advanced parameters](#) ▶ (page 128).

It also enables you to perform a [Factory reset](#) (page 114).

8.4.1 Factory reset

On occasions, when the robot is undergoing a maintenance or repair for example, it is necessary to remove all the current user settings so that valid testing can be implemented.

 **Note:** The method described here removes all the current configuration settings AND the current software version. To remove the configuration settings and **RETAIN** the current software version see [99 Reset Factory](#) (page 128) in the Service menu.

To perform a factory reset

1. The robot needs to be switched ON. If it is already on, switch it OFF, then ON again.
2. Switch the user interface ON (using the green on/off button).
3. Make sure that the robot's battery is fully charged.
4. Press the numbers **2 3 5 7**.

The reset process will begin and be indicated on the screen.



5. DO NOT switch the machine OFF until the process is complete.
6. Reset all the parameter values as required.

8.4.2 Infrastructure

The operations available from this menu are used to configure the robot's installation in the field.

See also: [Installation examples](#) (page 82)

- [Peripheral wires](#) ▶ (page 115)
- [Parcels](#) ▶ (page 116)
- [Stations](#) ▶ (page 118)

8.4.2.1 Peripheral wires

This schedules the "Wires Setting" screen.

Wire CH# ▶

A list of defined wires is presented, with the corresponding channel number. The list of parcels associated with the wire is listed below it.

Select a wire and press to see the [Wire properties](#) (page 115).

Create new wire ▶

Enables you to [Create a new wire](#) (page 116).

8.4.2.1.1 Wire properties

Wire id and magnetic distance



The identification of the wire in terms of the associated channel is displayed. In addition the current value and sign of the magnetic distance between the robot and the wire is indicated.

Signal channel

The signal (frequency) channel for the peripheral wire. This corresponds to the channel [set using the rotating switch in the charging station](#) (page 44). In the case of a multi-field installation, each wire used, must be assigned to a specific channel.

Reverse phase

The sign of the phase on the inside of the field is opposite to that on the outside. This is how the robot can detect whether it has crossed the peripheral wire. The phase should be *positive inside* the field.

You can see whether this is the case by examining the magnetic distance value shown at the top of the screen. If the value is positive the phase is correct. If it is negative you need to check this option to reverse the phase.

Delete Wire CH# ▶

This option only appears if there is more than one wire defined. It allows you to delete the current wire.



Note: At least one wire must be defined.

8.4.2.1.2 Create a new wire

To create a new wire

1. Select **Infrastructure > Peripheral wires > Create new wire**.
2. Select **OK** to confirm that you want to create the new wire.
3. The new wire and its associated parcel will appear in the wire settings list.
4. Select the new wire and click on .
5. Select the required channel number. This must correspond to value [set using the rotating switch in the charging station](#) (page 44).
6. Check the sign of the magnetic distance displayed at the top of the screen. If this value is negative, check the Reverse phase button ON.
7. Click **X** to exit the menu.

The newly created wire will appear in the Wire settings screen.

8.4.2.2 Parcels

The Parcels menu lists the defined channels and their associated parcels. There is, by default, one parcel associated with each wire.



For each parcel, the name and indication of the return direction is shown.

Selecting a parcel and pressing displays the list of parcel properties given below.

Edit parcels percentage

This allows you to view and set the percentage values for all parcels. The percentage value determines the proportion of time that the robot will start working in a parcel.

Parcel properties

Name

The current name of the parcel. This can be edited.

Return direction

Defines the *default* direction in which the robot returns to its station following the wire. This can be ClockWise or CounterClockWise.

The value of this parameter should be set to ensure that the robot can return to the station in the most efficient manner. This is most important if a problem has occurred and the robot does not know which parcel it is in.

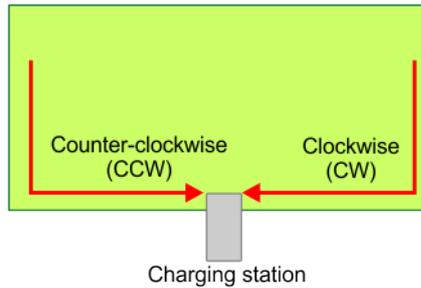


Figure 95: Return direction parameter



The current return direction is indicated in the list of parcels.

The figure below illustrates the advantage of setting different return directions in different parcels to facilitate the most efficient way for the robot to return to the charging station.

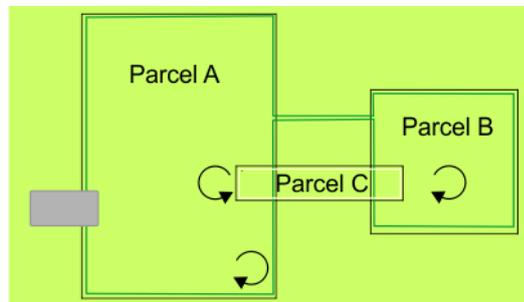


Figure 96: Parcel return directions

Use trackborder

This parameter defines whether the robot uses the **trackborder** (page 201) when leaving or returning to the station.

Note: This parameter value must be checked ON if the installation contains an island.

This parameter can be checked OFF in small loops/wires which are used just for the robot to return to the station. See [Return to station with a station loop](#) (page 88).

Trackbord. Min. / Trackbord. Max.

The minimum and maximum values allowed for the **track border** (page 201). The robot will select a random value between the defined values.

The maximum value for **Trackbord. Max.** is 3m.

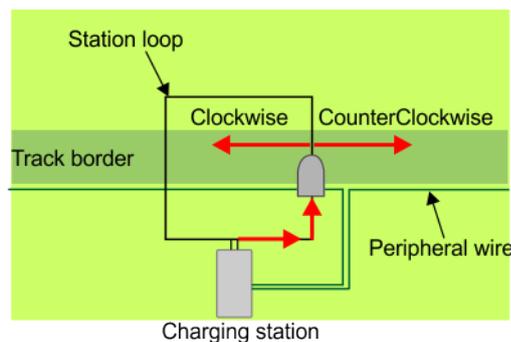


Figure 97: Minimum and Maximum trackborder values

Note: A general rule is that the maximum value of the track border = distance between the peripheral wires / 5m. If the distance between the wires is less than 15m, the maximum value of the track border must be accordingly reduced.

Min. Bounce Angle / Max. Bounce Angle

This is the angle through which the robot turns when it arrives at the peripheral wire. The range of values for this parameter is typically between 108° and 172°. (The minimum should be more than 90°.)

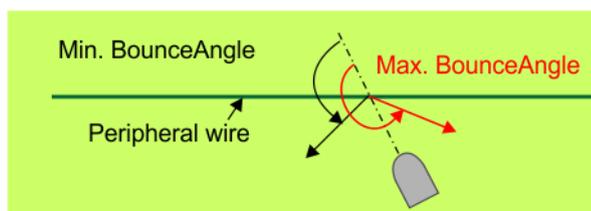


Figure 98: Bounce angle parameter

Perimeter

This defines a distance the robot will travel along the track border to return to the charging station. If the robot travels the {distance defined by this parameter}*1.5m and does not find the station, it will issue an alarm.

The recommended value of this parameter is the length of the peripheral wire around the field to be mowed. The default value is 1000m.

Neighboring parcels ▶

It is necessary to define how parcels are located relative to each other so that the robot can determine the route required to reach a particular parcel.

Two parcels are considered neighbors if they overlap. In the figure below:

- Parcel A is a neighbor of Parcel C
- Parcel C is a neighbor of Parcel B.

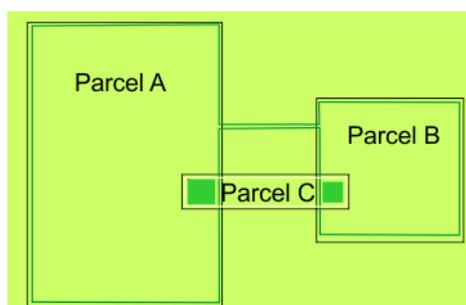


Figure 99: Neighboring parcels

In the example above, select Parcel C and then check the buttons next to Parcel A and Parcel B.

StartZones

Enables you to define [Start zones](#) (page 80).

8.4.2.3 Stations

The "Paired Stations" screen appears.

Existing stations ►

If stations have already been defined a list of them is presented.

For stations associated with a positioning beacon, selecting the station enables you to view the [properties of the station](#) (page 119) and to configure the way that the robot enters and leaves the station.

For stations that do not contain a positioning beacon, selecting a station enables you to view and edit the properties of the station. These are the same as those used in [creating the station](#) (page 119).

Start discovery ►

Starts a search for stations in the locality. This only applies if the stations have a positioning beacon.

When the process is complete, a list of known stations is presented.

Create new station ►

Allows you to manually [create a new station](#) (page 119).

This procedure is required to define a station that does not use a positioning beacon.

8.4.2.3.1 Create new station

For an installation that does not use a positioning beacon, the charging station must be defined manually. The following parameters must be defined.

Charge

This parameter defines whether the station is used to charge the robot or not.

Connected to parcels ►

This defines which of the defined parcels the station is connected to. For a multi-field installation a list of defined parcels will be presented and button next to the required one must be checked ON.



Note: This parameter *must be defined for a multi-field installation*.

Station Inside Parcel's Wire ►

This specifies whether the station is located inside or outside of the peripheral wire loop.

If the station is *inside* the loop, check the button ON.

Delete ►

Allows you to remove the manually created station from the installation.

8.4.2.3.2 Station properties



Note: The station properties listed here refer only to those stations that are associated with a positioning beacon.

Station properties include details of a station and the positioning beacon. This menu also allows you to specify **Access parameters**, which determine how the robot will enter and leave the station, and **Start Zones**, which are the points at which the robot start mowing after leaving the station.

Serial number

The serial number of the station. This will be retrieved as part of the search for the station.

Distance

Displays the distance between the robot and the selected station.

Charge

Defines whether the station is used to charge the robot or not.

Software version

The current version of the software for the station.

Connected to parcels ▶

This defines to which of the defined parcels the station is connected. For a multi-field installation a list of defined parcels will be presented and button next to the required one must be checked ON.



Note: This parameter *must be defined for a multi-field installation*.

Station inside Parcel's wire

This specifies whether the station is located inside or outside of the peripheral wire loop. If the station is *inside* the loop, check the button ON.

Access param. ▶

This menu displays a list of the defined sets of [access parameters](#) (page 78) and enables you to create a new set. Access parameters define how the robot will enter and leave the station.

Start Zones ▶

This menu displays a list of the defined [start zones](#) (page 80) and enables you to create a new one. Start zones define where the robot will start mowing after it has left the station.



Note: A start zone defined here is only used for a installation that contains a single wire and a positioning beacon.

8.4.3 Mobile connection

In the absence of a wireless network, the robot contains a SIM card that enables you to use 2G or 3G technology in the field.

Select the **Mobile connection** in the list and press

Status ▶**Status**

Displays the current mobile network status. The values of the status can be

- Connected
- Disconnected
- Roaming (if the robot is in a country other than the one associated with the SIM card).

Network

Displays the name of the current network operator.

Clicking on ▶ will initiate a scan of the networks. This may be worth doing if the Status is "Roaming". It will enable you to find and select another network operator.

Network Carrier

Displays the name of the current network carrier.

APN

Displays the current id of the Access Point Name of the SIM card.

Click on ► to edit the name. The alphanumeric keyboard is scheduled from which you can delete the current id and enter a new one. Select each character in turn, press "V", then press to accept it.



Note: There follows a list of parameter values relating to the signal strength and quality and the identification of the SIM card, the robot, the network carrier and the antenna. This information should be communicated to Echo EU if there are problems with the mobile connection.

8.4.4 Demonstration

This allows you to operate the robot in demonstration mode; i.e. before the peripheral wire has been installed.

Check the option ON.

Confirm you want to ignore the peripheral wire.



Important: The robot should not be left in Demonstration mode.

8.4.5 Service

The Service menu contains the following entries:

- [Calibrations](#) (page 121)
- [Information](#) (page 122)
- [Tests](#) (page 122)
- [Software update](#) (page 128)
- [99 Reset Factory](#) (page 128)

8.4.5.1 Calibrations ►

Cutting heads ►

This allows you to calibrate the rotational speed of the cutting heads.

1. If you have modified or installed a new cutting head, select **Calibrate now ►** and press .
2. Close the lid.
3. The cutting heads will be rotated and the rotational speed evaluated.
4. When you hear a beep, you can open the lid and view the results.
5. If any of the heads display a NOK value that is not in line with the others, you will need to examine the heads and see if there is any sort of blockage that is preventing the head from rotating normally.

Cutting height ►

The cutting height values need to be calibrated if

- erroneous values (negative) values are displayed,

- a cutting head has been replaced,
- the belt lifting the cutting heads has been modified or replaced.

During the calibration procedure the cutting heads are lifted until they reach their maximum height. Their position during this movement is termed the "raw position" and when the maximum height is reached, it is termed the "homing position" and assigned a scalar value. When the homing position has been reached, the cutting heads can be lowered to the required height.

1. To calibrate the cutting height select **Calibrate now ▶** and press .
2. The robot will move the cutting heads up to the maximum height. The cutting heads will then be lowered to the required height.
3. When the value is OK, you can set the required cutting height.
4. If there is a problem you need to examine the cutting heads and see if there is anything blocking the movement over the complete range.

8.4.5.2 Information ▶

Total distance

This is the total distance traveled by the robot to date. This information is used to decide when maintenance is required.

Bumper resistance

Displays the current value of the bumper resistance. This should lie in the range 82-94k-ohms.

8.4.5.3 Tests ▶

This menu enables you to execute tests on a number of components. These tests will be carried out before the robot is delivered to a customer and at the end of a regular service.

To execute a test

1. Use the down arrow  to select the test(s) you want to execute.
2. Press to select the test.
3. Repeat this for all tests required.
4. Select **Start** and press .
5. The robot will start executing each of the selected tests. Follow the instructions given on the screen.

Charge

This test checks

- if the robot can detect a charge
- if the received charging current is sufficient.

When this option is selected, the following information is displayed.

X/Y CHARGE_LR

X represents the current test in the current sequence.

Y represents the total number of tests to be performed in the current sequence.

Charge_LR is the name of the current test.

Detect

This displays whether the robot can detect a voltage on the left and right sides.

KO means it *can not* detect a voltage on the left or right side. OK means that it *can* detect a voltage.

Current

This displays whether a sufficient charge current can be detected (>7A).

KO means it *can not* detect sufficient charge current on the left or right side. OK means that it *can* detect sufficient charge current.

[value]

The current on the connected side.

Discharge required for current test

You will see this message if the current battery level is above 95%. It is best to perform this test when the battery charge level is lower.

To test the charge

1. Connect one side of the robot to the charging station.
2. The result will be displayed.
3. Repeat this for the other side.

If the results of the test are KO, check the connections between the robot and the charge station arms.

Bumper

This test checks that the electrical resistance of the bumper is within the correct range and that it responds to pressure from an obstacle.

The following information is shown.

X/Y BUMPER SENSORS

X represents the current test in the current sequence.

Y represents the total number of tests to be performed in the current sequence.

BUMPER SENSORS is the name of the current test.

Activate sensors

The sides of the bumper that need to be tested by activating. (Bumper Left Bumper Right)

Disable Sensors

The sides of the bumper that need to be disabled (Bumper Left Bumper Right)

To test the Bumper

1. Check that Bumper Left Bumper Right are listed below **Activate sensors**.
2. If these are listed under **Disable Sensors**, remove any constrictions that are compressing the bumper.
3. Press your hand against the bumper on the one left or right of the bumper.
4. If the resistance is modified sufficiently the item will be remove from the list.
5. Repeat this process on the other side of the bumper.
6. If an item remains in the list, the bumper is not functioning correctly and needs to be *replaced* (page 189).

