Belrobotics
THE GRASS MASTERS

Big mow BM2000 User's Manual

Software version 4.5

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

BM2000 is the replacement for Bigmow. This manual refers to both models.

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Contents

1 What's New

Software Version 4.5

• Sonar problem detection and diagnostics have been improved.

Software Version 4.4

• Improved GPS navigation.

  This overcomes problems that could arise when the robot fails to calculate a GPS path to the target point when it is close to the border of the field. This applies in particular to tight corners with a small radius and when it is necessary to navigate through narrow passages.

• Slowing down near the border of a GPS zone.

  In previous software versions, the deceleration of the robot at the edge of a GPS defined zone for random mowing was quite abrupt. In rare cases, when the battery did not allow to recover this energy, the back EMF from the wheels could cause a system level over-voltage resulting in failure of electronic boards (peripheral board, smart box, …). Decelerating when approaching the border of a GPS zone avoids this.

• Track wire improvements.

  This reduces the occurrence of alarms indicating "wire lost" during track wire movements in corners.

• Track border improvements

  This improves the navigation with a minimum track border distance (when the robot is close to the wire) .

• Tilt alarm improvements

  When using a high traction force to move the robot up a slope, the front is easily lifted, triggering a tilt alarm causing the robot to stop.
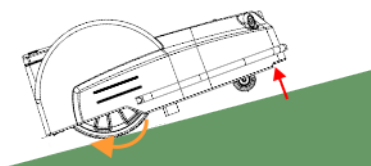
Figure 1: Tilt alarm triggered due to a slope

  The robot now waits for a certain time to check whether the tilt situation has been corrected. If it has, the robot will continue working.

• System level over-voltage, detection and protection of electronics.

  The main bus voltage is now constantly monitored. If it reaches a critical level the operation of the robot is shut down in a controlled manner to protect the electronics. If the system voltage remains high when the robot tries to restart, an alarm is triggered.

Software Version 4.3

• Patterned mowing is possible for robots set up to use RTK GPS positioning system.
• Robots can now operate in *border mode* (page 32) for multi-field installations.

- It is possible to prevent mowing on a specified parcel by *setting the cutting height of the blades to "disabled"* (page 53).
- *Parcel choice is based on work history* (page 36).
- *A robot will not cross unavailable fields when starting a new mission* (page 37).
- A *Max short cycles allowed* (page 60) parameter to limit the number of times the robot will execute a very short working cycle can be set.
- *Cutting heads disabled when returning to station* (page 26).
- *A robot will retry to dock after a failed connection* (page 26).

Software Version 4.2

This manual does not contain any information about using a charging station with a positioning beacon.

- Information about the portal is in a separate manual.
- Operation menu *Brake on idle* (page 59).
- *Cutting heads* (page 52). Cutting height can be set for a parcel.
- Return to station using GPS from multiple parcels. See *Go to charging station mode* (page 26).
- Exit from station using GPS. See *Go zone mode* (page 33).
- Options in a menu are presented graphically in a tree.

Release 4.1

- How to edit the robot's schedule using the web portal.
- The date format can be set using **Service Settings** > **Regional parameters**.
- The unit system used to display values can be set using **Service Settings** > **Regional parameters**.
- The system of returning to the station using GPS.
- An overview of all the signal channels can be seen by pushing **8** on the keyboard for 5 seconds.
- Additional information about the robot is available from **Service Settings** > **Device**.
- Additional icons have been added to the home screen on the *user interface* (page 44).
- The chapter on Troubleshooting has been temporarily removed and will be available shortly.

Release 3.5.1

- Corrections in the text.

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.
- Updates to the portal interface.

Release 3.1

- The contents of the *How Big mow BM2000 works* (page 22) 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 47) there is a new option to start the robot working in a specific parcel.

Release 3.0

LCD settings (page 56)

2 Introduction

This manual provides all the information required to use your Big mow BM2000 battery powered robotic lawnmower.

Big mow BM2000 is the new version of the Bigmow robot. All the information in this manual refers to the Bigmow robot using software version 4.5.

This manual contains the original instructions.

Your robot is installed by a Belrobotics authorized engineer. The configuration of your field is analyzed to determine the most suitable robot. The peripheral wire is installed, and the robot programmed according to the terrain and your requirements. Training is provided to enable you to manage the robot autonomously.

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 Belrobotics, without the need for prior announcement. Updated information can be obtained from your dealer and the website *https://myrobot.belrobotics.com/*.

Big mow BM2000 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 4.5

The current software version can be see by selecting ▤ -> **Device** from the interface screen or by viewing information about the robot on the web portal.

Related documentation

For related documentation go to the **Documentation** section on the web portal *https://myrobot.belrobotics.com*.

- MyRobot - User's Manual: for information about using the web portal.
- User manual (other languages).

Contact details

customerservice@yamabiko.eu

3 Conventions used in the manual

👉 **To charge the battery**	Indicates the start of a procedure to be followed.
blue text (page 9)	A link to another section of the manual.
green text (page 9)	A link to a word in the glossary.
Use active periods	Indicates an option to highlight in the user interface.
this is *less than* 5m	*italic* script for *emphasis*
1	An entry in the user interface
➡	Indicates a maintenance operation.
menu entry	Sequence of menu selections in the interface. **Infrastructure** > **Peripheral wires**
PARCELS	The name of a screen in the user interface.
{ }	Indicates a variable parameter value.
Robot Wi-Fi Access	User interface control on the smartphone app
| message |	Message displayed on the smartphone app

4 Big mow BM2000 description

This topic describes all the mechanical characteristics of the robot and the charging station .
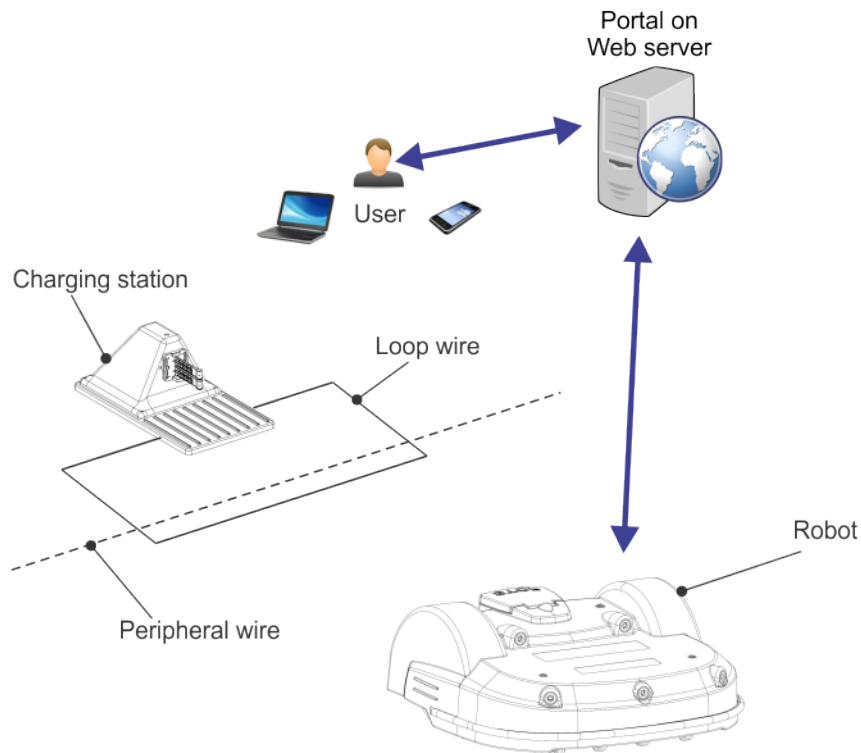
Figure 2: Components of the Big mow BM2000 mowing system

A user can exercise direct control over the robot using the User Interface. Once a robot is registered on the portal running on a web-server:
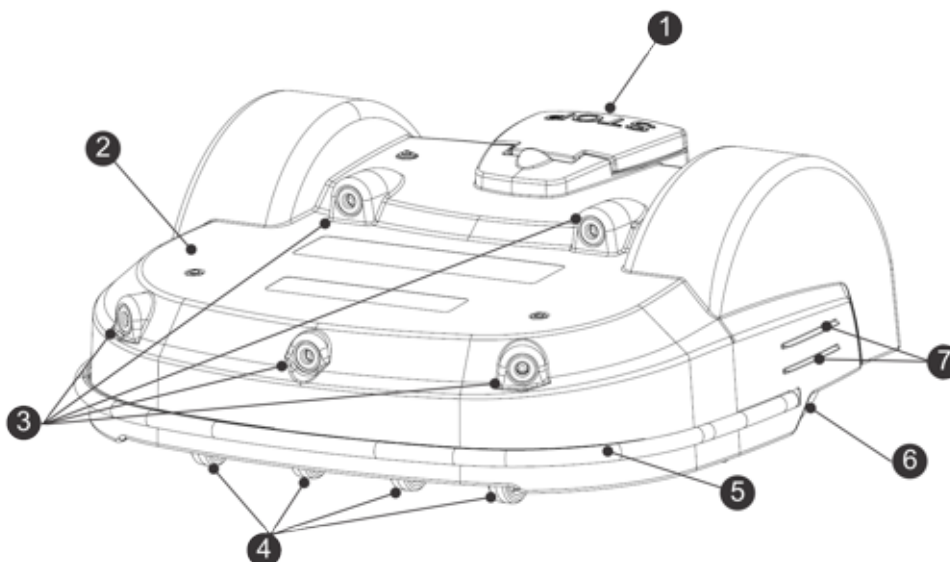
- the robot can send information to this server which can be seen by the user
- the user can issue commands to the robot, assess its performance and adjust the configuration.

Note however, that full control over the robot is only available with a subscription for that robot.

Go to *https://myrobot.belrobotics.com* .

4.1 The robot

Big mow BM2000 components

Figure 3: 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 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 *Sensors* (page 19).

(4) Front wheels

Front wheels.

(5) Bumper

The *bumper* (page 19) 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. See also *the slope kit option* (page 15).