Smartbox

This test checks all the functionality of the user interface panel.

To test the Smartbox

1. Follow each of the instructions as they appear on the screen.
2. Press to answer Yes to a question and **X** to answer NO.
3. If the item being tested is operating correctly it will disappear from the list.

If there is a problem with any of the items, the Smartbox should be replaced.

Lift Sensors

This checks whether each of the lift sensors is responding correctly.

X/Y LIFT_SENSORS

X represents the current test in the current sequence.

Y represents the total number of tests to be performed in the current sequence.

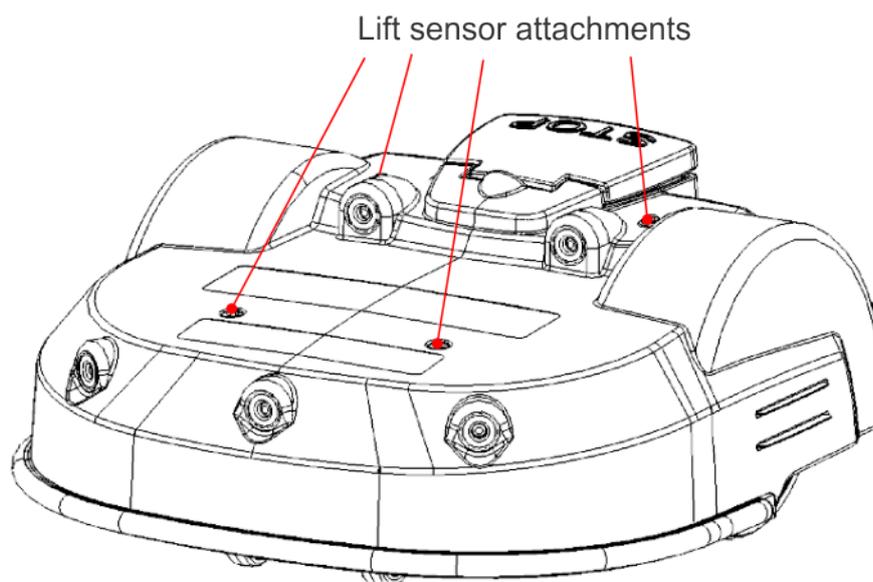
LIFT_SENSORS is the name of the current test.

Activate sensors

The lift sensors that need to be tested by activating by lifting. (Lift1 Lift2 Lift3 Lift4)

Disable Sensors

The lift sensors that need to be disabled by depressing them. (Lift1 Lift2 Lift3 Lift4)



To test the Lift Sensors

1. Check which Lift sensors are listed below **Activate sensors**.
2. Lift each of sensors in turn.
3. If the lift sensor is operating correctly, the item will be remove from the list.
4. Repeat for the remaining lift sensors.
5. If there are sensors listed under **Disable Sensors**, push down on the lift sensor to deactivate it.
6. When all the items have been removed from the list the test is complete.
7. Any items that remain in the list are not functioning correctly and need to be replaced.

Backwards Sensors

This checks that the backwards sensors are operating correctly.

The following information is shown.

X/Y BACK_SENSORS

X represents the current test in the current sequence.

Y represents the total number of tests to be performed in the current sequence.

BACK_SENSORS is the name of the current test.

Activate sensors

The number of sensors that need to be tested by activating them. (CollisionLeft CollisionRight)

Disable Sensors

The number of sensors that need to de-activated. (CollisionLeft CollisionRight)

To test the Backwards Sensors

1. Check that CollisionLeft and CollisionRight are listed below **Activate sensors**.
2. If these are listed under **Disable Sensors**, remove any constrictions activating them.
3. Push the body of the robot backwards on one side so that it moves relative to the chassis.
4. If the backward sensor on this side is functioning correctly it will be removed from the list.
5. Repeat this on the other side.
6. If an item remains in the list, the backward sensor is not functioning correctly. Visually inspect it to see if there is a constriction that is impeding its function. If not, replace it if necessary.

Signal Sensors

This checks the functionality of the coil that is used to detect a signal on a peripheral wire.

The following information is shown.

X/Y COILO_CENTER

X represents the current test in the current sequence.

Y represents the total number of tests to be performed in the current sequence.

COILO_CENTER is the name of the current test.

Detecting wire < {value}

{value} is the value of the "track value". If the result of the test is less than this value, the test is successful.

CH{A}:{result value}

If the test result is greater than the defined "track value", it will be listed here.

Move the robot closer to the signal wire detected. When the value is less than the "track value", the item should be removed from the list.

If the robot is close to the wire and the displayed values are high (900 or more) it is an indication that the coil connections are not good.

Drive Motor

This checks the function of the drive motor. It checks

- that the motor drives the wheel *forward* at 0.1m/s
- that a current of 2.5A is delivered to the motor.

To test the Drive Motor

1. Press to start the test.

2. Close the lid when requested.
3. The robot will move forward a short distance then stop and beep.
4. Open the lid.
5. If the robot moved forward, answer Yes to the question by clicking .
6. If the robot moved backwards answer No to the question by clicking . If this is the case, reverse the connections on the drive motor cable.

If the robot did not move, or only one wheel moved, the test will fail, and the report will indicate the problem.

1. Visually inspect the drive motors to see if there is a blockage.
2. Check the fuse and the cabling for the drive motors.

Cutting Motor

This test rotates each of the cutting heads and verifies that their rotational speed is correct. See [Cutting heads](#) (page 121).

If any of the heads display a NOK value that is not in line with the others, you will need to examine those heads and see if there is any sort of blockage that is preventing it from rotating normally.

Sonars System

This performs a test to verify that the sonar sensors are operating correctly.

If any of the sonar sensors are found to be defective, they need to be [replaced](#) (page 189). An indication of which sensor needs to be replaced is given.

Lid

In order for the robot to be able to execute its missions the lid needs to be shut, and to form a closed circuit between magnets on the lid and relays on the body. This circuit needs to be open when the lid is open *and* when the lid is pressed down and acts as the stop button. This requires that all magnets and relays are functioning correctly and some precision in their positioning. For a fuller description of the setup for the magnets and relays see [Correcting lid closure problems](#) (page 189).

This test checks the functioning and the positioning of the magnets and relays. In order to this, you need to have three gauges available with thicknesses of 15mm, 9mm and 2mm respectively.

To test the Lid

1. Follow the instructions given on the screen.
2. When requested, place the required gauge between the lid and the body and close the lid. The figure below shows the placement of the 15mm gauge.



3. When the 2mm gauge is in place, close the lid and press down gently to ensure that the lid is touching the gauge.

At the end of the test, if the test failed, the problems are indicated through the following messages:

- NO is stuck (open reed) - side + "reed 1S normally open of the body is stuck! Replace It."
The reed that is Normally Open (NO) on the indicated side must be *replaced* (page 190).
- NC not triggered (press reed) - side + "magnet must be lower. Add spacer.

The relay that is Normally Closed (NC) on the indicated side is not touching the magnet when the lid is closed. The NC relay is the lower one. You need to add a spacer behind the magnet on the indicated side and run the test again.

- NC too early (press reed) - side + "magnet must be higher. Remove spacer on it or add spacer between body and reed relay

The relay that is Normally Closed (NC) on the indicated side is being activated too early because the magnet is too low. The NC relay is the lower one. You need to either remove any spacer behind the magnet, or adjust the position of the relay.

- NO not magnetized soon enough(open reed) - side + "magnet must be lower. Add spacer between magnet and lid

Contact between the Normally Open (NO) relay on the indicated side is not being made because the magnet is too high. The NO relay is the upper one. You need to add a spacer between the magnet and the lid to lower it, and then run the test again.

- NO and NC not magnetized (dual error) - side + "add spacer under magnet or remove spacer between body and reed relay.

Neither of the relays on the indicated side are making contact with the magnet. You need to adjust the position of the magnet and/or the relays by adding or removing spacers.

- NC Is stuck (press reed) - side + "reed 4S (normally close) of the body is stuck or magnet is lost/defective! Replace It.

Check if the magnet on the indicated side is broken or missing and *replace it* (page 191) if necessary. If the magnet is OK, *replace the relays* (page 190).

- NO and NC reverse placement - side + "reed relays inverted? 4S (normally close) smartbox side (DOWN) and 1S (normally open) cover state (UP).

The relays have been installed in the wrong order.

- Relay NO (Normally Open) must be placed on the top. This relay is indicated by the digit 1 in the reference number on the relay.
- Relay NC (Normally Closed) must be placed on the bottom. This relay is indicated by the digit 4 in the reference number on the relay.
- Kit must be replaced - side + "replace the reed relays on the body"

The [relay kit](#) (page 190), including four relays and their cables must be replaced.

8.4.5.4 Software update ▶

This menu enables you to perform a software update. The current software version is displayed.

Select **Update now ▶** and press . The robot will contact the server, download and then install the latest software version.

8.4.5.5 99 Reset Factory

This performs a factory reset of all the robot configuration parameters.



Note: This operation removes all the configuration parameters but **RETAINS** the current software version. To remove all the configuration parameters **AND** the current software version see [Factory reset](#) (page 114).

8.4.6 Technician settings Advanced parameters

Max speed

Sets the maximum speed at which the robot will to move.

The maximum allowable speed of the robot is 1m/s (3.6km/h).

Wire crossing distance

Sets the distance the robot will move when it crosses the peripheral wire, before turning back into the field again.

The default value is 0.2m. This distance represents the distance between the front of the robot and the position of the coil that detects the presence of the wire.



Note: The values of [Distances between the peripheral wire and boundary of the area to be mowed](#) (page 50) are based on the use of a wire crossing distance of 0.2m.

Min temp

Sets the lowest temperature that the robot will operate at.



Note: Mowing at too low a temperature can damage the grass.

8.5 Advanced parameters

A screen displaying advanced parameters can be viewed by pressing **0** for several seconds on the keyboard.

Wire CH#

A list of currently defined peripheral wires. For each wire the following is displayed:

- the current magnetic distance between the robot and the wire.
- An indication of the shape of the pulse emitted on this signal channel, or whether a this channel is connected.

Station {id}

The current distance between the robot and the positioning beacon.

9 Troubleshooting (Error messages)

An alphabetical list of error messages.

- [Bad battery connection](#) (page 131)
- [Bad battery measure](#) (page 132)
- [Battery over voltage](#) (page 131)
- [Battery temperature issue](#) (page 131)
- [BMS communication wire is not connected](#) (page 132)
- [Cannot start MotorMow If we are in Alarm/Safety. Check navigation.](#) (page 145)
- [Collision too close to station \({X}m\)](#) (page 143)
- [Collisions at start-up: {0}](#) (page 143)
- [Did not find the zone due to collision \({0}\)](#) (page 145)
- [DMA Error, on sonars : {0}](#) (page 144)
- [Failed to consistently re-enter the zone](#) (page 140)
- [Failed to dock to station](#) (page 138)
- [Head {0} did not start!](#) (page 138)
- [Head {0} is blocked!](#) (page 138)
- [Lift\(X\) Detected - Front/Rear Left/Right](#) (page 142)
- [LongCollision \({0}\) event detected](#) (page 144)
- [ManualTask shall not complete: MotorDrive is in safety.](#) (page 145)
- [Motor blocked when going {0} to {1}mm](#) (page 139)
- [No charge current; Check contacts and charging station](#) (page 134)
- [No peripheral signal!](#) (page 135)
- [No positioning beacon detected](#) (page 133)
- [No station contact detected](#) (page 135)
- [No station found in any field](#) (page 136)
- [Noise on bumper](#) (page 142)
- [SelfTest failed to clear within 15s](#) (page 140)
- [Shutdown in 2min / inhibit shutdown principal / unblock brakes](#) (page 133)
- [Some wires not well configured. Please add at least one parcel to each wire](#) (page 134)
- [Sonars issue detected](#) (page 143)
- [Station contact lost for {0}s!](#) (page 134)
- [Station not found while doing border](#) (page 137)
- [Still in collision \({0}\)!alarm](#) (page 144)
- [STOP button issue detected](#) (page 139)
- [The {L/R} fuse is blown or the {L/R} motor is not connected.](#) (page 140)
- [The robot has no wire to mow. Please configure at least one wire.](#) (page 134)
- [The robot has no parcel to mow. Please configure least one parcel.](#) (page 135)
- [The wire is currently configured to be ignored.](#) (page 145)
- [Too many repetitive collisions!](#) (page 142)
- [Unable to find the working area](#) (page 137)
- [Unexpected exit zone event](#) (page 139)
- [Unhandled exit zone !](#) (page 140)
- [Unhandled collision event !](#) (page 143)

- *Unlock system : bad pin code* (page 137)
- *Wait for 5 Seconds of full contact* (page 141)
- *Wait for no collision* (page 145)
- *Waiting for signal* (page 141)
- *Waiting for station contact* (page 141)
- *Wire Lost during TrackWire !* (page 136)
- *Wrong wire and parcels Configuration.* (page 135)

9.1 Battery

9.1.1 Battery temperature issue

Scenario

Occurs when the battery temperature is above or below the allowed limit.

Symptoms / Observations

The robot remains at the charging station.

Solution

Wait for the temperature of the battery to return to normal.

9.1.2 Battery over voltage

Scenario

Occurs when one, or more, battery cell voltage is over the limit.

Solution

Take a photo of the GUI screen and report the problem to your dealer. (Note the date, time and robot S/N).

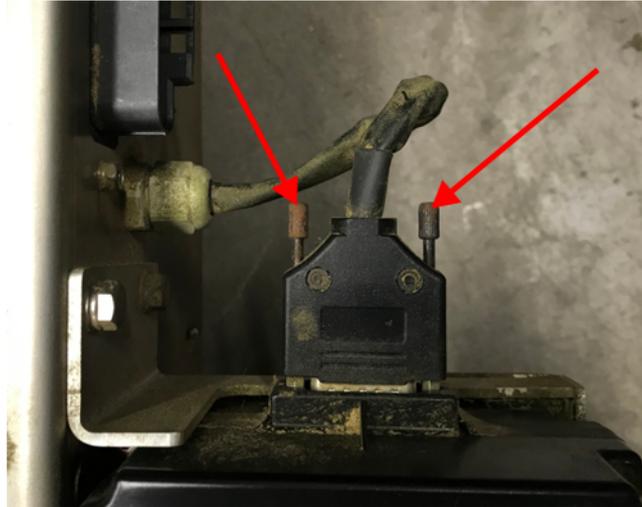
9.1.3 Bad battery connection

Scenario

Internal problem with the battery.

Solution

Either: Check that the black battery cable is a plugged in correctly,



Check that the screws indicated are properly tight.

Or: Change the battery.

9.1.4 Bad battery measure

Scenario

Occurs when the values displayed for the battery on the GUI screen do not correspond to the actual values.

Solution

1. Take a photo of the GUI screen and report the problem to your dealer. (Note the date, time and robot S/N).
2. Change the battery.

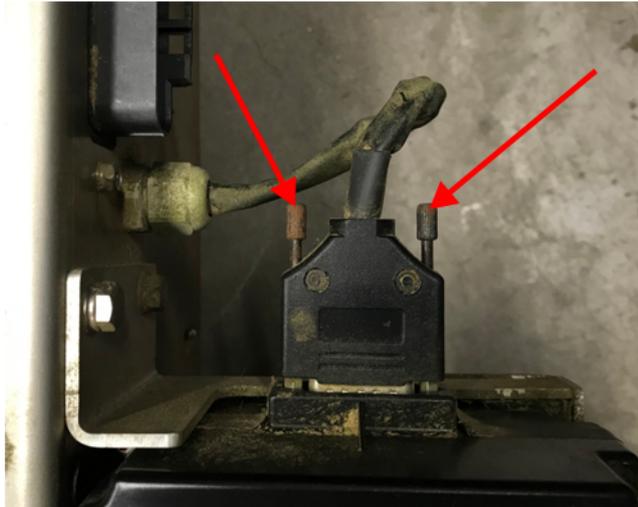
9.1.5 BMS communication wire is not connected

Scenario

Occurs when the BMS (Battery Management System) wire is not connected properly. This refers to the electronic part of the battery.