(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.
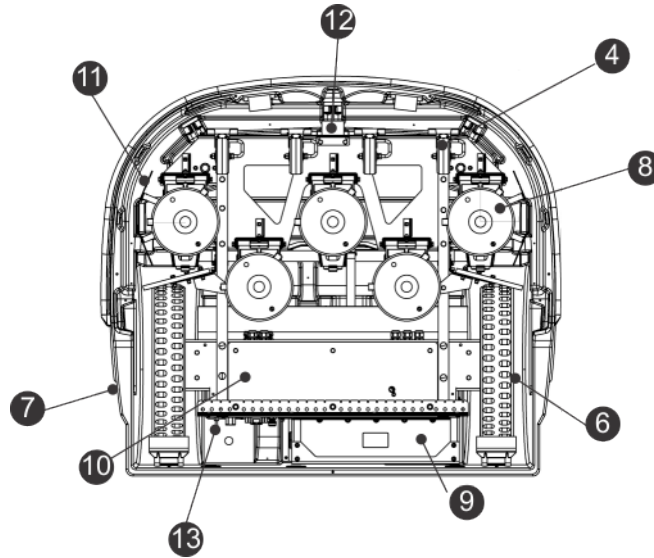
Figure 4: Bottom view of robot components

(8) Cutting heads

The robot is fitted with 5 rotating cutting heads. Each cutting head is equipped with three cutting blades, which are rotated on the head and which cut the grass.
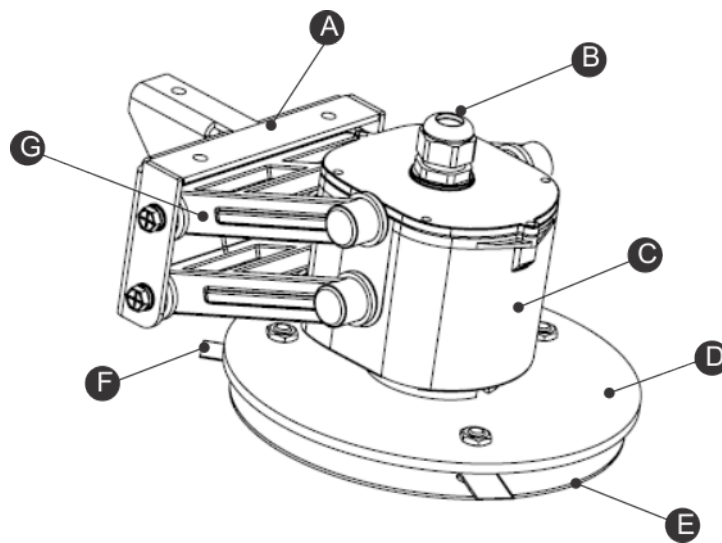
Figure 5: Detail of the cutting head

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

> **Note:** The blade support disc (**D**), the anti-friction disc (**E**) and the cutting blades (**F**) are referred to collectively as the "cutting disc".

If a problem is detected it is possible to *disable any number of cutting heads* (page 52).

Different *types of cutting blades* (page 16) are available depending on the mowing conditions.

The cutting blades need to be replaced on a regular basis to ensure optimal mowing performance. See *changing the cutting blades* (page 67).

The height of the cutting head determines the height of grass that is cut. This can be adapted to match the required conditions. See *setting the cutting height* (page 53).

(9) Battery

An LFP battery powers Big mow BM2000 whilst mowing. When the battery needs charging the robot will return to the charging station.

(10) Sealed Electronic box (Smartbox)

This contains the electronics and the robot motor.

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

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(11) Protection deflectors

These provide protection against a user's feet or hands coming into contact with the cutting heads.

(12) 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.

(13) On/Off switch
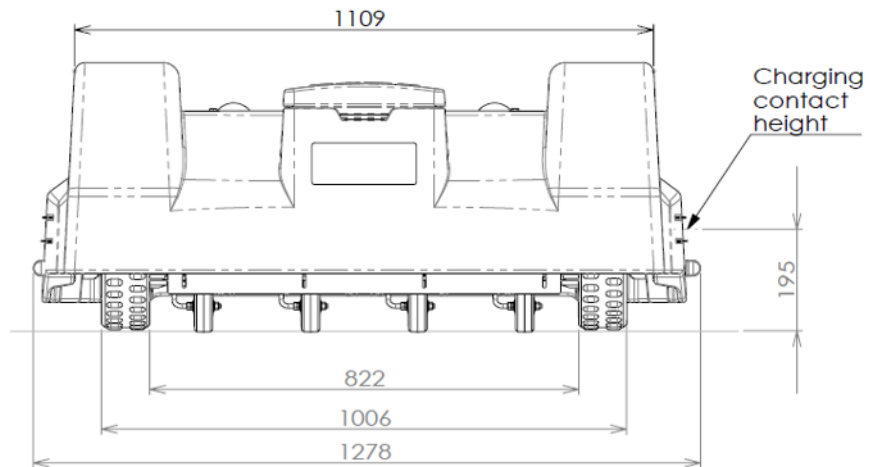
Switches the robot on or off.

Identification labels

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

Figure 6: Identification label under the Stop lid.

Dimensions

Figure 7: Rear view dimensions
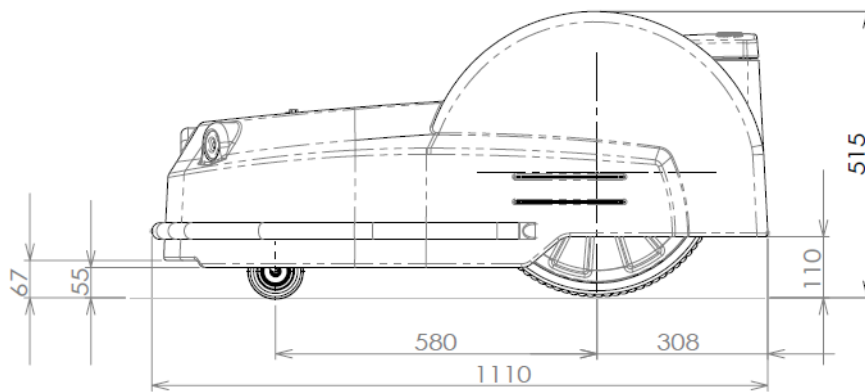
Figure 8: Side view dimensions
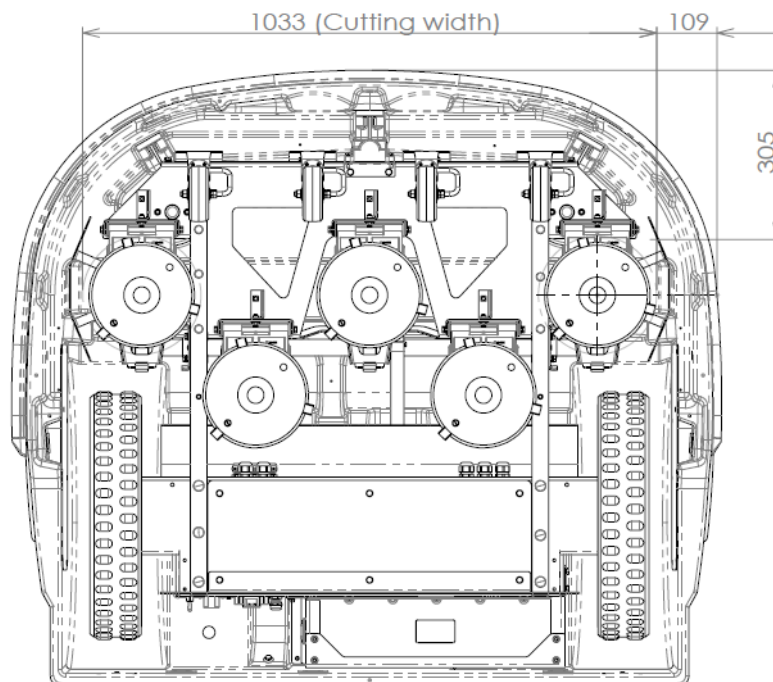
Figure 9: Bottom view dimensions

Technical details

For detailed technical specifications see *Technical specifications Big mow BM2000* (page 70) .

Sound level: The A-weighted emission sound pressure level is:

- >70dB dB at 1m distance
- 52 dB at 5m distance

Mass in kilograms: This can be seen on the identification label. See *Figure 6: Identification label under the Stop lid.* (page 13).

4.1.1 Robot options

Wheel brushes

The wheel brushes are installed behind the rear wheels to clean them.

Slope kit

For working areas where the robot needs to manage slopes of >45%, the slope kit provides more powerful motors to drive the wheels.

Groomer

A groomer is a device that can be fitted to the rear of the mower to improve the quality of the grass.

Figure 10: Groomer

The grooming device extends sprung tines vertically into the turf to remove thatch and horizontal runners. The result is that the grass is stimulated into more active ver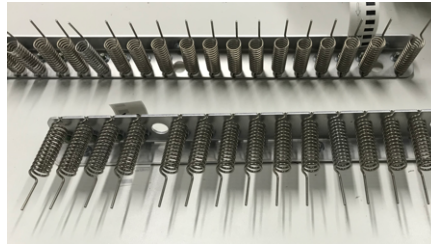tical growth as well as improved aeration and water penetration. Their regular use throughout the growing season leads to greatly improved turf on golf courses and playing fields.

Areas suitable for grooming	Areas Unsuitable for grooming
Sports fields that are flat and kept free from twigs, branches and dead leaves.	Rough areas.
	Areas with crossing paths.
	Areas that are covered with leaves and twigs during some parts of the year.

Blade types

Three types of cutting blades are available which vary in their hardness and durability.

Hard blades HRC 62

These blades can be identified by the engraving "0x".

These blades are durable and are not likely to break, but they have a tendency to wear around the fixation hole.

Soft blade HRC 48

These blades can be identified by the engraving "01".

These blades are not likely to break, but they do deform and need to be changed every week.

These blades are recommended for situations where the loss of a blade may cause injury, as on a sports field for example.

Mid-hard blades HRC 58

These blades have no engraving on them.

They have an additional collar around the fixation hole which reduces the risk of weakening in that area.

These blades are recommended for demanding applications.

📝 **Note:** The longevity of a cutting blade can be extended by taking a *number of measures* (page 69).

4.2 The charging station
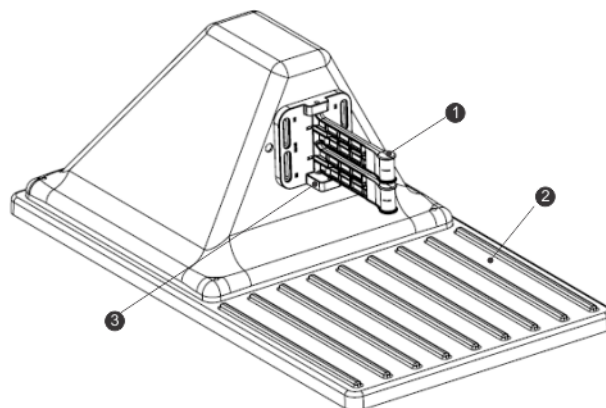
Figure 11: Components of the charging station

(1) Charge arms.

(2) Base.

(3) Occupation sensor. This is an optional feature indicating that the charging station is occupied in charging a robot.
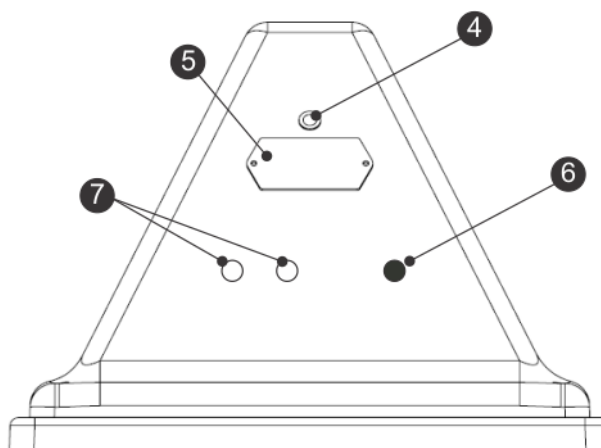
Figure 12: Rear view of the charging station

(4) LEDs which indicates the current state of the each wire:

- **Green - blinking**: wire 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. Contact a technician.
- **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. Contact a technician.

(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 13: Charging station identification label

5 Sensors

Big mow BM2000 is equipped with a comprehensive set of sensors that ensure its safe operation. These sensors ensure that the robot c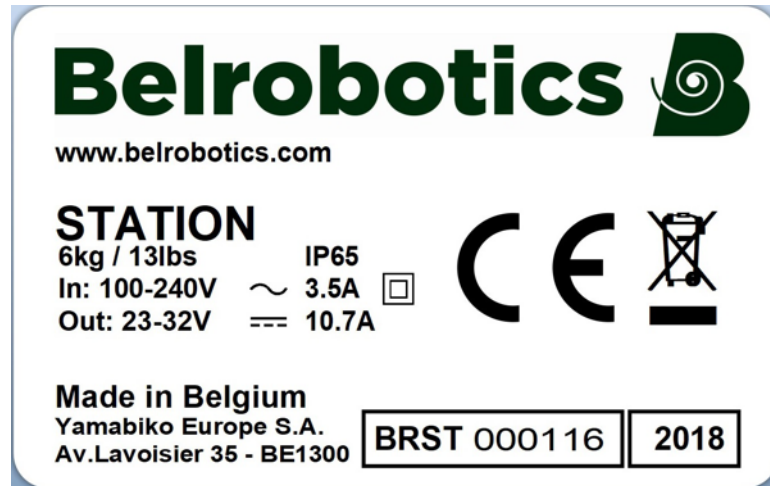an detect, and react if an obstacle lies in its path or if a small object is in danger of being damaged by the cutting blades.

Stop button

The stop button is easily visible, situated on the top of the robot (see *top view of the robot* (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 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).
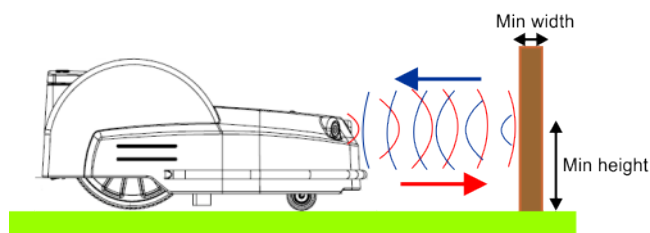
Figure 14: Detection of obstacles by sonar sensors

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 50mm 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.

If the robot is always moving at a slow speed, even if there are no obstacles in view, it indicates a problem with the sensors. In this case you should contact the after-sales team for help in analysing the problem.

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

Big mow BM2000 is fitted with sensors to detect when the robot body is lifted or displaced.
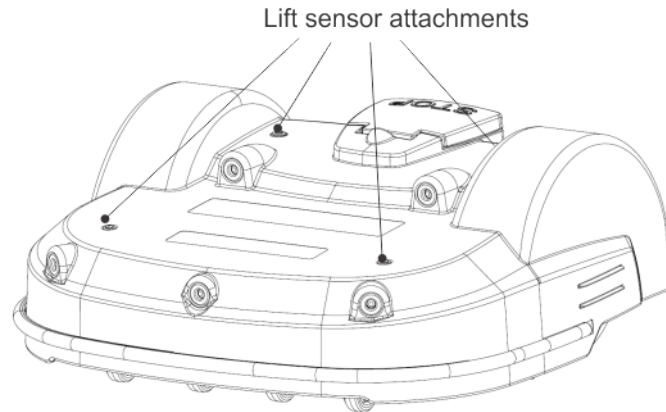
Figure 15: Location of the lift sensor attachments
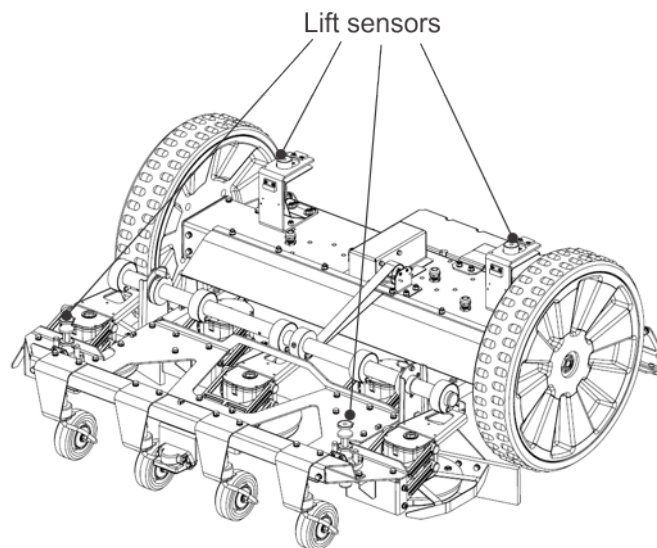
Figure 16: Lift sensors

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, 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.

Tilt/Rollover sensor

The tilt sensor detects the angle of the slope on which the robot is working. 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.

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 59).

6 How Big mow BM2000 works

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

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

Inactive state (page 38): The robot can enter an inactive state if there is a condition that causes the mowing mission (operational state) to be halted. The robot will return to the operational state when the problem has been resolved and/or a specific command has been issued to tell the robot to resume.

6.1 Operational state
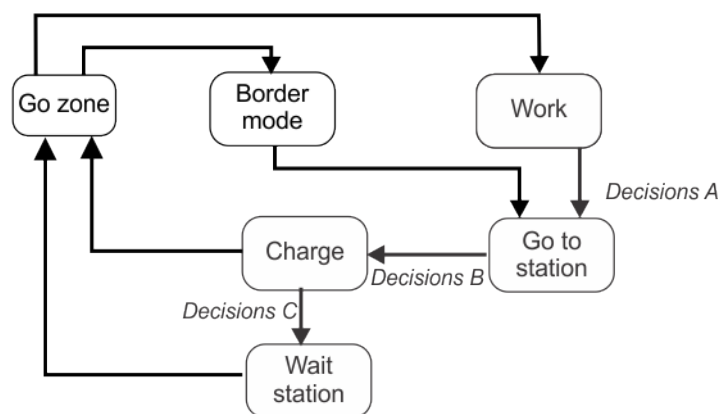
Figure 17: Operational state

In this state there are a number of modes:

Work

In this mode the robot mows the grass. For more details see *Work mode* (page 23).

Go to station

At a certain moment, which depends on the working schedule 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 26).

Charge

In this mode, the robot connects to the charging station and charges the battery. For more details see *Charge mode* (page 31).

Wait station

When the battery has been charged, the robot may remain at the charging station, depending on the working schedule and the current conditions. For more details see *Wait in charging station mode* (page 33).

Border mode

In this mode the robot mows the border of the field. For more details see *Border mode* (page 32).

Go zone

In this mode the robot performs a series of manoeuvres to leave the station and arrive at the point where it needs to start work. For more details see *Go zone mode* (page 33).

> **Note:** Programmed instructions can be over-ridden by instructions activated from the User Interface.

6.1.1 Work mode
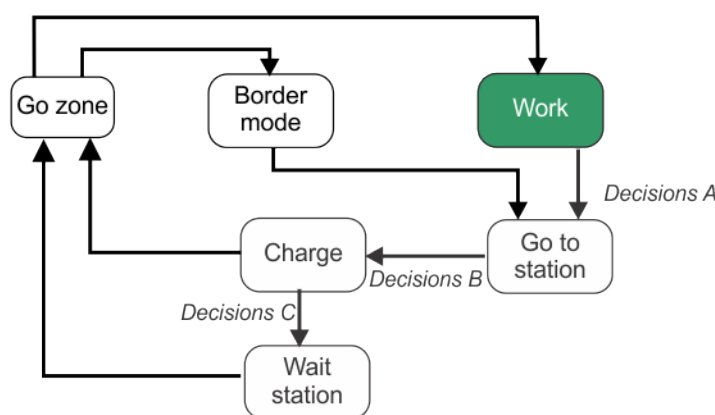
Figure 18: Work mode

When in work mode, Big mow BM2000 mows the grass in working areas. This can be in a parcel in the wire, or in a GPS zone. It executes random movements to ensure that the whole area is covered and that the robot's wheels do not leave traces on the grass.

- *Mowing using a random trajectory* (page 24).
- *Avoiding obstacles when working* (page 25).

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 scheduled mowing time has ended,

  (In the case of multi-field installations, this corresponds to the mowing schedule for the zone in which the robot is currently mowing.)
- An (external) command has been issued,
- The temperature is too low.

See *Go to charging station mode* (page 26).

6.1.1.1 Mowing using a random trajectory

Random mowing in a wired parcel
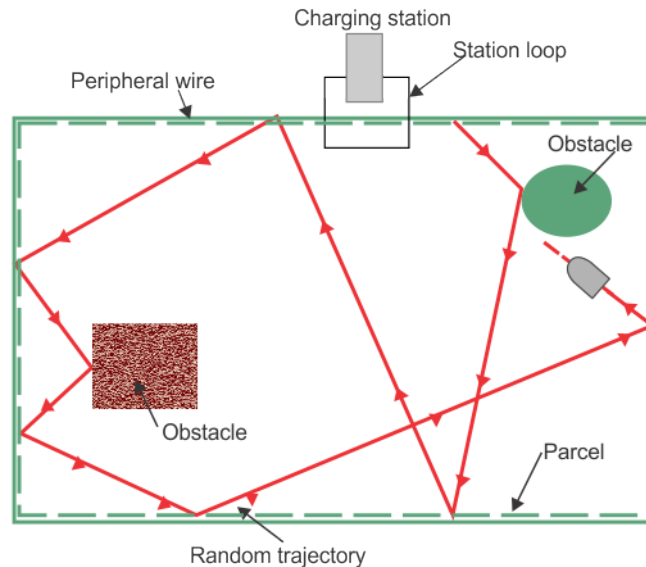
Figure 19: Random movement in a wired parcel

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.

Random mowing in a GPS defined zone

It is possible to create specific working areas defined by a set of GPS coordinates. A GPS zone is always associated with a wire, but allows the definition of zones with specific needs without having to install extra wires.
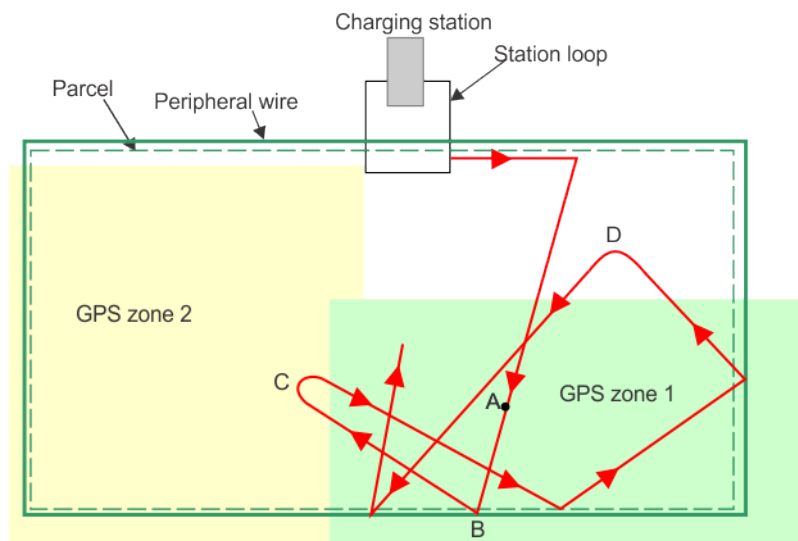
Figure 20: Random movement within a GPS defined zone

The robot will leave the station, turn through an angle and head towards to the centre of the GPS defined zone (**A**). It will then work in the zone using a random trajectory. It will stay in the zone as closely as possible, but GPS accuracy is +/-10m. If it detects that it has moved outside of the zone, (as at points **C** or **D**), it will stop, rotate and head back into the zone.