Solution

1. Check battery connection, i.e. that the screws indicated in the picture below are properly tightened.



2. Take a photo of the GUI screen and report the problem to your dealer. (Note the date, time and robot S/N).

9.1.6 Shutdown in 2min / inhibit shutdown principal / unblock brakes

Symptoms / Observations

- The GUI screen displays the alarm- and asks if you want to inhibit the shutdown,
- The LED is blinking very fast (~5x/s)
- The brakes are deactivated.

Meaning / Reason

Battery charge level is critically low.

Solution

1. Press to inhibit the shutdown.
2. Push the robot to the charging station.



Note: DO NOT send the machine to station on its own, it will stop again

9.2 Installation

9.2.1 No positioning beacon detected

Scenario

Occurs when the robot has been instructed to search for a station (containing a positioning beacon), and it fails to find one.

Solution

1. Check that the robot is close to a positioning beacon (less than 3m away).
2. Check there is no obstacle between the robot and the positioning beacon.
3. Check that the positioning beacon is powered up.

4. Check that the installation of the peripheral wire is correct.

If all of the above conditions are met, and the robot still fails to detect the positioning beacon, consider installing a "return to station loop". See [Installing multi-fields](#) (page 60).

9.2.2 Station contact lost for {0}s!

Scenario

Occurs when the robot has reached the station and started to charge, but at a certain time the station contact is lost. If the contact loss lasts for more than 1h, this alarm is triggered.

Solution

1. Check station power supply.
2. Check DC voltage on station arms (should be 32V)
3. Check that the charging station is correctly grounded.

9.2.3 Some wires not well configured. Please add at least one parcel to each wire

Scenario

Occurs when the configuration of wires and parcels is incorrect.

Meaning / Reason

At least one wire must be defined in the installation configuration, and at least one parcel must be assigned to each wire.

Solution

Check the installation configuration. See [Configuration using the menus](#) (page 78).

9.2.4 No charge current; Check contacts and charging station

Scenario

Occurs when the station voltage is detected but there is no supply current.

Solution

1. Check station power supply.
2. Check DC voltage on station arms. This should be 32V.
3. Check whether the temperature is too low.



Note: The charge current can be tested using the [Technician's menu](#) (page 114).
Select **Service > Tests**

9.2.5 The robot has no wire to mow. Please configure at least one wire.

Scenario

Occurs when no wire has been configured.

Meaning / Reason

At least one wire, defining a field to be mowed, must be configured.

Solution

Check the installation configuration settings. See [Configuration using the menus](#) (page 78).

9.2.6 The robot has no parcel to mow. Please configure at least one parcel.

Scenario

Occurs when no parcel has been configured. At least one wire must be configured defining a field to mow, and a parcel must be defined for each wire.

Solution

Check the installation configuration settings. See [Configuration using the menus](#) (page 78).

9.2.7 No peripheral signal!

Scenario

Occurs when the robot is unable to detect a valid magnetic signal.

Meaning / Reason

This can occur for a number of reasons which can be identified using the procedure outlined below.

Solution

1. Check that the robot is located *inside* the peripheral wire.
2. Check that the charging station is powered up.
3. Check all peripheral wire connections.
4. Check the integrity of the peripheral wire using a multi-meter.

9.2.8 Wrong wire and parcels Configuration.

Scenario

Occurs when the robot has encountered a problem while mowing in a particular parcel. When the robot re-starts it is not sure in which parcel it is located, and where it should start mowing.

Solution

1. Click .
2. Select **4. Mow now on ...** and select a parcel for the robot to mow in.

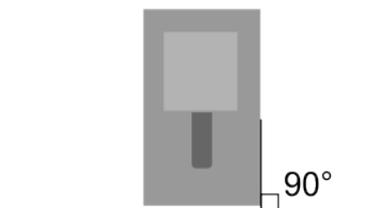
9.2.9 No station contact detected

Scenario

Occur if a positioning beacon is used to locate the charging station. If the robot has executed the loopstep (so has detected the positioning beacon signal), but has not made contact with the charge arms after 29m (by default), this error message will be shown.

Solution

1. Check there is no obstacle between the point where the robot performed the loopstep and the station.
2. Check the charging station power supply.
3. Check the DC voltage on station arms (should be 32V).
4. Check station alignment to the wire. The charging station arms should be approximately at right angles to the direction of the peripheral wire.



5. Check and clean the contacts.

9.2.10 No station found in any field

Scenario

Occurs if a positioning beacon is being used to locate the station. If the robot has passed through all the parcels but is unable to detect the station (positioning signal beacon) this error message is shown.

Solution

1. Check that the positioning beacon is powered up.
To do this, remove the charging station cover and check that the LED is blinking on the positioning beacon card.
2. Check that there is no obstacle on the path between the robot and the positioning beacon.

9.2.11 Wire Lost during TrackWire !

Scenario

Occurs when the robot is following the trackwire and is then unable to detect a signal on the wire. When this happens the robot will rotated through 360° in an attempt to detect a phase difference, and then issue this message.

Solution

1. Check station power supply.
2. Check peripheral wire connections.
3. Check peripheral wire integrity using a multi-meter.

9.3 Interface

9.3.1 Unlock system : bad pin code

Scenario

"System blocking" is set and must be unblocked by entering a pin code. An incorrect code has been entered.

Solution

Enter the correct code. If this is not known, contact technical support.

9.4 Operational

9.4.1 Unable to find the working area

Scenario

Occurs when the robot is unable to find a valid magnetic signal.

Solution

1. Check that the robot is located inside the peripheral wire.
2. Check that the charging station power is on.
3. Check peripheral wire connections
4. Check peripheral wire integrity using a multi-meter.

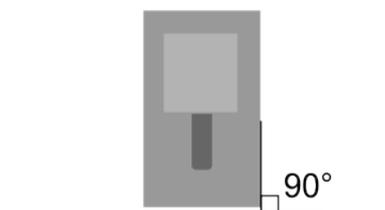
9.4.2 Station not found while doing border

Scenario

Occurs when the robot is trimming the borders. In border mode, the machine follows its wire, then touches the charging arm. This message is displayed when the robot failed to find the charging station. This only occurs if a positioning beacon is being used to locate the charging station.

Solution

1. Check there is no obstacle along the border next to the station (This is typically surrounding vegetation.)
2. Check station power supply.
3. Check DC voltage on station arms (should be 32V).
4. Check station alignment to the wire. The charging station arms should be approximately at right angles to the direction of the peripheral wire.



5. Check and clean contacts.

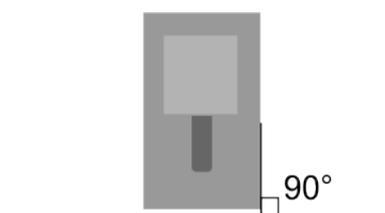
9.4.3 Failed to dock to station

Scenario

The machine has tried to return to station but failed.

Solution

1. Check there is no obstacle next to the station.
2. Check station power supply.
3. Check DC voltage on station arms (should be 32V).
4. Check station alignment to the wire. The charging station arms should be approximately at right angles to the direction of the peripheral wire.



9.4.4 Head {0} is blocked!

Head {0} is blocked!

Scenario

Occurs when a cutting head should be spinning, but is not.

Meaning / Reason

The cutting head is dirty or blocked.

Solution

Visually inspect and clean the cutting heads.



Note: The cutting heads can be tested and calibrated using the [Technician's menu](#) (page 114). Select **Service > Tests > Cutting motor**.

9.4.5 Head {0} did not start!

Scenario

Occurs when a cutting head should be spinning but it does not start.

Meaning / Reason

Cutting head is not operating properly.

Solution

1. Visually inspect the cutting heads.
2. Clean the cutting head.
3. [Recalibrate the cutting motor](#) (page 121).
4. Check and replace if necessary:
 - the fuse
 - the cable
 - the cutting drive card

- the motor

9.4.6 Motor blocked when going {0} to {1}mm

Scenario

Occurs after a command to change the cutting height has been issued, but the cutting head can not move.

Meaning / Reason

The motor lifting the cutting head is not working.

Solution

1. Remove the cover on the motor.
2. Clean the lifting band.
3. Inspect the lifting motor.
4. Check the magnet and pulley.

9.4.7 STOP button issue detected

Scenario

Occurs when the Stop button is not operating correctly. The Stop button must be closed when the robot is operating.

Meaning / Reason

The Stop button is determined to be closed by detecting a closed circuit between magnets on the lid and relays in the body. If these magnets are and relays are not connecting correctly the correct state of the lid can not be determined. This can arise due to wide temperature fluctuations.

Solution

See [Correcting lid closure problems](#) (page 189).

9.4.8 Unexpected exit zone event

Scenario

Occurs when the robot did not exit from the station correctly, possibly turning in the wrong direction.

Meaning / Reason

This can arise because:

- there is problem with the configuration of the robot,
- obstacles are impeding the exit from the station.

Solution

1. If a "return to station" loop is being used, check that the robot is turning in the correct direction in order to enter the station. The direction is set as a configuration parameter in the [Technician's menu](#) (page 114) . **Infrastructure > Parcels**. If the phase on the loop circuit is incorrect, the robot will turn in the wrong direction to enter and exit the station.
2. Check the area around the charging station and remove any obstacles.
3. If this does not rectify the situation, take photos/videos of the robot's behavior and report the event to your dealer. (Note the date, time and robot serial number.

9.4.9 The {L/R} fuse is blown or the {L/R} motor is not connected.

Scenario

Occurs if the robot can not detect any current in either the Left or the Right wheel motor.

Meaning / Reason

Either a fuse or a connection is faulty.

Solution

1. Check the fuse and replace if necessary.
2. Check all the cable connections.

9.4.10 Failed to consistently re-enter the zone

Scenario

Occurs after the robot has crossed the peripheral wire, but is not able to re-enter the field where it is mowing.

Reason

Possible reasons are:

- loss of signal,
- the robot is physically unable to re-enter the field because of mud or obstacles.

Solution

1. Check the signal on the peripheral wire.
2. Check that there are no obstacles near the robot,
3. Check that the robot is not sliding due to mud. If this is the case, stop the robot's activities and rectify the situation.

9.4.11 SelfTest failed to clear within 15s

Scenario

When the robot starts up, it executes a self-test of a range of functions. This error occurs if a failure occurred on any of the functions tested.

Solution

The same series of tests can be performed using the **Service > Test** menu from the [Technician's menu](#) (page 114). This can provide additional information about the function that failed.

9.4.12 Unhandled exit zone !

Scenario

Occurs when a problem arises as the robot exits the station.

Meaning / Reason

Software error.

Solution

1. If a "return to station" loop is being used, check that the robot is turning in the correct direction in order to enter the station. The direction is set as a configuration

parameter in the *Technician's menu* (page 114) . **Infrastructure > Parcels**. If the phase on the loop circuit is incorrect, the robot will turn in the wrong direction to enter and exit the station.

2. Check the area around the charging station and remove any obstacles.
3. If this does not rectify the situation, take photos/videos of the robot's behavior and report the event to your dealer. (Note the date, time and robot serial number.)

9.4.13 Waiting for station contact

Scenario

Occurs when the robot is in the charging station and it loses contact. It will wait one hour before generating the alarm.

Reasons

- Contact with the charging station arm has been lost.
- There is insufficient voltage on the arms to charge the robot.

Solution

1. Check station power supply.
2. Check the DC voltage on station arms, which should be 32V.
3. Check and clean the contacts.

9.4.14 Wait for 5 Seconds of full contact

Scenario

As the robot docks in the charging station, it waits 5 seconds to verify that contact is made.

Reason

This message appears if the Stop cover is opened during these 5seconds.

Solution

Close the lid and allow the 5seconds to pass before opening the lid again to issue a command.

9.4.15 Waiting for signal

Scenario

Occurs if the signal on the peripheral wire is lost. The robot will for a period of 12h and then start again - if the signal has been restored. This message appears if the lid is opened during the 12h period.

Reason

There is no signal on the peripheral wire.

Solution

1. Check the robot is located inside the field.
2. Check station power supply.
3. Check peripheral wire connections.
4. Check peripheral wire integrity using a multi-meter.

9.5 Obstacles

9.5.1 Noise on bumper

Scenario

Occurs when the electrical (background) noise level on the bumper is high enough to impair the proper operation.

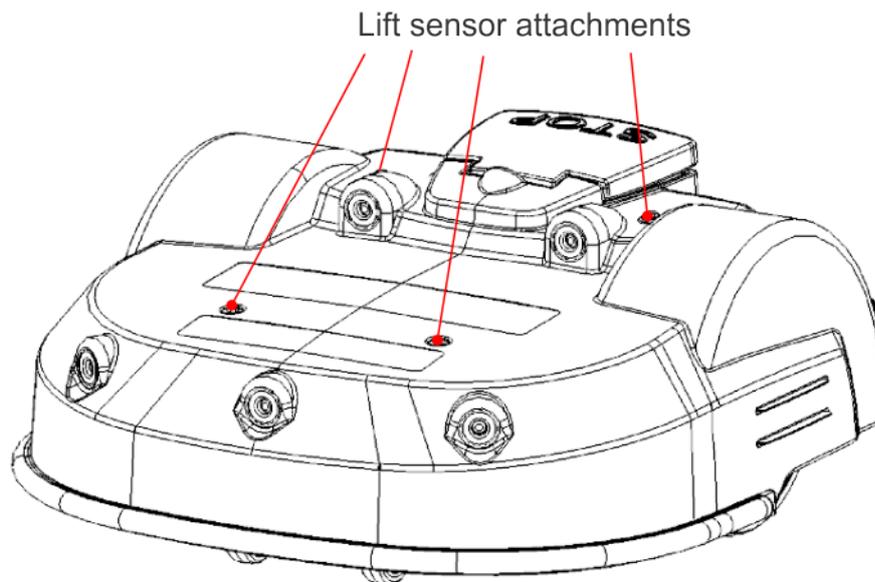
Solution

This only occurs when the robot is at the charging station. Check that the station is properly grounded.

9.5.2 Lift(X) Detected - Front/Rear Left/Right

Scenario

Occurs when a body lift is detected.



Meaning / Reason

An obstacle has caused the body to be lifted.

Solution

1. Remove the obstacle.
2. Clean the lift.
3. Check the magnet.

9.5.3 Too many repetitive collisions!

Scenario

Occurs when a series of repetitive collisions is detected.

Meaning / Reason

Too many obstacles.

Solution

1. Remove the obstacles.
2. If this error continues to appear, re-consider the installation and create islands/pseudo islands around the obstacles. See [Dealing with obstacles](#) (page 52).

9.5.4 Unhandled collision event !

Scenario

Occurs when the robot has encountered small obstacles .

Meaning / Reason

The robot has detected small obstacles in the mowing field, which are not large enough to trigger the operation of the lift sensors.

Solution

Check the ground at the point where the error was generated and remove any small obstacles.

9.5.5 Sonars issue detected

Meaning / Reason

Occurs when one of the sonar sensors is malfunctioning.

Solution

Change the sonar.

Sonar sensors can be checked using the [Technician's menu](#) (page 114). Select **Service > Tests > Sonars system**.

9.5.6 Collisions at start-up: {0}

Scenario

The machine can not resolve a collision at start up.

Meaning / Reason

There is an obstacle blocking the machine start up.