When it reaches a border of the zone that is bounded by the wire (**B**), it will rotate through an random bounce angle and then continue in a new direction (as described above).

6.1.1.2 Avoiding obstacles when mowing

This section describes how the robot deals with small obstacles within the working area. Larger, permanent and dangerous obstacles have to be avoided using wires or GPS NoGo zones which form part of the installation.

When mowing normally, the robot moves at a speed of about 1m/s (3.5km/h). 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 19). 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.
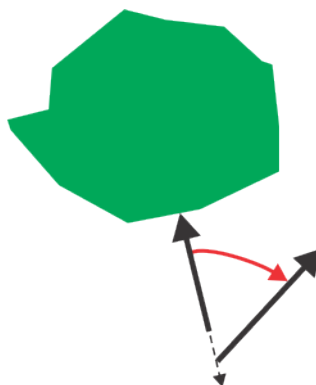
Figure 21: Robot maneuvers around an obstacle

6.1.2 Go to charging station mode
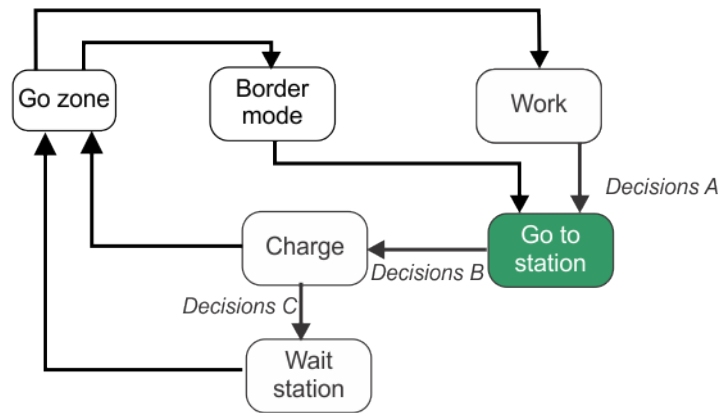
Figure 22: Go to station mode

Whilst working, the robot checks the current conditions and its scheduled instructions. As a consequence, at a certain moment, it will decide to return to its charging station. The reasons for this could be:

- The battery needs charging.

  When the battery voltage drops below a certain threshold, the robot will stop the cutting heads in order to save energy. This means that the robot can navigate for longer and increases the likelihood that the robot will reach the station before the battery is depleted.

- The scheduled work period is over.
- An external command has been issued.

The robot can use various methods to return to the station:

- The robot moves towards a **station loop wire using the track border** :
    - How the robot returns to the station from a *single field* (page 26).
    - How the robot returns to the station from *multiple fields* (page 28).
- The robot uses *GPS defined navigation points* (page 29) to locate the station.

> 📝 **Note:** When a robot fails to dock to the station or loses contact with the charging arm, it will depart from the station, go around the loop on the track wire and try to re-dock. This improves the chances of docking correctly and avoids discharging the battery.

6.1.2.1 Return to station loop from a single field

The default method to return to the station involves the robot following the track border. This is shown in the figure below. It is also possible for the robot to *Return to station using GPS* (page 29).
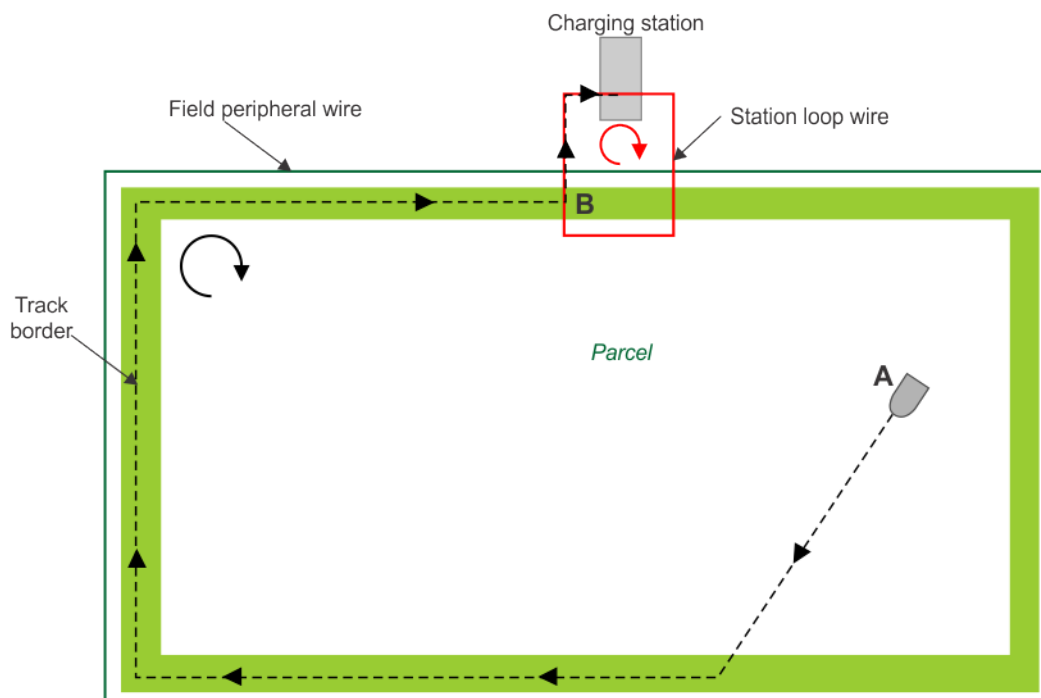
Figure 23: Return to station using the station loop

At point **A**, the robot decides to return to the charging station.

> 📝 **Note:** Point **A** may be in a wired parcel, as shown above, or in a GPS defined zone associated with the wired parcel.

It then moves towards the track border (page 76) and follows the track border of the single mowing field until it reaches point **B**. The direction when following the track border depends on the return direction defined for the parcel, which in the example shown above is clockwise.

When the robot reaches point **B**, it must follow the station loop wire until it arrives at the charging station. The route it takes depends on the return direction defined for the loop parcel.

When the return direction for the loop parcel matches that of the working loop, the robot will take the route shown in the figure below, which corresponds to the behaviour shown in the example above.
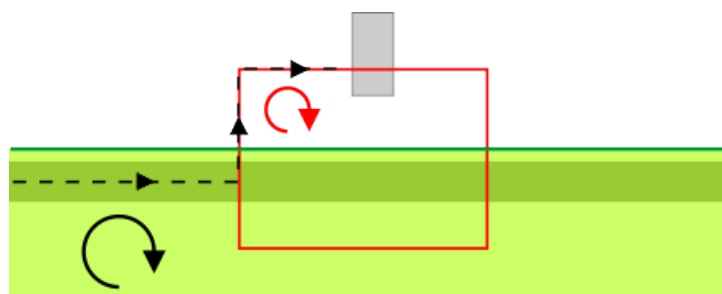
Figure 24: Matching return directions

When the return direction for the loop parcel is *opposite* to that of the working loop, the robot will take the route shown in the figure below.
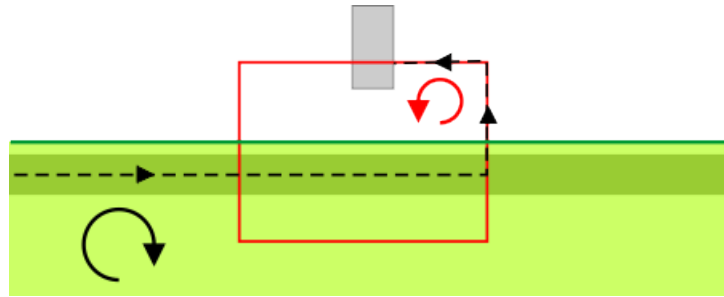
Figure 25: Opposite return directions

Once the robot has arrived at the charging station, it enters *Charge mode* (page 31).

6.1.2.2 Return to station loop from chained fields

The default method to return to station involves the robot following the track border. This is shown in the figure below. It is also possible for the robot to *Return to station using GPS* (page 29).
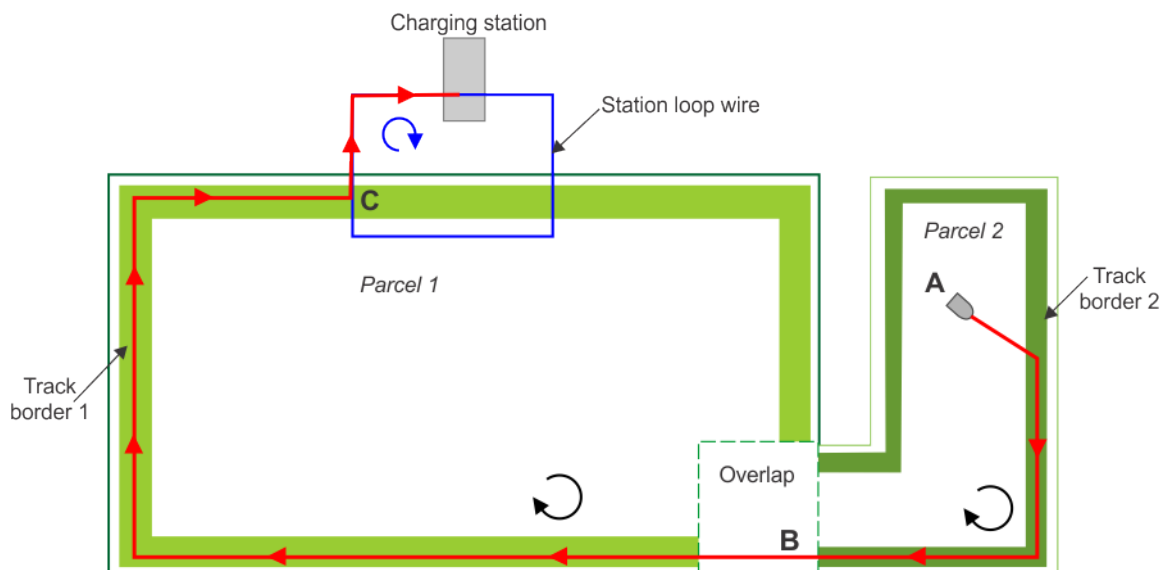
Figure 26: Return to station from chained fields using the station loop

At point **A**, the robot decides it needs to return to the charging station.

> 📝 **Note:** Point **A** may be in a wired parcel, as shown above, or in a GPS defined zone associated with the wired parcel.

It moves towards the track border in "Parcel 2" and then follows "Track border 2". The direction taken when it reaches "Track border 2" depends on the return direction defined for the parcel, which in the example shown above is clockwise. When the robot reaches point **B**, it will cross into Parcel 1.

It then follows "Track border 1" until it reaches point **C**. Once again the direction taken depends on the return direction defined for the parcel, which in the example shown above is clockwise.

When the robot reaches point **C**, it must follow the station loop wire until it arrives at the charging station. The route it takes depends on the return direction defined for the loop parcel.

When the return direction for the parcel loop matches that of the working loop, the robot will take the route shown in the figure below, which corresponds to the behaviour shown in the example above.
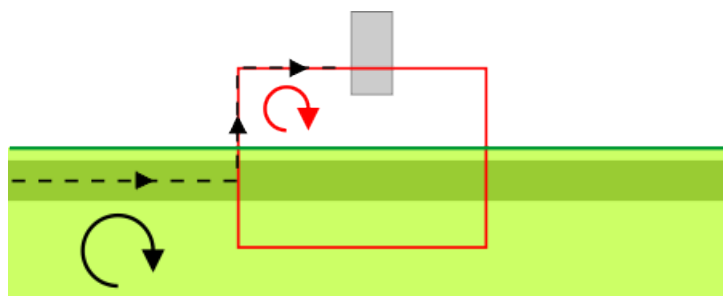
Figure 27: Matching return directions

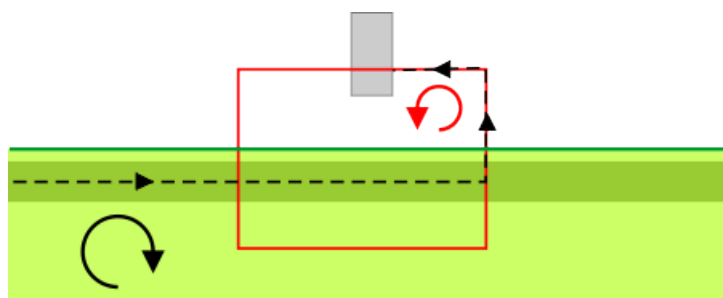When the return direction for the parcel loop is *opposite* to that of the working loop, the robot will take the route shown in the figure below.

Figure 28: Opposite return directions

Once the robot has arrived at the charging station, it enters *Charge mode* (page 31).

6.1.2.3 Return to station using GPS

GPS provides an efficient means for the robot to move through its working areas to return to and leave a station. It provides a number of steps in which the robot can move directly to defined points either close to a station or in a working parcel. If the robot is not able to use the GPS navigation system, it will revert to the default method to return to or leave a station by following the track border.

Return to station with a loop using GPS

An example of the manoeuvres to accomplish this are shown in the figure below. In this example, the dimensions of the overlap mean that the GPS point, must be placed outside of the overlap.
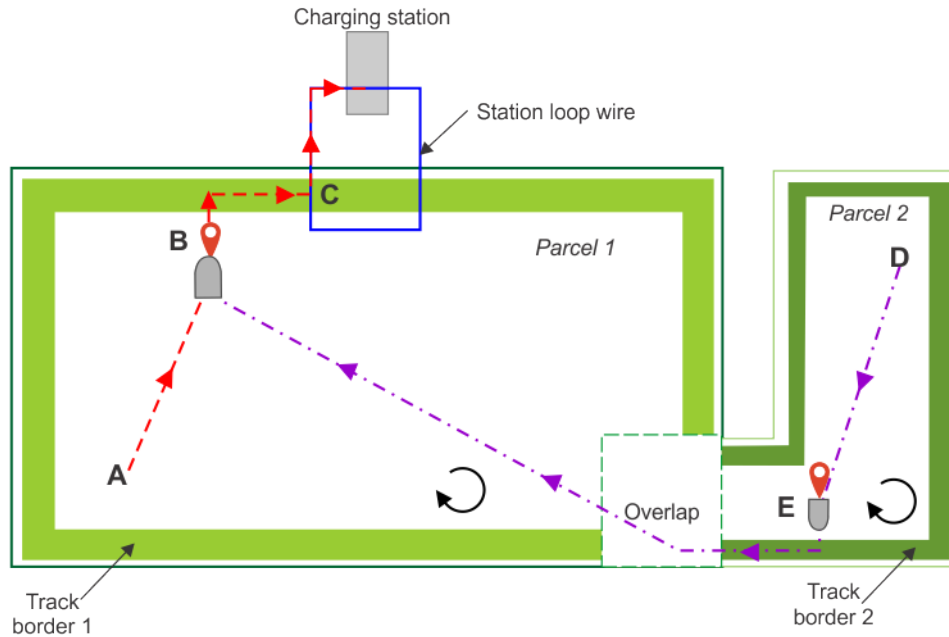
Figure 29: Return to station with a loop using GPS

These manoeuvres depend on whether the robot is in the parcel nearest to the station (Parcel 1) or whether it is in a neighbouring parcel (Parcel 2) when it needs to return to the station.

Robot is in Parcel 2: At point **D** the robot needs to return to its charging station. It will move directly to the GPS point **E** located in the current parcel. It will turn towards the wire and follow Track border 2 until it detects the wire of the neighbouring Parcel 1. The direction followed depends on the defined return direction for Parcel 2, which in this example is clockwise.

It will continue along the track border for a short distance and then move towards point **B** (which is the GPS point nearest the station). The procedure to return to the station from point **B** is given below.

Robot is in Parcel 1: At point **A** the robot will take the shortest route to the defined GPS point **B** close to its charging station.

Move from point (B) to the station

Once at point **B**, the robot will turn so that it is heading towards the peripheral wire. It will then follow the track border until it detects the loop wire, at point **C**.

When the robot reaches point **C**, it must follow the station loop wire until it arrives at the charging station. The route it takes depends on the return direction defined for the loop parcel.

When the return direction for the parcel loop matches that of the working loop, the robot will take the route shown in the figure below, which corresponds to the behaviour shown in the example above.
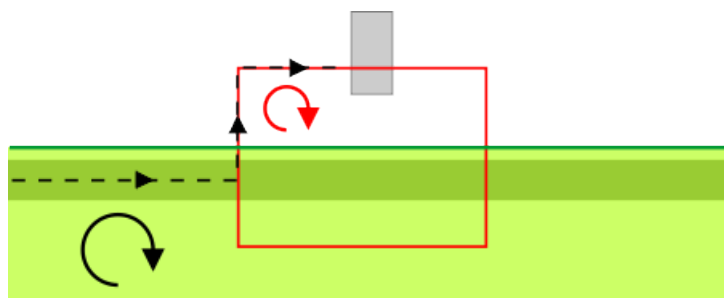
Figure 30: Matching return directions

When the return direction for the parcel loop is *opposite* to that of the working loop, the robot will take the route shown in the figure below.
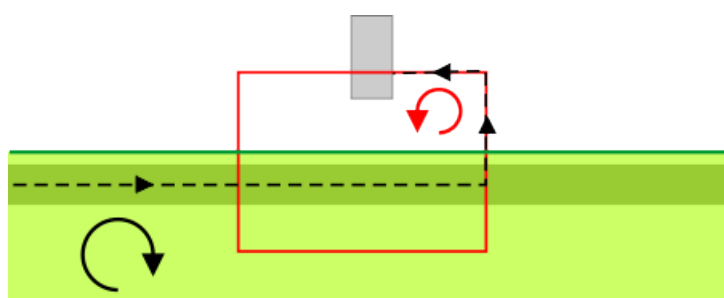

Figure 31: Opposite return directions

6.1.3 Charge mode
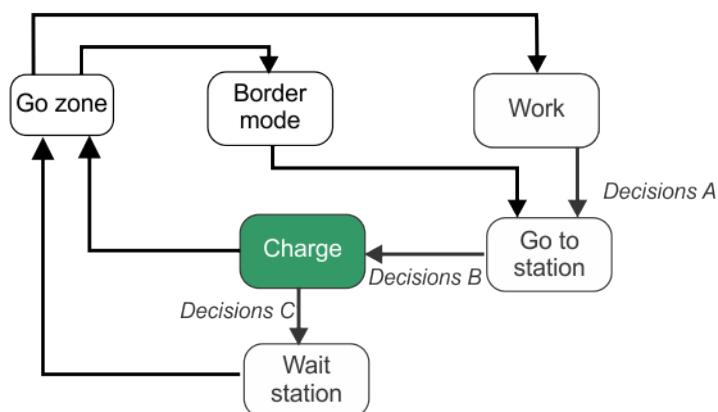
Figure 32: Charge mode

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

📝 **Note:** The battery can be charged if the *temperature of the battery* is above 5°C.

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 the robot's working schedule 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.

6.1.4 Border mode
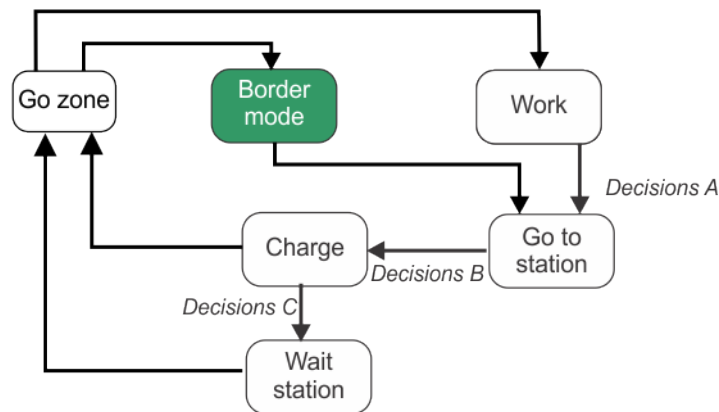
Figure 33: Border mode

When the robot is operating in border mode, it mows the very edge of the working field.

The robot executes border mode automatically a certain number of times per week. The number of times per week can be set as an *operating parameter* (page 53) for each defined working area.

When the robot mows the border, it will adopt the cutting height of the parcel.

When the robot has mowed the border, it returns to the station before continuing working according to its schedule.

6.1.5 Wait in charging station mode
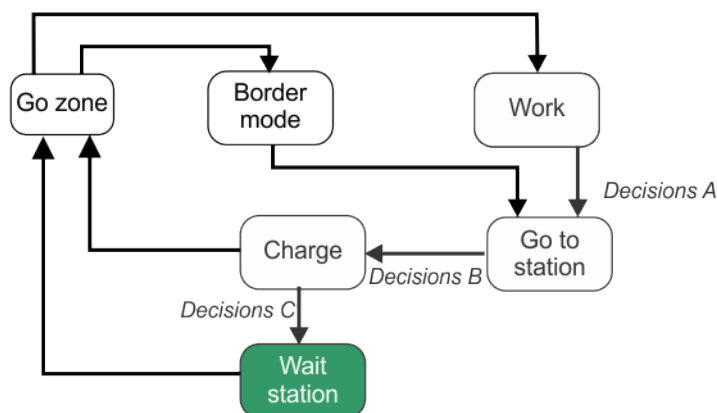
Figure 34: Wait in station mode

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,
- the temperature of the battery is higher than 5°C.

6.1.6 Go zone mode
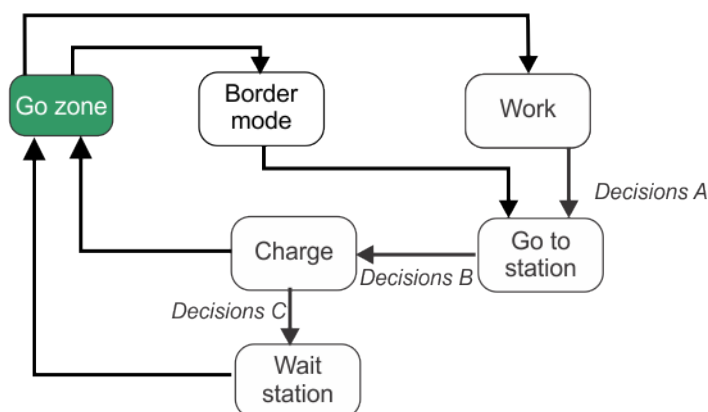
Figure 35: Go zone mode

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

The manoeuvres the robot makes to leave the station and start mowing depend on the type of installation configuration.