Solution

1. Remove obstacles.
2. Push the machine into an obstacle-free area.
3. If a "return to station" loop is being used, check that the robot is turning in the correct direction in order to enter the station. The direction is set as a configuration parameter in the [Technician's menu](#) (page 114) . **Infrastructure > Parcels**. If the phase on the loop circuit is incorrect, the robot will turn in the wrong direction to enter and exit the station.

9.5.7 Collision too close to station ({X}m)

Scenario

Occurs when the robot is leaving the charging station. The robot encountered an obstacle (at {X}meters from the charging station), but was unable to move around it because it was too close to the charge arms.

Meaning / Reason

Obstacle too close to the charging station.

Solution

1. Remove any obstacles
2. If a "return to station" loop is being used, check that the robot is turning in the correct direction in order to enter the station. The direction is set as a configuration parameter in the [Technician's menu](#) (page 114) . **Infrastructure > Parcels**. If the phase on the loop circuit is incorrect, the robot will turn in the wrong direction to enter and exit the station.
3. Consider moving the station to another location if obstacles cannot be moved.

9.5.8 DMA Error, on sonars : {0}

Scenario

Occurs when there is a hardware error in the sonar control system.

Solution

Change the defective sonar.

Sonar sensors can be checked using the [Technician's menu](#) (page 114). Select **Service > Tests > Sonars system**.

9.5.9 LongCollision ({0}) event detected

Scenario

Occurs when either a lift or a backwards sensor has been blocked for at least 10s.

Solution

1. Remove the obstacle.
2. If a "return to station" loop is being used, check that the robot is turning in the correct direction in order to enter the station. The direction is set as a configuration parameter in the [Technician's menu](#) (page 114) . **Infrastructure > Parcels**. If the phase on the loop circuit is incorrect, the robot will turn in the wrong direction to enter and exit the station.

9.5.10 Still in collision ({0})!alarm

Scenario

Occurs when a manoeuvre to avoid a collision has failed after 1 minute.

Solution

1. Remove obstacle.
2. If a "return to station" loop is being used, check that the robot is turning in the correct direction in order to enter the station. The direction is set as a configuration parameter in the [Technician's menu](#) (page 114) . **Infrastructure > Parcels**. If the phase on the loop circuit is incorrect, the robot will turn in the wrong direction to enter and exit the station.

9.5.11 Wait for no collision

Scenario

Occurs after a collision. The robot moves backwards and then checks if the obstacle is still there. It will then wait until the obstacle has been removed. This message appears while it is waiting.

Solution

Remove the obstacle.

9.5.12 Did not find the zone due to collision ({0})

Scenario

Occurs when the robot has crossed the peripheral wire, but was unable to re-enter the zone to be mowed because of an obstacle.

Solution

Remove the obstacle.

9.5.13 ManualTask shall not complete: MotorDrive is in safety.

Scenario

The robot did not start.

Solution

Take photos and send the information to your dealer.

9.5.14 The wire is currently configured to be ignored.

Scenario

The robot sends a cautionary message before starting work. It can come out of its area and there is a risk it could fall into water.

Solution

Disable demo mode.

9.5.15 Cannot start MotorMow If we are in Alarm/Safety. Check navigation.

Scenario

The robot was asked to start, but an existing alarm has not been cleared.

Solution

Clear the alarm on the screen and retry.

10 Connecting to robots

Communication with a robot is available through:

- [Hands-on human-machine interaction](#) (page 146)
- [Remote access via the web server](#) (page 146).

Hands-on human-machine interaction

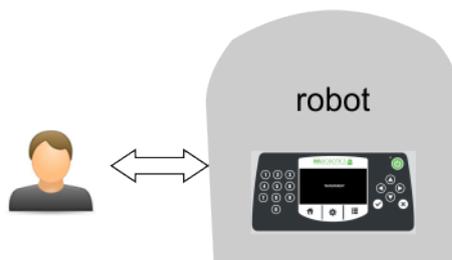


Figure 100: Human Machine Interaction

This type of communication refers to the direct operation of the robot using the user interface provided.

All the operations available are described in [The user interface](#) (page 96).

 **Note:** There are some instructions which can only be issued using this method of communication.

10.1 Remote access via the web server

This method of communication allows a user to connect to the robot using a smartphone, tablet or PC via a web server using the internet.

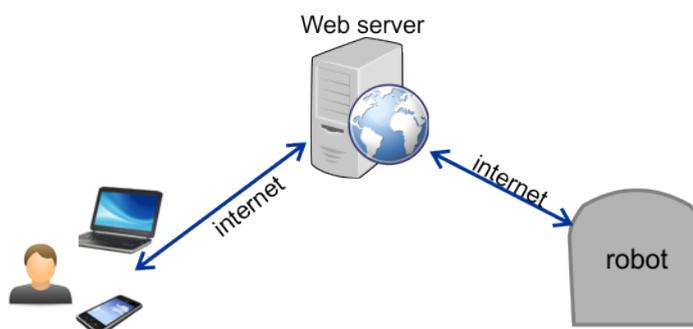


Figure 101: Remote access via the web server

Each Turfmow 1000 machine can send data to and can receive commands from the web server. A user can also receive information from the server and send commands to it, which will then be transferred to the robot.

The means of communication between the user, the robot and the web server are shown in the figure below.

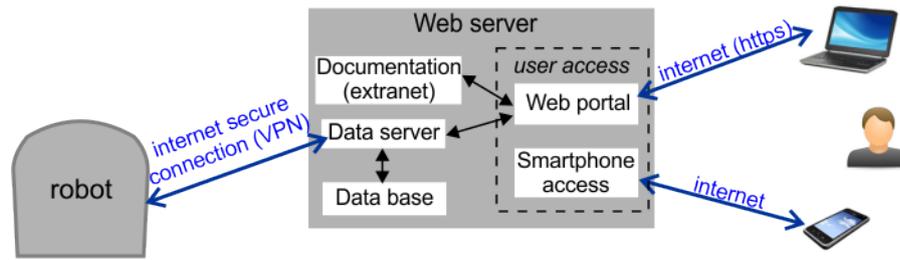


Figure 102: Communication between the robot, the user and the web server

The type of interaction transmitted through the web server is shown in the figure below.

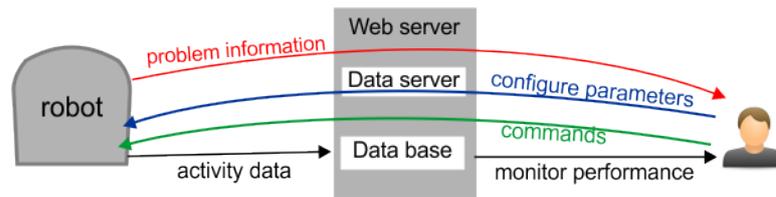


Figure 103: Information transmitted through the data server

To access the web server requires a user account. This depends on the concepts of *Entities, users and robots* (page 147).

See *Creating accounts* (page 148).

Through access to the web server the user can:

- Receive notifications about problems encountered by the robot (alarms and warnings)
- Issue commands to remotely control the robot, such as send to station, start from station
- Change or remotely configure some parameters, such as the working hours... Information about robot configuration parameters that can be modified through the web server is available online on the "FAQ" page.
- Monitor the performance of the robot.
- Implement automatic software updates under the control of Yamabiko.

10.1.1 Entities, users and robots

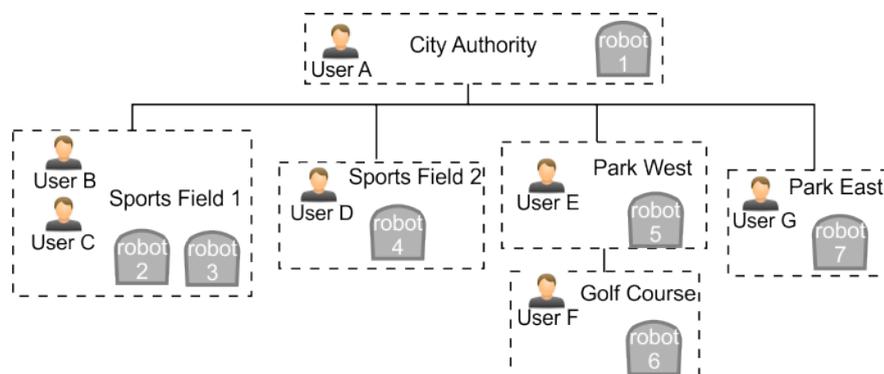


Figure 104: Entities users and robots

There are 5 entities in the example above that are related in a hierarchical structure. The parent entity is the "City Authority". It has 4 child entities ("Sports Field 1", "Sports Field 2", "Park West" and "Park East"). The entity "Park West" has a child entity "Golf Course".

An entity is a group of users and robots associated with a "site". Each entity can have a number of robots that are used within the site.

Users and Roles

A user has an account that is associated with an entity. This is referred to as the user's "home" entity. The information and the operations available to a user depend on the roles that are have been assigned to the user.

Information about users and their roles is available online on the "FAQ" page.

Robots

Robots are transferred from a parent entity to a child entity when the robot is "sold" by the parent to its child. The end-user entity and the end-user account used to access the web server are created at the moment when the robot is commissioned. See [Creation of accounts by a parent entity](#) (page 148). Following this, the account holder will receive an email from which [the account can be activated](#) (page 151).

In the case where an end-user purchases a robot directly, an account will be created using the information received on the registration card supplied with the robot. See [Creation of an account by an end-user](#) (page 150)

10.1.2 Creating accounts

The creation of an end-user account can be done by:

- The parent entity (a distributor or dealer for example). This is done when the parent entity (distributor or dealer) sells the robot to the user entity. See [Creation of accounts by a parent entity](#) (page 148).
- By the end-user who has purchased a robot. This uses the information on the registration card supplied with the robot. See [Creation of an account by an end-user](#) (page 150).
- Once you have created an account you need to [activate the account](#) (page 151).

10.1.2.1 Creation of accounts by a parent entity

This consists of a number of stages.

Stage 1: The parent creates a new child entity

This step is performed by the representative from the parent entity who currently owns the robot.

For this procedure, an example of creating a new entity called "New distributor" is used.

To create a new child entity

1. Log on to the web-server.
2. Click on Management.
3. Click on [Create Entity].
4. Enter the "Last name" of the new entity ("New distributor" in this example).

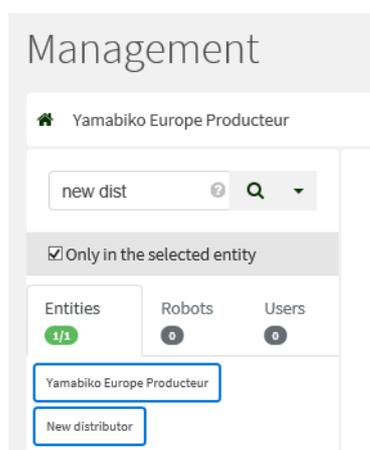
5. Enter a description if necessary. This is optional.
6. Enter the "Street", "Number", "City", "Postcode" and "Country" fields. All of these are required.
7. Click .

A message will appear to show that the new entity has been created.

To see the new entity

1. Click on Management.
2. Search for the "Last name" of the newly created entity and click on .

The newly created entity will appear in the hierarchy under the "Entities" tab.



Stage 2: The parent entity creates a user account for the new entity manager

Once the new entity has been created, a user account for the manager of this entity can be created.

For this procedure the email address of the manager is required.

1. Click on the newly created entity in the "Entities" list. ("New distributor" following the example above.)

This will be reflected in the hierarchy at the top of the page.

 Yamabiko Europe Producteur > New distributor

2. Click on [Create user].
3. Enter the details of the new entity manager.

 **Note:** The fields "First name", "Last name" and "E-mail address" are required.

4. Click .

The new user will receive an email from the web server to activate the account.

Stage 3: The robot is transferred to the new entity

This step is performed by the representative from the original parent entity.

1. On the web server click on Management.

2. Search for robots.
3. Click on the "Robots" tab.
4. Select the robot to be transferred.
5. Click on [Change Parent Entity].
6. Search for the entity to which the robot is to be transferred.
7. Click on the entity.

The robot will be transferred and the information updated on the screen.

Click 

10.1.2.2 Creation of an account by an end-user

The procedure is for a user who has purchased a robot from Echo EU. It requires information on the registration card that was delivered with the machine which contains the serial number and the activation code for the robot.

An example of where this information can be found on the card is shown below.

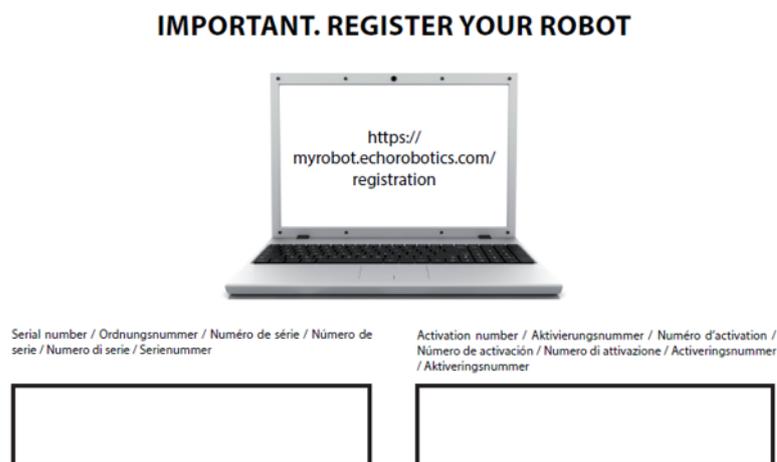


Figure 105: Robot number and activation code on the registration card

To open an account

1. Go to <https://myrobot.echorobotics.com/registration>

OR

Go to <https://myrobot.echorobotics.com/login> and click on **Create an account**.

2. Enter all the details required. *All fields are required.*
3. Click [Confirmation].

At this point, *the account will be created* and an email sent to the email address supplied. Follow the procedure [To add the robot to your account](#) (page 151).

 **Note:** If you *do not receive* the email, or you *do not respond rapidly enough* follow the procedure to [initiate an account activation](#) (page 151).

To add the robot to your account

1. Copy the link in the email into the address bar of your browser and press the <Enter> key.
2. On the Home page click on "Add 1st Robot".
3. Enter the Serial number for the robot (see the registration card).
4. Enter the validation code (see the registration card).
5. Enter a name for the robot.
6. Enter the number of the charging station to be used with the robot.
7. Click "Validate".

The robot will be added to your user account and you can now use the web server to [access information](#) (page 152) about the robot.

10.1.2.3 Account activation

An account must be activated before full access to the web server can be made. An account is created either by your dealer or directly *by an end-user* (page 150). Following the creation of the account, an email is sent to the account holder enabling the account to be activated.

 **Note:** You should [activate the account](#) (page 151) as soon as possible after receiving the email.

 **Important:** If you *did not receive the email*, or you *did not respond rapidly enough*, follow the procedure to [initiate an activation](#) (page 151).

To activate an account

1. Open the "Account validation" email received from Echo EU.
2. Copy the link in the email into the address bar of a browser.
3. Enter the password you wish to use.



Recommendation: There are no restrictions on the password - but it is recommended that you use a strong password. This has at least 12 characters and which includes numbers, symbols, and a mixture of upper and lower case letters.



Note: You can change the password later by [modifying your profile](#) (page 152).

4. Re-enter the same password.
5. Click [Send].

You can now login to the web server using your email address and the password that you defined above.

To initiate an account activation

If you did not receive the activation email, or you did not respond rapidly enough to it, you can follow the procedure below to gain access to your account.

1. Go to <https://myrobot.echorobotics.com/login>
2. Enter the email address used when the account was created.

3. Enter the password defined in the creation of the account.
4. Click [Login].

You will be able to request an activation email to be sent to your address. You can then follow the instructions given above to activate the account.

10.1.3 Accessing the web server

 **Note:** Before you can access the web server you need to have set up an account. See [Creating accounts](#) (page 148).

The web server can be accessed using a web browser on a PC or by using the [app that can be downloaded onto a smart phone or tablet](#) (page 160).

 **Note:** This section refers to the use of the web-server through a browser.

To access the web server

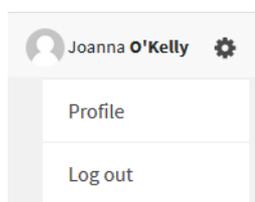
1. Enter the URL <https://myrobot.echorobotics.login> in the browser.
2. Enter the email address used to activate the account.
3. Enter the password defined when you activated the account.
4. Click [Login].

You can then:

- [Modify your profile parameters](#) (page 152).
- [Change your password](#) (page 152).
- See a list of your robots and information about their history, alarms, statistics and the map of the field they mow. See [My robots](#) (page 153).
- Create and manage users and entities. This functionality is only available to users who have a suitable role. See [Management](#) (page 156)
- Specify the type of notifications you want to receive and how they will be delivered. See [Notifications](#) (page 159).
- Access [Documentation](#) (page 160).

To modify your profile

1. Click on the gear wheel next to your user name.



2. Click on **Profile**.
3. Modify any of the settings.
4. Click [Register].

To change your password

The password was set when you activated the account.

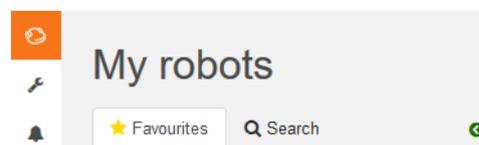
1. Click on the gear wheel next to your user name.
2. Click on **Profile**.
3. Scroll down to the Password panel.
4. Enter your current password. (If you have forgotten the password, click on the gear wheel, and logout. Enter your email address and then click on "Forgotten password". An email will be sent, with a link which will allow you to enter a new password.)
5. Enter the new password in the two fields provided.



Recommendation: There are no restrictions on the password - but it is recommended that you use a strong password. This has at least 12 characters and which includes numbers, symbols, and a mixture of upper and lower case letters.

6. Click [Register].

10.1.3.1 My robots



This page enables you

- [To search for a robot](#) (page 153)
- [To add a robot to the favourites list](#) (page 153)
- [To view the current status and issue a command](#) (page 154)
- [To view the robot history](#) (page 154)
- [To view the alarm history of a robot](#) (page 155)
- [To view a map of a robot's movement](#) (page 155)
- [To view a robot's statistics](#) (page 155)
- [To view identification information for a robot](#) (page 156)

To search for a robot

1. Click on the Search tab.
2. Enter the name or part of the name of the robot you are searching for. (There is no need to add any wild cards.)
3. Click .

The list of robots that match the search criteria will appear.

To add a robot to the favourites list

1. Search for robots as described above.
2. Click on .
3. Click on the Favourites tab to see the list of Favourites.

To view the current status and issue a command

1. Click on the robot in the Favourites list.
2. Click on the "Report and Commands" tab.
3. Click on the required command.

Note: This functionality is not fully supported in the current version.

To view the robot history

1. Click on the robot in the Favourites list.
2. Click on the "History" tab.

This page provides information on the activities and status of the selected robot over a period of time.

The time period is shown in the period field. To adjust the time period, use the up and down arrows to choose the number of days and then click on .

The information is provided in two formats:

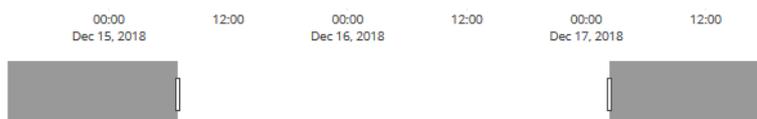
as a chart.

in tabular format.

Viewing the history as a chart

This shows the time the robot spent in various states over a period of time. The number of days for which the data is displayed is set using the period field shown above. You can select a part of this period by clicking on a button above the chart all 3d 1d 12h 6h.

You can also restrict the time period, by dragging the sliders at the bottom of the chart.



A set of tools are available to manipulate the view of the chart. These will appear when the mouse is hovered on the top right side of the chart.



In each case the function of the tool can be seen by hovering over it as shown above.

Viewing the history in a table

You can sort the data in the table on any of the columns by clicking on the up or down arrows to select Ascending or Descending order.

For some items you can filter the data displayed by selecting required content from the drop-down list.

Different states are shown in different colors. Information about the colors used is available online on the "FAQ" page.

To view the alarm history of a robot

If the robot is in an alarm state, this will be indicated in the Favourites list.

1. Click on the robot in the Favourites list.
2. Click on the "Alarms" tab.

A list of alarms and the times when they occurred as well a map showing where the alarm occurred will be displayed.

See [Troubleshooting \(Error messages\)](#) (page 130) for information on alarms.

To view a map of a robot's movement

1. Click on the robot in the Favourites list.
2. Click on the "Map" tab.
3. Choose the time period for which the movements are required.
 - Click on the calendar icon next to the date and choose the start and end date required.
 - Click Set
4. Click [Get Data].



Note: You can add a "Symbolic" map of the field which improves the visualization of the robot movements.

To do this:

1. Go to <http://geojson.io> (Satellite/OSM views)
2. Follow the instructions on their site.
3. Copy the contents of the generated file.
4. On the robot's map page click on [Manage Geojson].
5. Import the contents of the file.

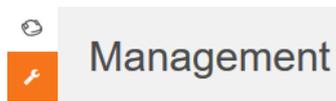
To view a robot's statistics

1. Click on the robot in the Favourites list.
2. Click on the "Statistics" tab.
3. Choose the time period for which the statistics are required.
 - Click in the date field and choose the date required.
 - Click [Set].
4. Click Refresh .
5. To change the presentation of the data:
 - click on  to see cumulative data in a pie chart.
 - click on  to see daily information in a bar chart.
6. To download the information click on .

To view identification information for a robot

1. Click on the robot in the Favourites list.
2. Click on the "Information" tab.

10.1.3.2 Management



Note: This section is only available to users who have the "Manage Entities" role.

This section allows you to search for and manage *Entities, users and robots* (page 147).

Manage entities

This enables you to:

- *To view information about your entity and its child entities* (page 157)
- *To create a new entity* (page 157)
- *To change the properties of an entity* (page 157)
- *To change the parent entity* (page 157)

Manage robots

This enables you

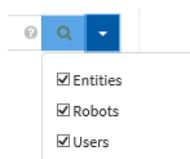
- *To view the robots in an entity* (page 158)
- *To view the properties of a robot* (page 158)
- *To move a robot to another entity* (page 158)

Manage users

This enables you

- *To view the users in an entity* (page 158)
- *To view the properties of a user* (page 158)
- *To create a new user* (page 159)
- *To delete a user* (page 159)

On this page you can search for entities, users and robots. To search for particular items use the filter list.



10.1.3.2.1 Managing entities

When you login, your account is associated with your parent entity.

To view information about your entity and its child entities

1. Click on
2. Enter the name of the entity or part of it in the search field.
(Enter * to search for all entities).

3.

Set the filter to Entities

4. Click
5. Click on an entity to see the details.

The breadcrumb above the list is adapted. Clicking on any entry will take you to that level.

To create a new entity

1. Select the parent of the new entity in the Entities list.
2. Click on [Create entity].
3. Fill in all the details required. (See also [Creation of accounts by a parent entity](#) (page 148).)
4. Click .

To change the properties of an entity

1. Search for the entity.
2. Click on it in the list.
3. Modify the required information.
4. Click (located on the far right-hand side of the screen).

To change the parent entity

1. Search for the entity.
2. Click on it in the list.
3. Click [Change parent entity]
4. Select the new parent entity.
5. Click (located on the far right-hand side of the screen).

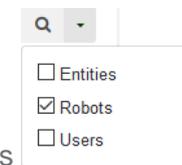
10.1.3.2.2 Managing robots

Note: The information given here, refers to the operations available from the Management section of the web-server.

For other operations refer to [My robots](#) (page 153).

To view the robots in an entity

1. Enter the name or part of it in the search field.
(Enter * to search for all robots).

2. 

Set the filter to Robots

3. Click .
The list of robots and their parent entity will be displayed.

To view the properties of a robot

1. Click on the robot in the list.
The properties of the robot will be displayed.

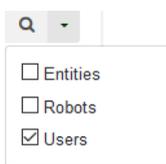
To move a robot to another entity

1. Click on the robot in the list.
2. Click [Change parent entity].
A pop-up window will appear
3. Enter the name of the new parent entity, or choose one from the list.
The pop-up window closes
4. Click  (located on the right hand side of the screen).

10.1.3.2.3 Managing users

To view the users in an entity

1. Click on 
2. Enter the name or part of it in the search field.
(Enter * to search for all users).

3. 

Set the filter to Users

4. Click .
The list of users and their parent entity will be displayed.

To view the properties of a user

1. Click on the user in the list.
The properties of the user will be displayed.

Note: The properties of a user cannot be modified here. This must be done by the user *adapting his profile* (page 152).

To create a new user

1. Select the parent entity to which the user is to be added.
2. Click [Create user].
3. Enter the details of the new user.

Note: The fields "First name", "Last name" and "E-mail address" are required.

4. Click

An email will be sent to the new users email address, from which the user can activate the account.

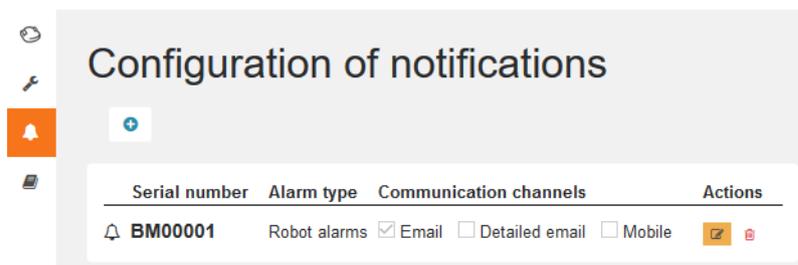
To delete a user

1. Click on the user in the list.
2. Click [Delete user].
3. Confirmation will be requested to delete the user. Click to confirm.

The user will be deleted.

10.1.3.3 Notifications

This section allows you to set the robot notifications you want to receive and the manner in which they will be delivered.



To add a new notification

1. Click +.
2. Enter the name of the robot (serial number)
3. Select the Notification type.
4. Choose the delivery method.
 - Email - to your email address
 - Smartphone - the notification can be viewed in the ECHO Robotics app.
5. Click

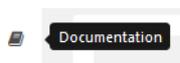
To modify a notification

1. Click .
2. Modify the notification.
3. Click .

To delete a notification

1. Click .

10.1.3.4 Documentation



Provides access to the documentation available.

10.1.4 Using the app

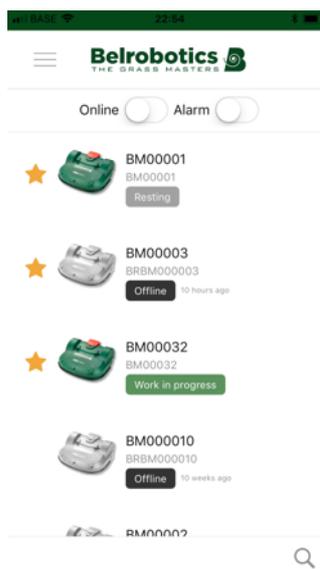
You can view information about your robots using an app that can be downloaded onto a tablet or a smartphone.

You can find the app by searching for "Belrobotics" in the app store.

Note: Before you can use the app you need to have [set up an account](#) (page 148) and activated it.

The functionality available from the app is a subset of the functions available when accessing the server through a web browser. It provides the functions in [My robots](#) (page 153).

To see information about a robot: tap on the robot in the list.



To see the alarm history: tap on .

To see the battery level and the robot details: swipe on the robot.



 To see the location of the robot: tap on 

11 Service and Maintenance

This section deals with regular maintenance and servicing of your Turfmow 1000 robot.

Maintenance refers to regular operations that should be carried out regularly throughout the mowing season.

Service refers to the (annual) check carried out by authorized technicians. All machines should be regularly serviced!

11.1 Maintenance

Maintenance refers to a set of tasks that should be carried out regularly throughout the mowing season. In addition to these an (annual) service of the robot by an authorized technician should be undertaken.

The service interval depends to some extent on the operational load of your robot, but it is recommended that it is serviced by an authorized technician *at least once a year*.

Whilst maintaining your robot for optimum performance, do not attempt to make any changes to your robot. You risk disturbing its operation, causing an accident, and damaging parts.

 **Note:** If you notice any unusual behavior or damage - call a technician.

When carrying out these maintenance procedures the following safety regulations should be observed.



Stop the machine: Always switch off the power and wait for the cutting blades to stop before handling the machine.



Operate the disabling device before working on or lifting the machine.

This is especially important:

- before clearing a blockage,
- before checking, cleaning or working on the machine,
- after striking a foreign object to inspect the machine for damage,
- if the machine starts to vibrate abnormally.



Important: Keep all nuts, bolts and screws tight to be sure the machine is in safe working condition.



Use gloves: Protective gloves must be worn whenever handling the machine, and especially when handling the cutting system.

Always use OEM (Original Equipment Manufacturer) parts supplied by Echo EU. In addition to the risk of accidents, the use of any non-OEM parts will result in the annulment of the

guarantee for any resulting damage. Echo EU declines all liability in case of accident due to the use of non-OEM parts.

Table 1: Maintenance tasks for Turfmow 1000

Component	Weekly	6 months	Annual
<i>Station charge contacts</i> (page 164)	Inspect /Clean		
Body			
<i>Bumper</i> (page 164)	Inspect /Clean		
<i>Sonar</i> (page 164)	Clean		
<i>Robot charge contacts</i> (page 164)	Clean		
<i>Wiring</i> (page 167)		Inspect/Clean	
Mechanical parts			
<i>Front wheels</i> (page 165)	Clean	Inspect	
<i>Front wheel axle</i> (page 165)	Clean		
<i>Cutting head</i> (page 165)	Clean		
<i>Cutting disc</i> (page 166)	Clean		
<i>Blades</i> (page 166)	Inspect	Replace	
<i>Rear wheels</i> (page 167)	Clean		
<i>Battery</i> (page 167)			Charge

11.1.1 Maintenance procedures

These procedures should be carried out at the recommended frequency by the regular user of the robot.

 **Note:** Throughout the mowing season you should regularly check that all screws, nuts and bolts are properly tightened. Tighten any that are loose, and if there is damage or evidence of a problem contact an authorized technician.

Every day

- *Regular cleaning (during wet weather)* (page 164)

Every week

- *Clean the charge contacts* (page 164).
- *Clean the bumper* (page 164).
- *Clean the sonar sensors* (page 164).
- *Clean the front wheels* (page 165).
- *Clean the front wheel axle* (page 165).
- *Clean the cutting head* (page 165)
- *Clean the cutting disk* (page 166)
- *Check the cutting blades* (page 166)
- *Clean the rear wheels* (page 167)

Every six months

- [Check the wiring](#) (page 167).
- [Replace the cutting blades](#) (page 166)

At the end of the season

- [Battery](#) (page 167).
- [Wintering](#) (page 168)

Regular cleaning (during wet weather)

During periods of wet weather it is necessary to ensure that mud and grass do not accumulate on the moving parts: the wheels and the cutting heads. These should be inspected and cleaned *daily*.

1. Hit the red button to stop the robot.
2. Turn the machine onto its rear side.
3. Switch the machine OFF.
4. Remove any accumulations of grass and dirt using a wire brush and/or a spatula.
5. Rub the body with a soft, damp cloth or sponge.
6. If the body is very dirty, use a soapy solution or washing-up liquid. *Never use solvents!*

Clean the charge contacts

This procedure should be performed *weekly* on both the robot and the charging station.