- *Exit station into a single working area* (page 34).

- *Exit station into multiple chained working areas* (page 34).

In the case of multiple working areas the robot must *choose in which one to work* (page 36).

6.1.6.1 Exit station into a single working area

The configuration shown below contains the parcel to be mowed and the station loop.

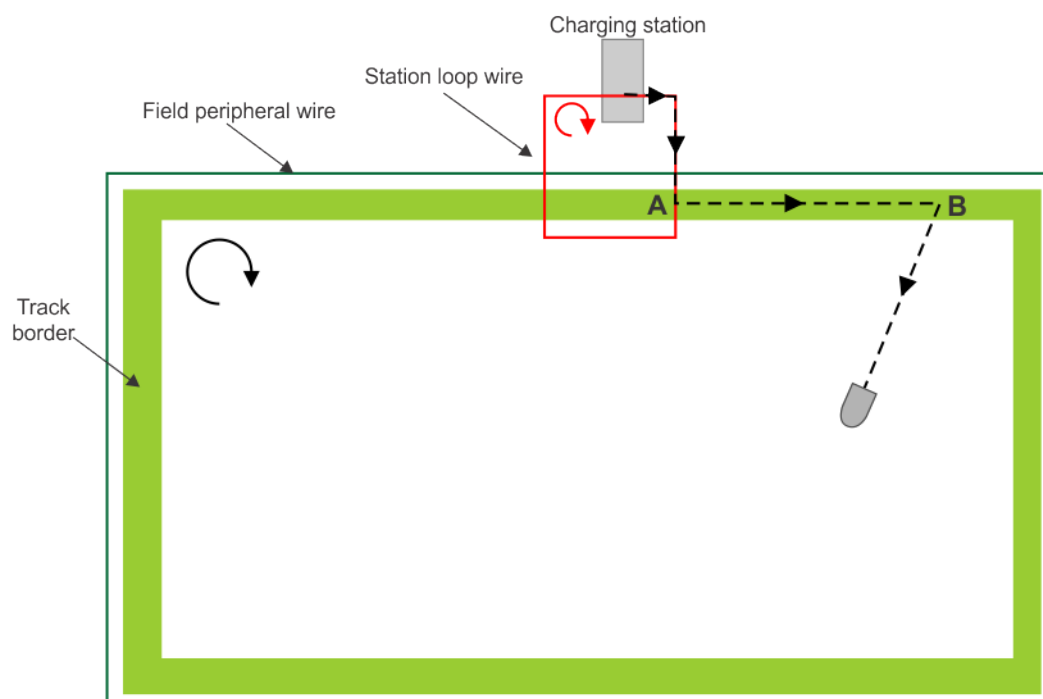**Note:** The parcel associated with the wire may contain GPS zones in which the robot is scheduled to work. The manoeuvres used to exit the station are the same.

Note: The robot may also leave the station to *mow the border* (page 32).

Figure 36: Leaving the charging station into single field

When the robot leaves the station it follows the station loop wire, until it reaches point **A** within the track border. The direction taken is defined by the return directions for the parcel to be mowed and the loop parcel. In the example above these are both clockwise.

At point **A** the robot 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.

6.1.6.2 Exit station into multiple chained working areas

In this configuration there are multiple wires, each defining a parcel (area to be mowed), as well as the station loop wire.

Note: The wired parcels may also contain GPS zones in which the robot is scheduled to work.


> **Note:** The robot may also leave the station to *mow the border* (page 32).

Before leaving the station the robot must decide where to start mowing. See *Choosing where to work* (page 36).

This topic describes the default manoeuvres used to leave the station and how the robot leaves the station *using GPS navigation points* (page 35). If the GPS mode is not available the robot will revert to the default manoeuvres.

Go zone default behaviour

The figure below illustrates the example of when the robot starts mowing in "Parcel 2" (or a GPS zone in "Parcel 2").
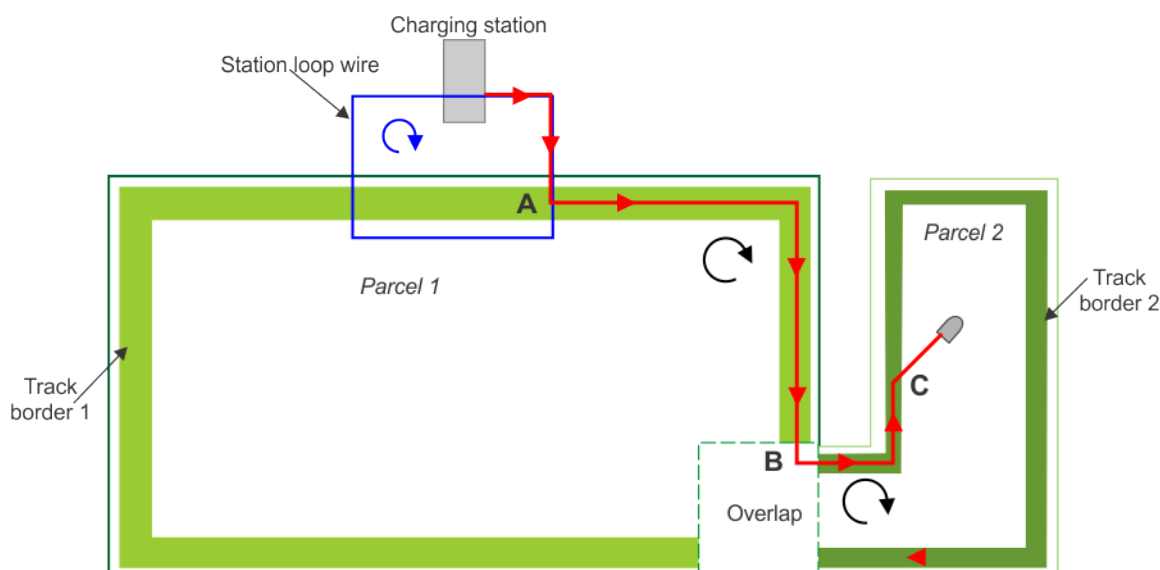
Figure 37: Leaving the charging station into multiple fields

When the robot leaves the station it follows the station loop wire, until it reaches point **A**, within the track border. The direction the robot takes depends on the return direction for the station loop. In the example above, this is clockwise.

At point **A**, it will turn and follow the track border of the parcel connected to the station loop. Once again the direction it takes depends on the defined return direction for Parcel 1. In this case it is clockwise.

It will follow the track border until it reaches point **B**. It will then follow the track border in Parcel 2 according to the return direction for this parcel (clockwise in this example) until it reaches point **C**. At this point it will turn into the field and start mowing.

Exit station using GPS navigation points

The movement of the robot from the station into a neighbouring parcel can be accomplished more efficiently using GPS. In this case a GPS point is defined in the parcel connected to the station near to the overlap between the two parcels as shown in the figure below.
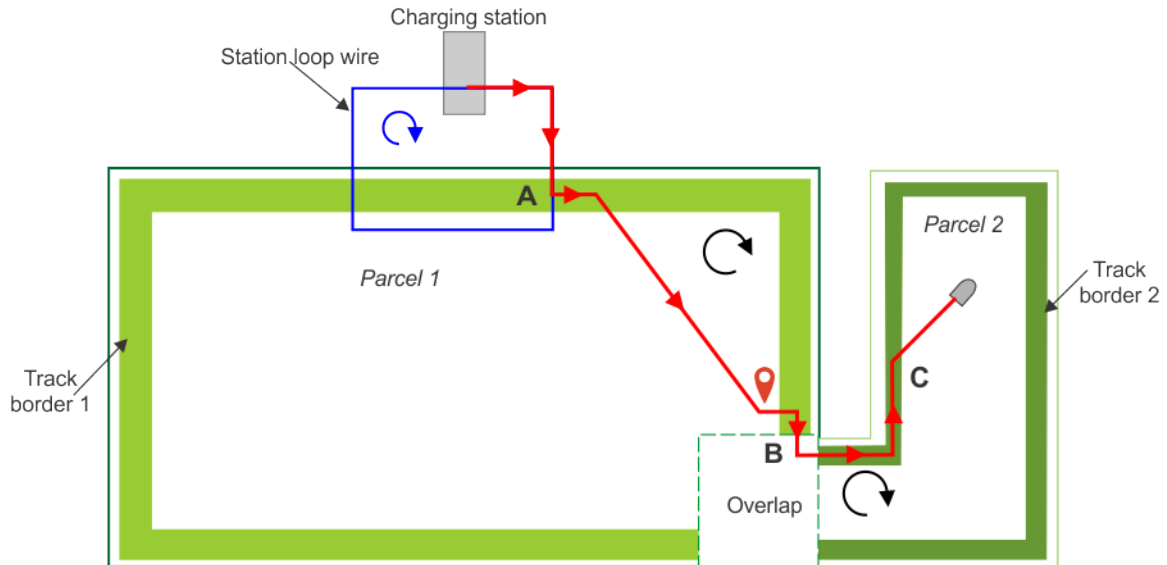
Figure 38: Go zone using GPS into multi-fields

When the robot leaves the station it follows the station loop wire, until it reaches point **A**, within the track border. The direction the robot takes depends on the return direction for the station loop. In the example above, this is clockwise.

It will follow track border 1 for a short distance and will then take a direct path to the GPS point (**B**) located in Parcel 1. This point will be near or inside the overlap between the two parcels.

From **B**, it will turn towards the track border and follow it towards the overlap until it detect the wire of the neighbouring Parcel 2. It will then follow track border 2 until it turns into the field to start working.

6.1.6.3 Choosing where to work

When there are multiple areas (parcels or GPS zones) in which the robot can work, the robot must decide where to work when it starts a new cycle. (page 74) This decision is based on two fundamental criteria:

- The defined working schedule.
- The percentage of time allotted to a parcel.

Working schedule

When a schedule is defined, which dictates exactly where the robot should work, the robot will follow the schedule. This will override the percentage of time allotted to a working area.

The schedule for a robot can be set using **Settings** ⚙ > **Schedule** or from the web portal.

Working without a schedule

If no schedule is defined, OR if the schedule allows the robot to work in any parcel or zone, the robot will choose the parcel according to the percentage of time allotted.

This is illustrated in the figure below, where it can be seen that before 12:30h and after 15:30h the robot can work in any of the three zones. In this case it will choose the parcel or zone according to the allotted percentage.

Figure 39: Overlapping work schedules

This decision is based on the actual time spent working in a parcel which the robot logs over a period of 14 days. At the start of each cycle, the robot will choose the parcel where the difference between the actual time and the allotted time is the greatest. If the percentage allotted to parcels is modified, the working history is reset.

The percentage of time allotted to a parcel is set using **Service settings** ▤ > **Operations** > **Edit parcels percentage**.

6.1.6.4 Crossing parcels

The robot can be optionally configured not to cross one parcel to work in another if the parcel it needs to cross is unavailable.

This is useful in the case of two sports fields. In the example shown below, the robot must cross Sports Field 1 to work in Sports Field 2. However it can be configured to *not* cross Sports Field 1 if this field is in use, as dictated by the schedule.
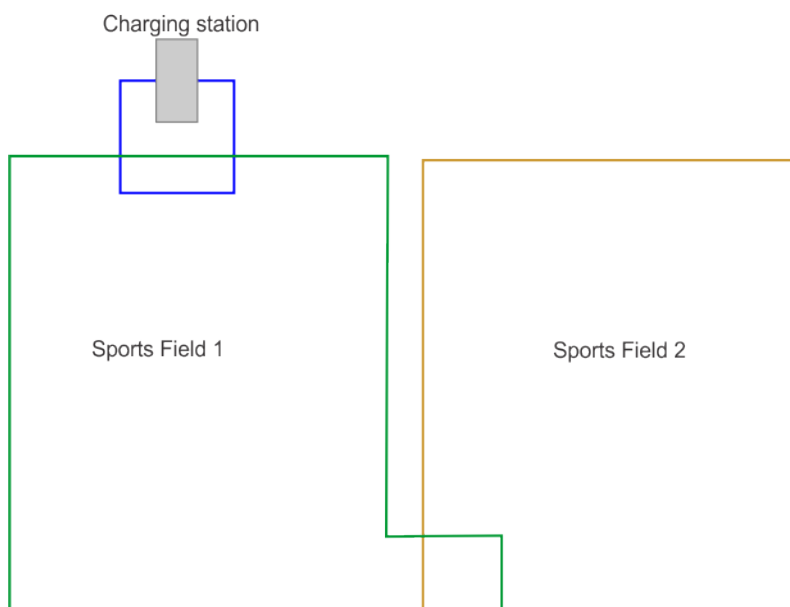

Figure 40: Crossing parcels

An example of such a schedule is shown below. The robot is scheduled to work in Sports Field 2 from 14:30h until 16h. But Sports Field 1 is unavailable from 13:30h until 16:30. The robot can not therefore access Sports Field 2.
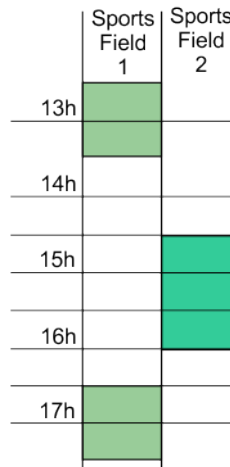
Figure 41: Sports field schedules

If it is necessary that the robot works in Sports Field 2 while Sports Field 1 is in use, there are two solutions:

- The robot can be configured to enable it to cross an unavailable parcel.
- The schedule can be adapted, so that the Sports Field 1 is available before the robot needs to work in Sports Field 2.
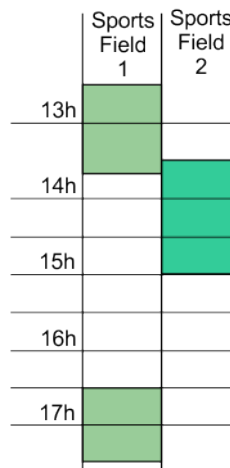
Figure 42: Adapted sports field schedules

When the scheduled working time for Sports Field 2 is complete, or it needs to charge its battery, the robot will cross Sports Field 1 to return to the charging station. The return to station manoeuvre takes priority over the schedule.

Parcels connected to the loop are always available.

6.2 Inactive state

A condition may arise which causes the robot to stop its autonomous mowing mission and enter an inactive state. Reasons for this could be:

- the robot has encountered a problem and has issued an **alarm**.
- the mission has been **manually stopped**.

In both these situations there are mechanisms for managing the power consumption of the robot.

Alarm
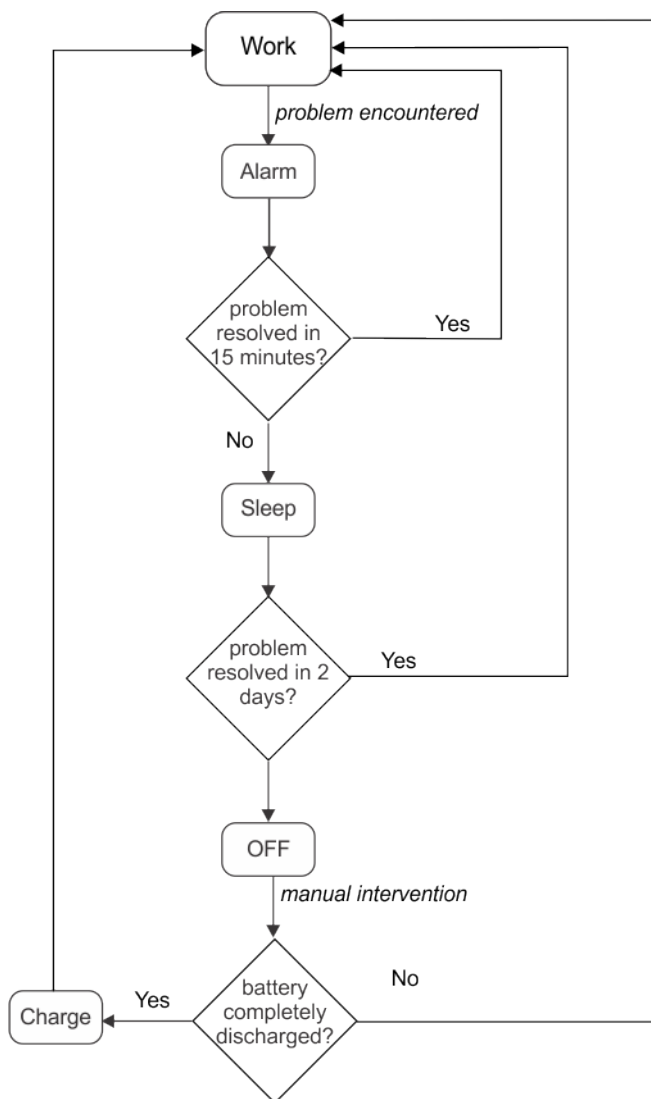
Figure 43: Inactive modes following an alarm

When the robot encounters a problem it will register an alarm, which will eventually require manual intervention.

If the alarm has not been cleared after 15minutes, the robot will enter "sleep mode". In this state the robot will reduce its power consumption, by shutting down everything apart from the modem.
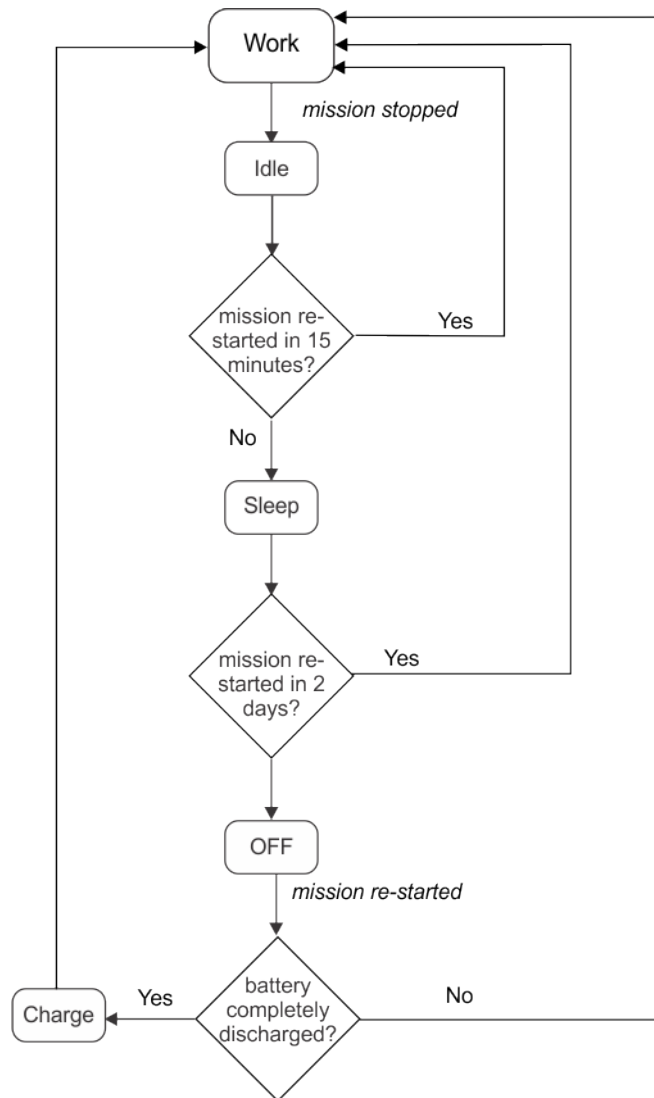

Note: Sleep mode will only be enabled if the robot has been switched on for more than one hour.

It will continue in "sleep mode" for 2 days, or until the battery reaches a very low level, after which it will switch itself OFF.

This will require manual intervention:

- either to clear the alarm and resume the autonomous work mode,
- or to push the robot to a charging station to charge the battery.

Mission stopped

Figure 44: Inactive modes following a manual halt

In this case the robot will enter into an "idle" state. By default, after 15 minutes of being idle, the robot will enter the "sleep mode" described above, in which the power consumption is reduced to a minimum. It will continue in "sleep mode" for 2 days, or until the battery reaches a very low level, after which it will switch itself OFF.

Before resuming working the robot will perform a self test, to check the integrity of the entire system (including electronics, sensors, mechanics and software).

- If the result of the self test is successful, the robot will resume the autonomous working state.
- If the result of the self test is NOT successful, the robot will register an alarm, which will require and intervention.

7 Using your robot

Your Big mow BM2000 robot has been installed and configured according to your requirements.

Before using the robot refer to the *Safety measures* (page 41).

There are a number of *Safety notices* (page 42) 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.

The user interface enables you to manage the operation of your robot.

7.1 Safety measures

Note: Before starting your robot, check that the working 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 (worn parts, missing screw or nut, defective cable, ...), stop the machine and contact an authorized technician.

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 pets unattended in the vicinity of the machine when in operation.

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.

7.2 Safety notices

The symbols shown below appear on all robots. Each of them is described below.

⚠️ 📖	**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.
	Instructions: Read this manual carefully before using this machine.
	Yamabiko Europe 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.

⚠️ 🛑🔧	**Handling the machine:** *Never* place hands or feet under or near the machine when it is operation.
	Stop the machine: Always stop the machine and wait for the moving parts to stop before handling the machine.
	Operate the disabling device (ON/OFF switch) before working on or lifting the machine.

	Handling the machine: *Never* place hands or feet under or near the machine when it is operation. **Keep a safe distance:** Always keep a safe distance from the machine when operating.
	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. **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.
	Animals: Keep animals away from the robot when it is operating. **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.
	Water: Cleaning with water systems can cause damage. **Gloves:** Protective gloves must be worn when handling the robot, especially the cutting system.
	Keyboard: The robot is protected by an access PIN code. **Lock:** The robot is equipped with an anti-theft system.

8 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.