Charge contacts on the robot



Charge contacts on the station

- ➔ Rub the contact surfaces with grade 280 sandpaper until they appear clean.

Clean the bumper

This procedure should be performed *weekly*.

- ➔ Check that the bumper material is intact; no cuts or tears. If it is contact an authorized technician.
- ➔ Clean the bumper with a damp cloth.

 **Note:** Do *NOT* use water.

Clean the sonar sensors

This procedure should be performed *weekly*.

The sonar sensors need to be kept clean if they are to operate properly. All need to work properly. If any of the sensors are not operating properly an alarm is issued.



- ➔ Remove any mud, grass or dirt and wipe with a damp cloth.

 **Note:** Do *NOT* use water.

Clean the front wheels

This procedure should be performed *weekly*.

- ➔ Remove any mud and grass with a wire brush or a cloth.
- ➔ Check that they rotate easily and that there is not too much play. If so contact an authorized technician.

Clean the front wheel axle

This procedure should be performed *weekly*.

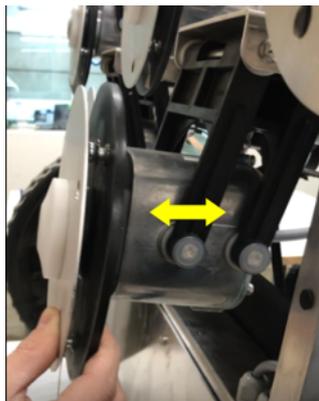


- ➔ Clean the front wheel axle with a brush and/or a cloth.
- ➔ Visually inspect the axle. If there is a problem contact an authorized technician.

Clean the cutting head

This procedure should be performed *weekly*.

- ➔ Clean the cutting head using a brush. If compressed air is available, this is preferable.
- ➔ Check that the entire cutting head moves smoothly backward and forwards as shown by the arrow in the figure below.



See also: [adjusting the height of the cutting head](#) (page 98).

Clean the cutting disk

This procedure should be performed *weekly*.

- ➔ Clean the cutting disc using a brush. If compressed air is available, this is preferable.
- ➔ Check that it rotates smoothly. If there is a problem contact an authorized technician.

Check the cutting blades

The condition of the cutting blades is the essential for a satisfactory mowing operation.

The service life of the blades depends on:

- the amount of time they have been in operation,
- the working area they need to cover,
- the type of grass and soil,
- the presence of obstacles/objects on the ground such as fallen fruits, pebbles, toys, ...

Every *week* you should inspect:

- the blades,
- the blade bolts,
- the cutter assembly.

Cutter assembly parts should be replaced every *every six months* or whenever they are damaged.

- ➔ Rotate the disc, so that the screw head holding the blade is visible.



➔ Undo the screw to remove the blade.

Note: Use a flat-headed screw driver with a blade width of 8mm and a thickness of 1.2mm.

➔ Position the new blade and tighten the screw.

Note: After any intervention on the cutting heads:

- Rotate each of them independently.
- Check that each one does not cause any of the other heads to rotate.

Clean the rear wheels

This procedure should be performed *weekly*. (*Daily* in periods of wet weather.)

➔ Remove any mud and grass using a wire brush.

If wheel brushes are installed, these will keep the wheels clean, but the brushes should be inspected and cleaned.

Check the wiring

This procedure should be performed *every six months*.

➔ Visually inspect the wiring under the robot. If any problems are detected, contact an authorized technician.

Battery

Turfmow 1000 robotic mowers are equipped with the latest generation LFP batteries.

Note: In the event of leakage of electrolyte, flush with water and seek medical help if it comes in contact with the eyes etc.

The automatic (programmed) operation of the robot optimizes battery life. It is advisable to allow the robot to manage its working cycles. If these work cycles seem unusually short, contact an authorized technician to check the condition of the battery.

Note: It is possible to monitor these cycles using the portal.

This procedure should be performed *at the end of the mowing season*.

➔ Make sure that the battery is fully charged before winter, then switch the machine OFF. See [Figure 3: Bottom view of robot components](#) (page 12) to see the location of the switch.

Wintering

In addition to charging the battery (see above)

- Clean the robot and arrange for it to be serviced.
- Store the robot in a dry, protected and frost free place.
- It is recommended to protect the charging station with a shelter or a tarpaulin.
- It is not necessary to switch the charging station off. Leaving it connected provides a degree of warmth.

At the start of the new season.

1. Switch the robot ON.
2. Check that the power is connected to the charging station.
3. Check the battery voltage of battery. The battery level can be seen on the user interface screen.
4. Start the robot and test it comes back normally to the charging station

11.2 Service

Servicing should be carried out by an authorized technician.

The procedures involved in the (annual) service are listed below.

 **Note:** All the torques required for the maintenance procedures are listed in the [Torque references](#) (page 183).

See also [Winter service check list](#) (page 196).



Use gloves: Protective gloves must be worn whenever handling the machine, and especially when handling the cutting system.

Always use OEM (Original Equipment Manufacturer) parts supplied by Echo EU. In addition to the risk of accidents, the use of any non-OEM parts will result in the annulment of the guarantee for any resulting damage. Echo EU declines all liability in case of accident due to the use of non-OEM parts.

Body

- [Body](#) (page 169)
- [Bumper](#) (page 170)
- [Sonar sensor](#) (page 170)
- [Wiring](#) (page 171)
- [Smart box](#) (page 171)

Mechanical components

[Chassis](#) (page 171)
[Coil](#) (page 171)
[Suspension](#) (page 172)
[Front wheels](#) (page 172)
[Front axle](#) (page 172)
[Front lift sensor](#) (page 172)
[Front silentblocs](#) (page 173)
[Cutting head](#) (page 174)
[Pantograph](#) (page 174)
[Cutting disk](#) (page 174)
[Blades](#) (page 174)
[Cutting motor](#) (page 178)
[Gasket](#) (page 178)
[Cutting height system](#) (page 179)
[Wiring cutting disk](#) (page 178)
[Rear lift sensor](#) (page 180)
[Rear silent blocs](#) (page 180)
[Rear wheels](#) (page 181)
[Rear wheel motor](#) (page 181)
Battery

11.2.1 Service procedures

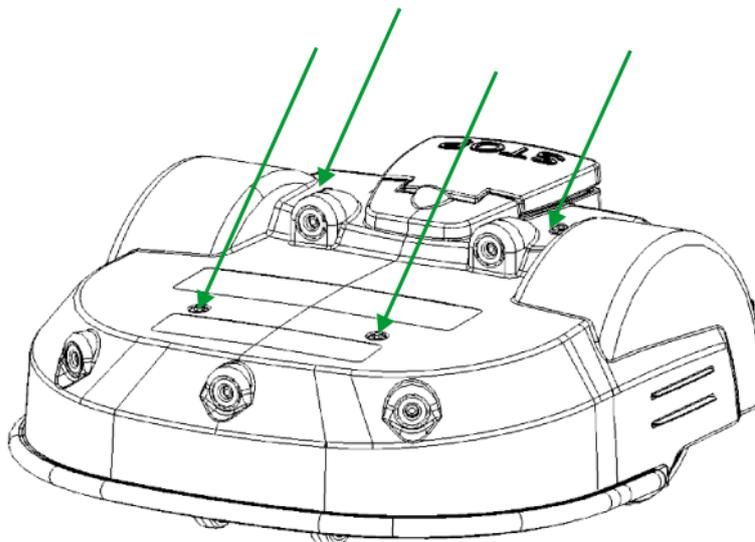
These procedures should be carried out by an authorized technician as part of the (annual) service of a Turfmow 1000 robot.

Clean the body

1. Switch the machine OFF.
2. Turn the robot onto its rear side.
3. Disconnect (un-clip) the cables.



4. Unscrew the 4 bolts that attach the body to the chassis.



5. Lift the body off.
6. Clean away the mud and the grass using the brush and/or a spatula such as the ones shown below. If compressed air is available this is more effective.



When the service is complete:

1. Replace body onto the chassis.
2. Tighten the 4 bolts to a torque of 7Nm.
3. Re-connect the cables.

Inspect the bumper

1. Check that the bumper material is intact; no cuts or tears. If so *replace it* (page 189).
2. Clean the bumper with a damp cloth.

Note: Do *NOT* use water.

Inspect and clean the sonar sensors

The sonar sensors need to be kept clean if they are to operate properly. All need to work properly otherwise an alarm is issued.

1. Remove any mud, grass or dirt and wipe with a cloth.

Note: Do *NOT* use water.



2. [Replace any defective sonar sensors](#) (page 189).

Check the wiring under the body

1. Visually inspect all of the cabling.
2. If there is slight damage, cover with tape.
3. If there is serious damage revealing wires, [replace the cable](#) (page 189)

Smart box

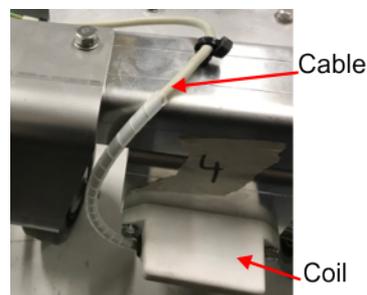
1. Visually inspect of the base of the smart box and of the screen for any damage.
2. [Replace if necessary](#) (page 189).

Clean the chassis

1. Clean away the mud and the grass using the brush and/or a spatula such as the ones shown below. If compressed air is available this is more effective.



Inspect the coil and cable



1. Visually inspect the coil for damage.
2. Inspect the cable and the clips.
3. If there is slight damage, cover with tape.
4. If there is serious damage revealing wires, [replace the cable](#) (page 189).

Inspect suspension

1. Visually inspect and clean the suspension.



Inspect and clean the front wheels

1. Clean the wheels of mud and grass with a brush and/or a cloth. If compressed air is available this is more effective.
2. Inspect that they turn easily and that there is not too much play. If so *replace them* (page 189).

Clean and inspect the front wheel axle

1. Clean the axle of mud and grass with a brush and/or a cloth. If compressed air is available this is more effective.
2. Visually inspect the condition of the axle, and *replace* (page 189) if necessary.



Front lift sensor

Check that the sensor moves up and down easily.



Replace Front silentblocs

1. Undo the sensor using the bolt underneath and remove it.



2. Place the new silentbloc in place in the position as shown below.

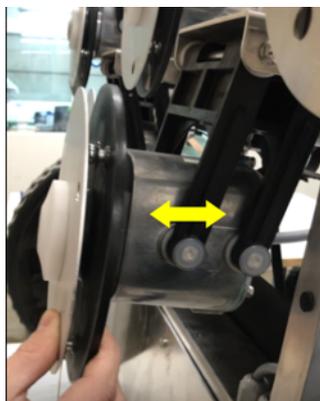


3. Fix the new silentbloc in place using the bolt underneath. Use a torque of 6Nm.



Cutting head

1. Clean the cutting head using a brush and/or a brush. If compressed air is available, this is more effective.
2. Check that the entire cutting head moves smoothly backward and forwards as shown by the arrow in the figure below.

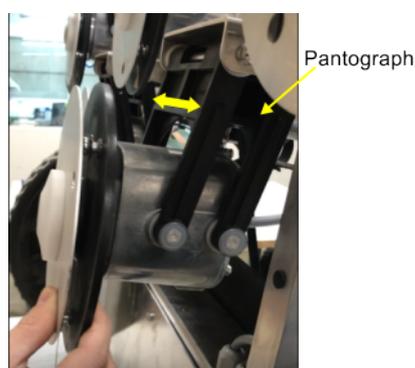


3. Check that the cutting disc rotates smoothly.



Pantograph

1. Check that there is not too much play in the pantograph by moving it in the direction shown below.



2. *Replace if necessary* (page 189).

Cutting disk

1. Remove the cutting head by unscrewing the screw shown below.



2. Undo the screw on the axle shown below.



3. Undo the nut to remove the axle.



4. Separate the two discs.



Replace the blades

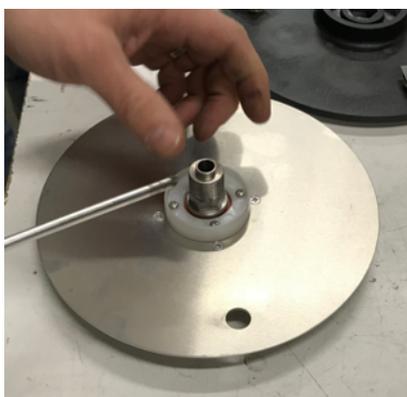
1. Unscrew the blades.



2. Replace the blades.
3. Use a torque of 2Nm to tighten the screws.

Aluminum anti-friction disk

1. Check that it turns smoothly.
2. Unscrew the 4 screws to remove the white plastic ring shown below.



3. Remove the axle.



4. Inspect and clean the disc.
5. Replace the disc if damaged.
6. Place the axle firmly back into the sleeve.
7. Attach the white plastic ring using the 4 screws.
8. Place the blade support disc over the axle and replace the circular washer.



9. Add some glue to hold the washer on the threaded axle.



10. Replace the hexagonal washer. Tighten it to 20Nm.



11. Set the screw in the axle.



12. Place the disc assembly back onto the cutting head axle. Make sure that the screw shown above touches the flat surface of the cutting head axle as shown below.



13. Tighten the screw onto the axle using 6Nm.

Wiring cutting disk

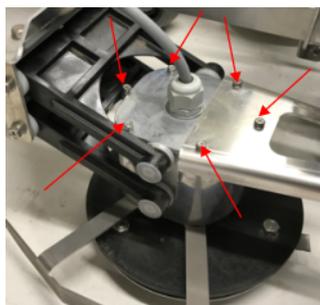
1. Visually inspect the wiring for the cutting discs.



2. Repair any damage to the sheathing with tape.
3. Replace clips if necessary.
4. [Replace the cable](#) (page 189) if damaged.

Cutting motor

1. Undo the 6 screws shown below (3 on the motor casing, and 3 on the bracket).



2. Remove the bracket.
3. Loosen the nut on the cable connection and lift the lid.
4. Remove the green gasket.



5. Un-clip the electrical connections.



6. Visually inspect the interior of the motor. Check for dampness and dry it out if necessary.
7. Visually inspect the electronic board.
8. Re-connect the electrical connections.
9. Place the new green gasket in position.
10. Place the lid back in position.
11. Replace the bracket.
12. Screw the 6 screws in place. Use a torque of 1.5Nm.
13. Tighten the nut around the cable connection.

Cutting height system

1. Visually inspect all the straps.
2. Rotate the shaft by hand and check that the cutting heads move up and down smoothly.



Wiring cutting disk

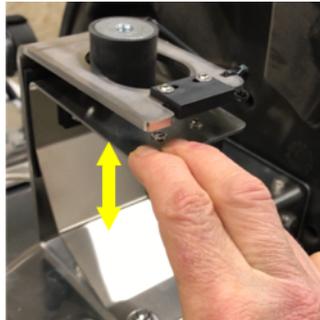
1. Visually inspect the wiring for the cutting discs.



2. Repair any minor damage to the sheathing with tape.
3. Replace clips if necessary.
4. [Replace the cable](#) (page 189) if damaged.

Rear silentblocs

1. Replace the rear sensor silentblocs.
2. Check the movement of the bracket to ensure the correct rear lift detection.



3. Check the movement of the bracket to ensure the correct reverse detection.



4. Check the wiring.
5. Repair any minor damage to the sheathing with tape.
6. Replace clips if necessary.



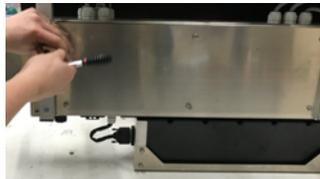
7. *Replace the cable* (page 189) if damaged.

Rear wheels

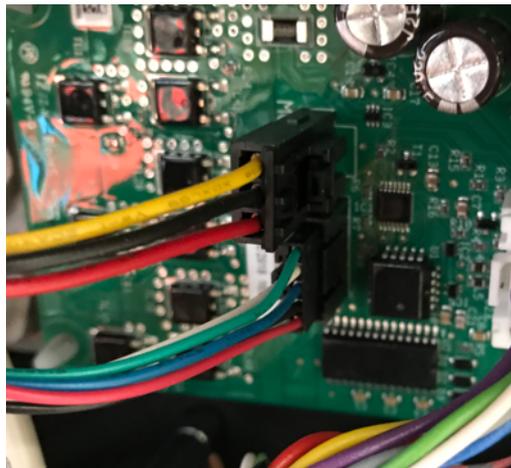
1. Undo the screw.



2. Remove the wheel.
3. Undo the 6 screws that hold the rear plate in place.



4. Remove the cables. The upper one is the power, the lower one is the control.



5. Undo the nuts on the motor housing.
There are two on the top, two on the side and two on the bottom.



Note: Make sure to only undo the screws shown below.



6. Remove the motor.



7. Remove plastic covers.



8. See the [video on YouTube for the greasing](#).

9. Replace plastic covers.

10. Replace the motor.

11. Replace the housing - correct orientation is assured by the position of the screw holes.

12. Tighten the screws to 15Nm.

13. Re-connect the cables.

14. Replace the back plate. Tighten the bolts to 6Nm.

15. Put the washers back in the correct orientation (flat side towards axle, curved side towards wheel).

16. Clean the axle.



17. Grease the axle.



18. Put the wheel back on the axle.

Make sure the inner conical sleeve can rotate independently within the outer sleeve so that it can tighten on the wheel axle.

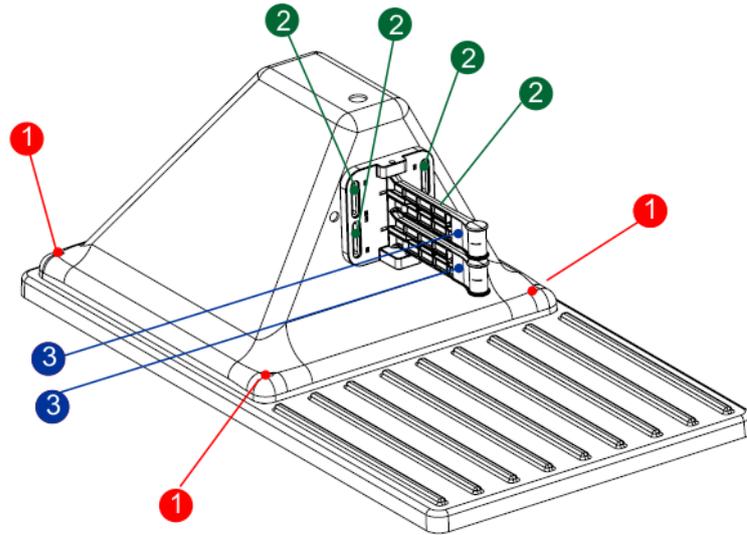
19. Push the complete sleeve firmly into place.



20. Tighten up the wheel screw to 65Nm.

11.2.2 Torque references

This section lists all the torque values that must be applied during the servicing procedures for .



(1) 2 Nm

(2) 2 Nm

(3) 2 Nm

(4) 7 Nm

(5) 2 Nm

(6) 2 Nm

(7) 2 Nm

(8) 7.5 Nm + Loctite 2701

(9) 1.5 Nm + Loctite 243

(10) 6 Nm + Loctite 243

(11) 3 Nm

(12)

(13) 3 Nm + Loctite 243

(14) 1.5 Nm

(15) 12 Nm

(16) 15 Nm

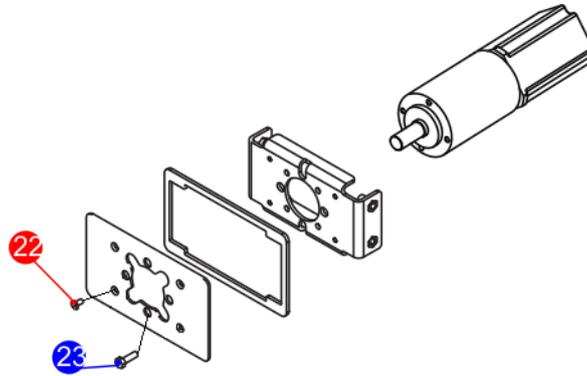
(17) 3 Nm

(18) 3 Nm

(19) 3 Nm

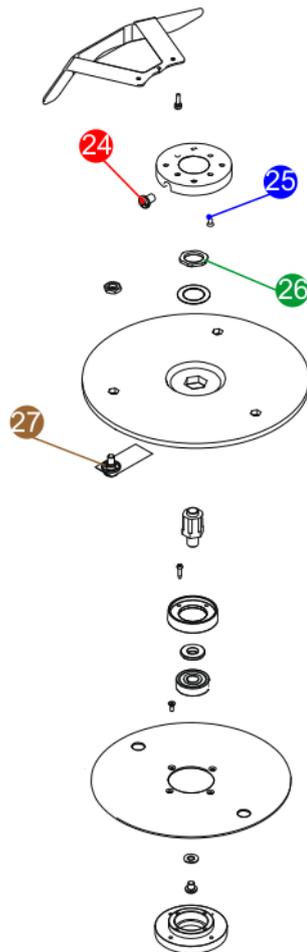
(20) 10 Nm

(21) 6 Nm



(20) 3 Nm + Loctite 243

(21) 6 Nm + Loctite 2701

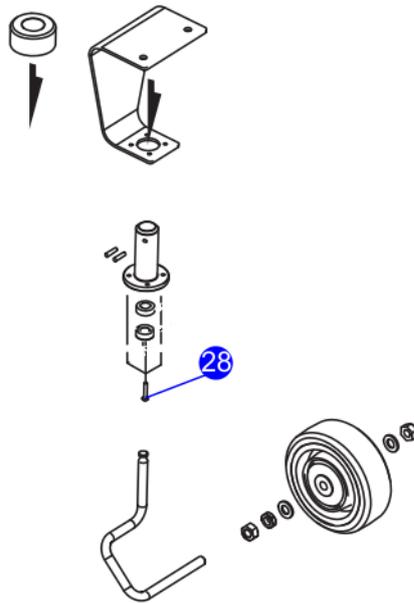


(24) 6 Nm

(25) 2 Nm + Loctite 243

(26) 20 Nm + Loctite 243

(27) 2 Nm



(28) 1.5 Nm

11.2.3 Lift sensor raiser kits

Instructions for installing raiser kits on front and rear lift sensors.

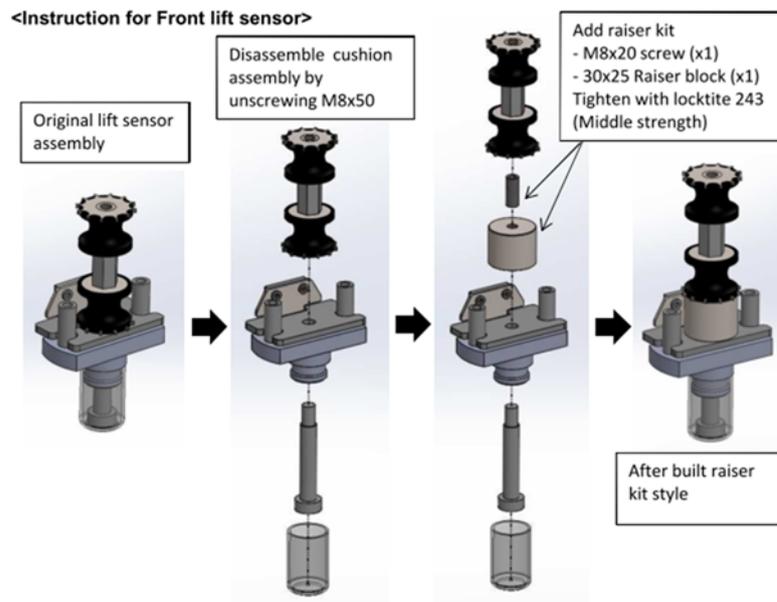


Figure 106: Install raiser kit on a front lift sensor

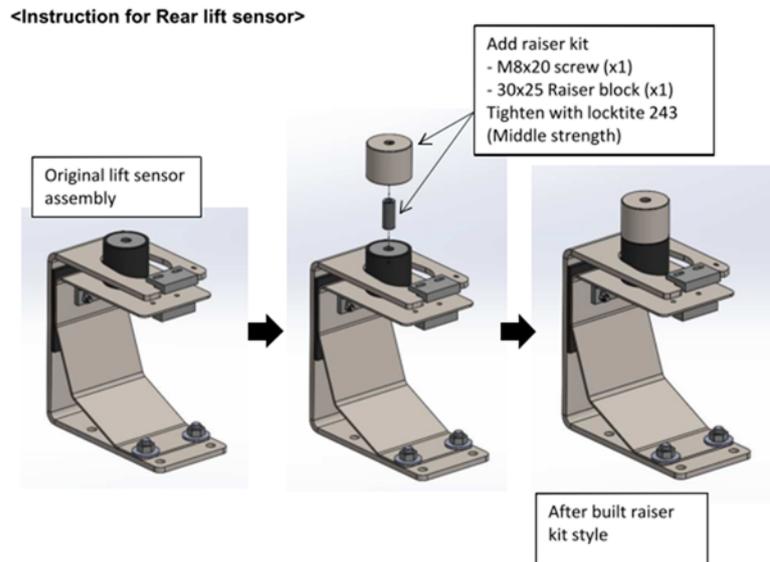


Figure 107: Install raiser kit on a rear lift sensor

11.2.4 Peripheral board replacement

Check the version of the peripheral board.

If the version is V2.3B, make sure that you can see a blue or white mark, as shown below.

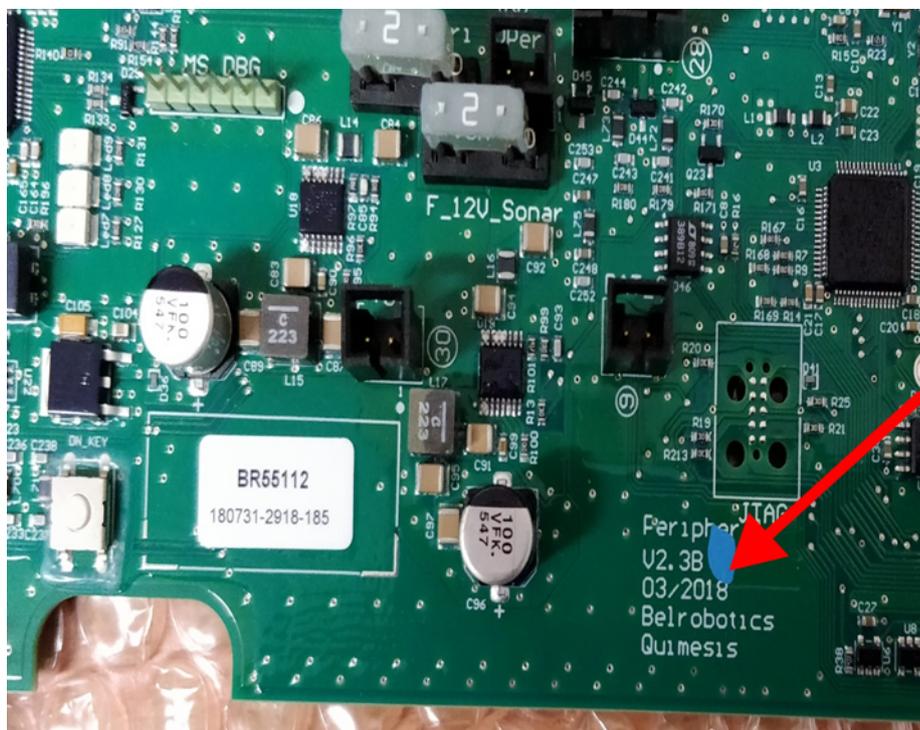
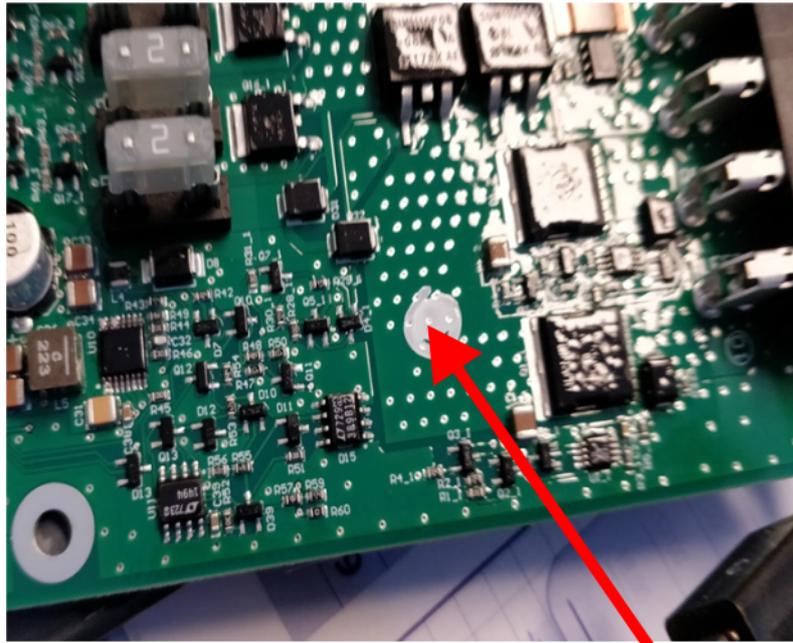


Figure 108: Colored mark on a V2.3B board

If the version is V2.3B *but there is no colored mark*, you must replace it.

For the boards that have the colored mark, a cable has been added behind the card.



12 Repair



Warning: Always unplug the charging station before opening it.

In those situations where there is no plug, remove the fuse from the charging station.

If the charging station supply cord is damaged, it must be replaced by a special cord or assembly available from Echo EU or your service agent.

12.1 Electric circuitry

Information on this will be available in a forthcoming edition of the manual.

12.2 Replace sonar

Information on this will be available in a forthcoming edition of the manual.

12.3 Bumper

Information on this will be available in a forthcoming edition of the manual.

12.4 Replace the smartbox

Information on this will be available in a forthcoming edition of the manual.

12.5 Cutting head

Information on this will be available in a forthcoming edition of the manual.

12.6 Front wheel and axle

Information on this will be available in a forthcoming edition of the manual.

12.7 Correcting lid closure problems

The lid needs to be properly closed before the robot can perform its specified missions. On occasions, even when the lid has been closed properly, the robot does not start its mission and the message "Lid not closed, please select option again" is displayed.

In order for the robot to be able to execute its missions the lid needs to be shut, and to form a closed circuit between magnets on the lid and relays on the body. This circuit needs to be open when the lid is open *and* when the lid is pressed down and acts as the stop button. This requires that all magnets and relays are functioning correctly and some precision in their positioning.

The figure below shows a schematic representation of the situation.

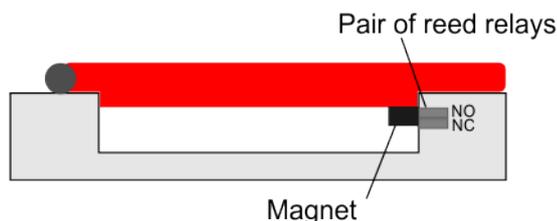


Figure 109: Closed lid

One of the relays is "Normally Closed" (NC) and the other is "Normally Open" (NO). The circuit is shown below.

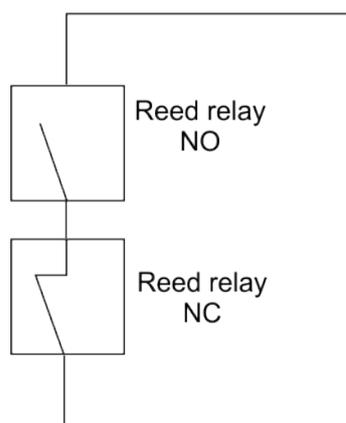


Figure 110: Lid circuit

When the lid is closed the magnet must be in a position to align with the reed relays and close the circuit which allows the robot to operate.

- When the lid is open, the circuit is open, thus preventing the robot from operating.
- When the lid is depressed, the roles of the two relays are reversed and the circuit is open thus preventing the robot from operating.

If there are problems with the lid closure you can analyze the problem by running a test. Select **Service > Tests > Lid** from the *Technician's menu* (page 114).

Relays

The pairs of relays must be installed one above the other in the correct order:

- NO must be on top. This relay is identified as having the digit 1 in the reference number.
- NC must be on the bottom. This relay is identified as having the digit 4 in the reference number.

The relays are supplied as two pairs and the cabling between them.

- Product number YB-033-00021

When installing a replacement reed cable set, visually examine the position to ensure that the relays align correctly. Run the service test to check whether spacers need to be inserted or removed.



Figure 111: Positioning of magnets and the reed relays

Magnets

The magnets must be fixed to the lid as shown below. The parts required are

- YB-034-00000 Bonnet magnet
- YB-505-03012 Screw M3x12



Figure 112: Location of the magnets on the lid

The magnets must be magnets must be at the correct height so that when the lid is closed or pressed down they connect with the correct relays. If necessary spacers must be placed behind the magnets, if they are too low and the position of the relays must be adjusted with spacers if the magnets are too high. This can be determined by running the test. Select **Service > Tests > Lid** from the [Technician's menu](#) (page 114).

13 Notices



Your robot meets European standards.



Recycle: Waste electrical and electronic equipment is subject to selective collection. Please recycle your robot according to the standards in force.

Icons on the battery



Make sure you are familiar with the documentation before handling and using the battery.



Do not allow the battery to come into contact with water.



Caution Take care when handling and using the battery.

Do not crush, heat, incinerate, short circuit, dismantle, or immerse in any liquid. Risk of leakage or rupture. Do not charge below 0°C. Only use charger specified in the user's manual.



Recycle your battery.

Refer to the user's manual for battery recycling instructions.



Indicates the polarity of the battery.

14 Declaration of conformity



Declaration of Conformity

Yamabiko Europe SA, residing Avenue Lavoisier, 35 at 1300 Wavre, Belgium, hereby declares under sole responsibility that the robotic mowers Echo®, model Turfmow® 1000 (with serial numbers starting from EEPM000101 and onwards) complies with the requirements of the European Council's Directives:

- 2006/42/EC: Machinery Directive
- 2014/35/EU: Low Voltage Directive
- 2014/30/EU: Electromagnetic Compatibility
- 2014/53/EU: Radio Equipment Directive
- 2006/66/EC: Battery Directive
- 2011/65/EU: Restriction of the use of hazardous substances
- 2000/14/EU: Noise emissions from outdoor equipment



Wavre, Belgium, July 27th 2018



Emmanuel Bois d'Enghien
Managing Director

15 Technical specifications Turfmow 1000

Capacity

Maximum mowable area (1 (page 194))	12,000m ²
Recommended mowable area (2 (page 195))	10,000m ²
Number of sports fields per robot	1
Mowing width	633mm
Speed	2.8km/h
Maximum slope	35%

Cutting

Number of cutting heads	3
Number of cutting blades	9
Low cut (minimum)	22mm
High cut (maximum)	80mm
Adjustment of cutting heads	Electronic
Maximum noise level	<70dB(A)

Battery

Type	LFP
Nominal Voltage	25.6V
Nominal Capacity	19.2Ah
Max. charge current:	19.2A
Energy	491.5Wh
Working temperature range	Between -20°C and +60°C
Time to fully charge (minimum)	90 minutes

Weight and dimensions

Weight	48kg
Length	1002mm
Width	1044mm
Height	466mm

Software and monitoring

Security PIN code	Yes
-------------------	-----

GPS positioning (Geo-fence)	In a future release
APP robot management	Standard

Intelligence

Sonar detection of obstacles	Multiple. Height 400mm, diameter 70mm.
Adaptive cut	This will be available in a future version
Return to station via GPS	This will be available in a future version
Multiple starting zone	Yes
Multi field (optional)	Yes
Multi robot	In a future release

Safety

Lift sensors	Yes
Reverse sensors	No
Bumper	Electronic

(1) Valid for a lawn that is rectangular, flat, without obstacles, without fertilizer and watering, being mowed 24/24 and 7/7.

(2) Valid for a lawn that is rectangular, flat, without obstacles, with fertilizer and watering, being mowed 24/24 and 7/7.

16 Winter service check list

Test information			
Client		Technician	
Serial number		Field	
Date		Installation date	

Tests before service		
	OK/NOK	If NOK, indicate why
Software version 3.5		
Height of cutting head (mm)		
Check history on Myrobot		

Perform Service tests, Select **Technician's menu** > **Service** > **Test**

Service tests before service		
	OK/NOK	If NOK, indicate why
Charge		
Bumper		
Smartbox		
Lift Sensors		
Backward Sensors		
Signal Sensors		
Drive Motor		
Cutting Motor		
Sonar Sensors		
Lid		
Do 2 cutting height tests: highest/lowest/in_use and check all heads go to correct height		
Trajectory check: select a trajectory along a straight line 20..30m long without obstacles - check in particular if straight line followup (if possible)		
Noise: start the machine - report abnormal levels/noises (wheels, cutting heads,body vibrations,...)		

Service tests before service		
Noise: report any abnormal noise from the cutting height motors		

Checks during service		
	OK/NOK	If NOK, indicate why
Body		
Body fixing screws: check for rust. Replaced by A4 type screw during the first service.		
Bumper; check for scratches and cuts and the attachment.		
Sonars; clean and check the connections.		
Check the quality of all glued surfaces.		
Clean the charge contacts		
Clean the GUI screen.		
Check that there is no dampness or condensation on the screen.		
Smamrtbox. If the client has indicated a problem with GPS signal, replace it.		
Inspect the inside of the bodywork: <ul style="list-style-type: none"> - cable condition - attachment and path of cables, - cable connections, - loof for any deterioration between the chassis and the bodywork, - check the areas under the black protectors, - check the the soldered connection on the charge contacts, - check the JEA40 connector for oxidation, - check the charge connector for oxidation 		
Frame		
Coil: check the attachment, cable, connection		
Front wheel axes: check for wear, the seal and the bearing.		
Front wheels: check rotation, tires		

Checks during service		
Front suspension: check for splits		
Front lift sensors: check grease and cable		
Front silentbloc: replace if necessary or at least every 2 years. If the robot is equipped with an <i>raiser kit</i> (page 186), be sure to use the latest version.		
Cutting head: check <ul style="list-style-type: none"> - check the cable, - check the lifting strap, - check for moisture in the housing, - replace the top seal, - check the clearance in the pantograph arms, - check the cutting disc, - check the anti-friction disc bearing, 		
Only during the first maintenance or when replacing a pantograph arm, put Loctite243 on the pantograph screws and tighten to 7 Nm.		
Replace the cutting blades		
Inspect the cutting head motor, grease		
Inspect the backwards sensors: magnet, grease		
Rear silentbloc: replace if necessary or at least every 2 years. If the robot is equipped with a <i>raiser kit</i> (page 186), be sure to use the latest version.		
Inspect all cables: check connections, repair damage		
Remove the rear wheels		
Main box: check cables, boards, presence of moisture, <i>check the version of peripherals and replace if necessary</i> (page 187).		
Drive motor: Lubricate the motors during every service. Check and replace the axle, bearing and the seal on the outlet of the gear unit if necessary.		
Replace the rear wheels. Tighten them to 65Nm		

Tests after service		
	OK/NOK	If NOK, indicate why
Software version 3.5		
Height of cutting head (mm)		
Check history on Myrobot		

Service tests after service		
	OK/NOK	If NOK, indicate why
Charge		
Bumper		
Smartbox		
Lift Sensors		
Backward Sensors		
Signal Sensors		
Drive Motor		
Cutting Motor		
Sonar Sensors		
Lid		
Do 2 cutting height tests: highest/lowest/in_use and check all heads go to correct height		
Trajectory check: select a trajectory along a straight line 20..30m long without obstacles - check in particular if straight line followup (if possible)		
Noise: start the machine - report abnormal levels/noises (wheels, cutting heads,body vibrations,...)		
Noise: report any abnormal noise from the cutting height motors		

Remarks and Replaced parts

17 Glossary

Access parameters

Access parameters define how the robot enters and leaves the station. They only need to be defined for robots returning to stations that use a positioning beacon. They define the direction taken to return to the station and the distances used for the maneuvers. See [Access parameters](#) (page 78).

Start zone

Start zones define the distances used in the maneuvers when the robot leave the station, or where it will start mowing in a particular parcel. See [Start zones](#) (page 80).

Border mode

When the robot cuts the grass at the very edge of the field. This is done a number of times per week. Border mode is only used for a mono-field installation using a positioning beacon.

Entity

A collection of robots and users that operate within a site. Information about the robots in an entity can be viewed on the web server.

Field

An area of grass to be mowed with a defined boundary. This boundary is defined by a single peripheral wire.

Island

A loop in the peripheral wire specially installed to prevent the robot mowing inside it. The peripheral wire is taken around the obstacle and the approach and return wires laid next to each other.

Loopstep

A movement the robot makes when returning and leaving a charging station associated with a positioning beacon. During the loopstep, the robot turns through a right angle between the peripheral wire and the track border.

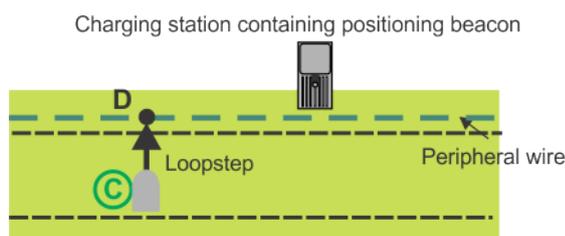


Figure 113: Loopstep move towards the wire

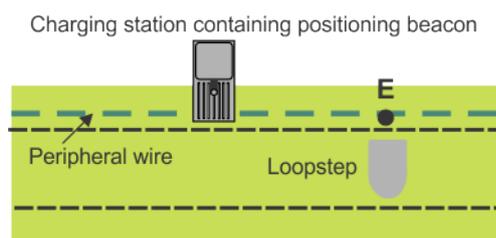


Figure 114: Loopstep move away from the wire

Obstacle

An object in the field that the robot must avoid. Obstacles can be permanent (e.g.. trees, furniture) or transitory, (e.g.. animals).

Obstacles are detected by sensors. Permanent obstacles can be avoided by making loops in the peripheral wire to form "islands" or "pseudo-islands".

Parcel

An area to be mowed within a peripheral wire. At least one parcel is associated with one wire.

Several parcels can be defined.

Percentage

This represents the proportion of time that the robot will spend working a particular parcel. If there is only one parcel, the robot will spend 100% of its time there.

Peripheral wire

A wire laid below the surface of the field to be mowed which defines the area to be mowed and controls the limits of the robot's movement. The area defined by the peripheral wire is termed a "parcel".

Pseudo-island

The peripheral wire is taken around the obstacle, maintaining a specific distance between the approach and the return wires.

Site

The entire area which includes the area to be mowed, as well as surrounding landscaping that is not mowed.

Station loop

A station loop is a short wire around a charging station which is used to guide the robot into the station. When the robot detects that it is in the station loop it follows the wire until it arrives in the station.

Station positioning beacon

A device, usually installed in the charging station, that emits a signal that allows the robot to accurately locate the charging station.

Terrain

An area of grass surrounding the field that is not to be mowed.

Track border

A width of grass around the edge of the parcel to be mowed. The robot follows the track border when leaving or returning to a station.

There is no track border specified for a wire that acts as a "return to station loop (page 201)".

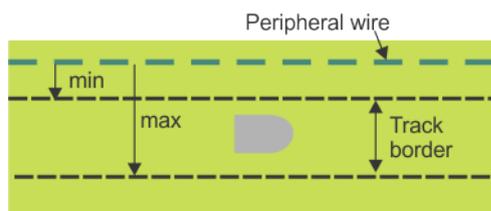


Figure 115: Track border

The track border lies next to the peripheral wire, and is defined by minimum and maximum dimensions set as installation parameters. It is wider than the robot. The path taken by the robot within the track border is selected in a random manner. This ensures

that the robot does not repeatedly move along the same path and so create ruts in the field.

If the robot encounters an obstacle whilst in the track border, the sensors will cause it to reverse and then rotate through a random angle in order to proceed. This may be repeated a number of times if necessary.

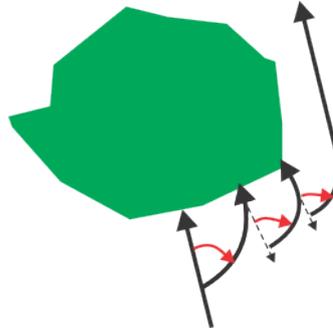


Figure 116: Maneuvers to avoid an obstacle within the track border

Trackwire

Movement of the robot along the peripheral wire as it enters and leaves the charging station.

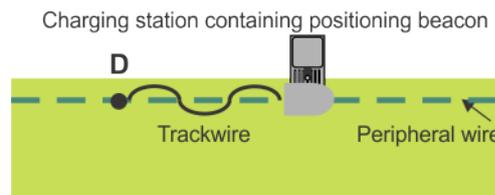


Figure 117: Trackwire movement to the charging station

Due to the manner in which the peripheral wire is detected, the Trackwire movement takes a "waveform" nature.

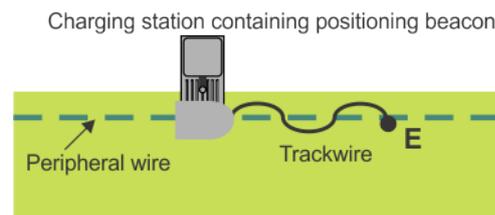


Figure 118: Trackwire manoeuvre to leave the charging station

18 Abbreviations

APN: Access Point Name (GSM)

BMS: Battery Management System

LFP: Lithium Ferrous Phosphorous

UWB: Ultra Wide Band

CPU: Central Processing Unit

GPS: Global Positioning System

AP: Access Point (WiFi)

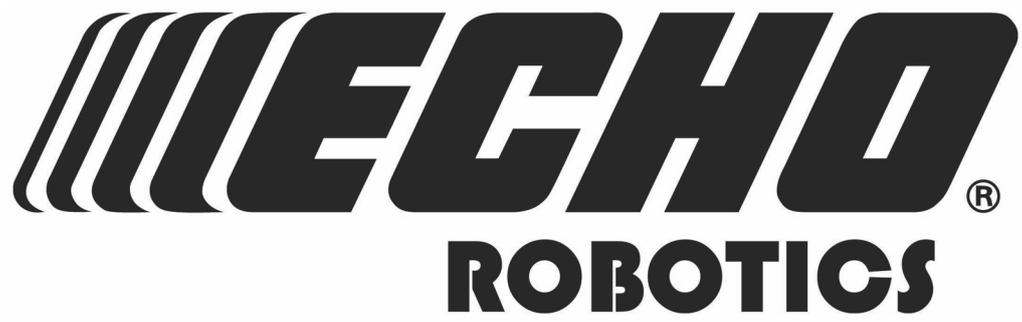
19 Robot registration details

Each robot should be registered on the portal.

You can note here the Serial Number and the Email address used in the registration.

Serial Number

Email address



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