Your Belrobotics technician has pre-programmed your robot according to your needs, but this interface enables you to see the current status, modify the settings and issue particular instructions.
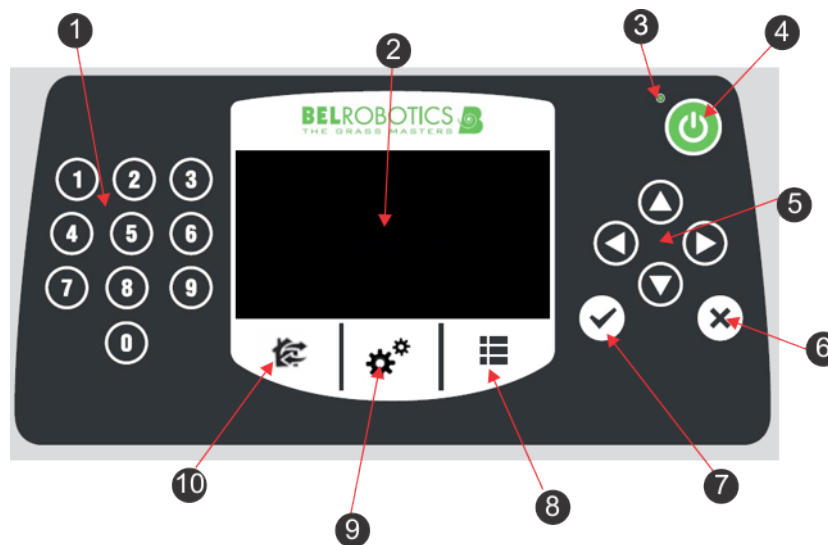
Figure 45: Components of the user interface

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 45).

(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 57).

(9) Settings menu button

Allows you to define operational settings. See *The Settings menu* (page 49).

(10) Action menu button

Allows you to issue a number of operating instructions. See *The Actions menu* (page 47).

The LED screen

Name

The name of the robot. *To change the robot name* (page 60).

Cloud

Indicates that the robot is connected to the web portal.

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 60).

Mobile signal level

Indicates the robot has a mobile signal.

No mobile connection

This icon indicates that there is no mobile connection.

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.

No WiFi

Indicates that the WiFi setting is OFF.

WiFi Access Point (AP)

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

Battery charge level

Percentage of battery charge.

Message

Shows the current status of the robot or alarm.

8.1 User Interface Commands

Commands area available from three menus.

Actions

Provides a number of direct missions for the robot.

Settings

Defines parameters controlling the operation of the robot

Service settings

Provides a set of commands most commonly used by service technicians.

The table below lists all the commands available from these menus.

Table 1: Commands available from the user interface

Command / parameter	Route
Activation code	**Service settings** > **Device**
APN	**Service settings** > **Device** > **Device info**
Bootloader ver.	**Service settings** > **Device** > **System version**
Border	**Actions**
Border	**Settings**
Brain version	**Service settings** > **Device** > **System version**
Brake on idle	**Service settings** > **Operations**
Change pin code	**Service settings** > **Security** > **PIN code**
Charge & stay	**Actions**
Cutting heads	**Settings**
Cutting height	**Settings**
Date format	**Service settings** > **Regional parameters**
Device info	**Service settings** > **Device**
Edit parcels percentage	**Service settings** > **Operations**
Enable pin code	**Service settings** > **Security** > **PIN code**
Go charge	**Actions**
IP address	**Service settings** > **Connections**
Language	**Service settings** > **Regional parameters**
Latitude	**Service settings** > **Device** > **Device info**
Longitude	**Service settings** > **Device** > **Device info**
MAC address	**Service settings** > **Device** > **Device info**
Max short cycles allowed	**Service settings** > **Operations**
Min temp	**Service settings** > **Operations**

Command / parameter	Route
Mode	**Service settings** > **Connections**
Mow	**Actions**
Mow after charge	**Actions**
Mow now	**Actions**
PIN code	**Service settings** > **Security**
Robot name	**Service settings** > **Device**
Schedule	**Settings**
Search for networks	**Service settings** > **Connections**
Serial number	**Service settings** > **Device** > **Device info**
Software version	**Service settings** > **Device** > **System version**
SSID	**Service settings** > **Connections**
Stay in station after charge	**Actions**
System locking	**Settings**
System version	**Service settings** > **Device**
Time zone	**Service settings** > **Regional parameters**
Unit system	**Service settings** > **Regional parameters**
Version	**Service settings** > **Device** > **System version**
Visible satellites	**Service settings** > **Device** > **Device info**

8.2 ☙ 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 47).
- *when the robot is at the charging station* (page 48).

Operations when the robot is in the field

Actions menu
|————Go charge
|————Charge & Stay
|————Mow
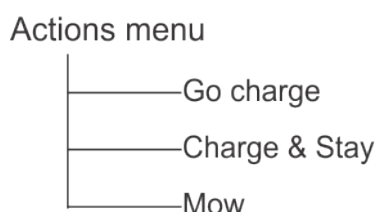
Figure 46: Overview of Actions menu in the field

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.

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.

☞ **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 the closed contact Belrobotics .

Operations when the robot is at the charging station

Actions menu

Mow now

Mow after charge

Stay in station after charge

Border
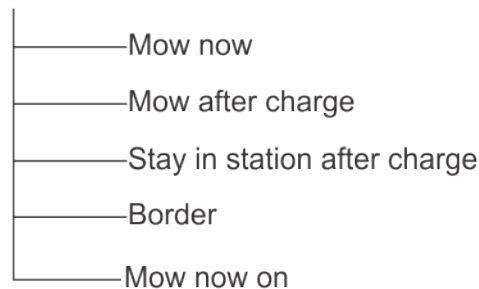
Mow now on

Figure 47: Overview of Actions menu at the station

Use these operations to override the regular operating schedule.

Mow now

Leave the charging station and continue mowing.

Mow after charge

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

Stay in station after charge

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

Border

Execute *Border mode* (page 32) and then return to the charging station.

Mow now on ...

This option appears when there is more than one parcel to be mowed. Leave the charging station and continue mowing in a specific parcel. A list of (neighbouring) parcels appears in which you can choose the required one. Only those parcels with a working percentage of more than 0% are listed.

👉 **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 the closed contact Belrobotics .

8.3 The Settings menu ⚙

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

```
Settings menu
        ├──────── Schedule
        ├──────── Cutting heads
        ├──────── Border
        ├──────── Cutting height
        └──────── System locking
```
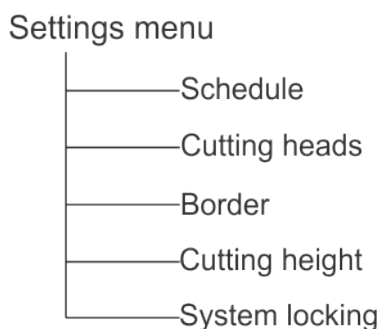
Figure 48: Overview of Settings menu

See also: *LCD settings* (page 56).

8.3.1 Schedule ▶

This command enables you define the working schedule for the robot. It defines the times when the robot can or cannot enter a parcel or GPS zone to work.

> 📝 **Note:** A schedule can also be defined using the web portal.

A schedule influences how the robot works. See also:

- *Choosing where to work* (page 36).
- *Crossing parcels* (page 37).

- A working schedule can be defined for each day of the week.
- A number of working periods can be defined for each day, each parcel and each GPS zone.
- 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 working 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 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.

```
┌─────────────────────────────┐
│   │Mon│Tue│Wed│Thu│ Fri│Sat│Sun│
│ 88│   ║  ║  ║   ║  ║  ║  ║   │
│   │   ║  ║  ║   ║  ║  ║  ║   │
│ 12│   ║  ║  ║   ║  ║  ║  ║   │
│   │   ║  ║  ║   ║  ║  ║  ║   │
│ 24│   ║  ║  ║   ║  ║  ║  ║   │
│Edit ▶                       │
└─────────────────────────────┘
```
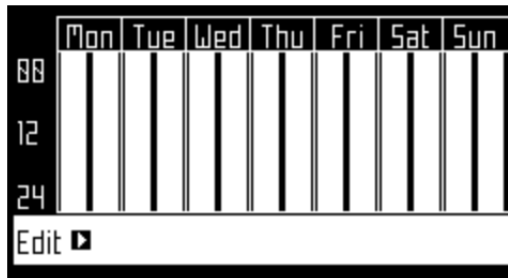
📝 **Note:** By default all the time periods will appear white, meaning the robot will work continuously.

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

   The following screen appears.

```
┌─────────────────────────────┐
│       PARCEL SCHEDULE       │
│ Parcel 1 ▶                  │
│     Follow sched.      ▣    │
│ Parcel 2 ▸                  │
│     Follow sched.      ▣    │
└─────────────────────────────┘
```

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 ☑

```
┌─────────────────────────────┐
│ Mon│Tue│Wed│Thu│Fri│Sat│Sun │
│ Period 1      06:55-09:05   │
│     Active         ▣        │
│ Period 2      00:00-00:00   │
│     Active         □        │
│ Period 3      00:00-00:00 ▾ │
└─────────────────────────────┘
```

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 51).

11. Press ✖ to return to the `PARCEL SCHEDULE` screen shown above.

12. 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.

> ⚠ **Important:** When creating a schedule for GPS zones, the schedule for the wired parcel associated with the zones must be set to continuous, i.e. shown as solid white.

👉 To copy the schedule from one day to another

1. Follow the procedure above to define the mowing schedule for one day.

2. When all the required periods have been defined, use the down key to highlight `Copy`. Press ☑.

The following screen appears.
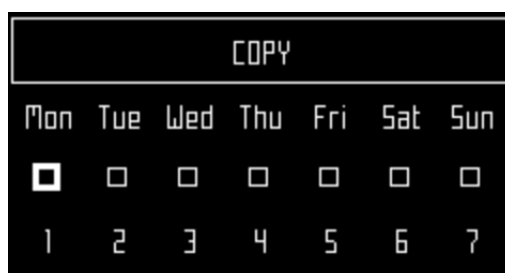
3. Press the number key that corresponds to *the day to which the schedule is to be copied*. More than one day can be selected.
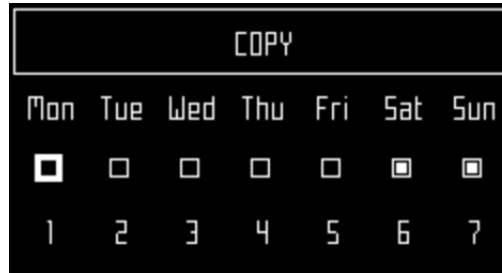
4. Press ☑.

5. Press ✖ to return to the overview of the schedule.

👉 To ignore the working schedule

1. Press ☰.

2. Highlight Edit .

3. Press ☑.

4. Use the arrow keys to highlight Follow sched. and press ☑ to uncheck the button.

8.3.2 Cutting heads ▶

The robot is supplied with cutting heads which, under normal conditions, should all be used. When there is a problem with a cutting head, this command allows you to disable it. This operation can also be executed from the web portal.

📝 **Note:** It is also possible to *disable the cutting heads in a particular parcel* (page 55).

👉 To enable/disable specific cutting heads

1. Press ⚙.

2. 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.

8.3.3 Border ▸

Sets the number of times the *border mode* (page 32) is used each week for each parcel. The border mode will be implemented at regular intervals during the week.

👉 To set the number of border mode operations per week

1. Press ☰.
2. Press the up 🔺 and down 🔻 arrows to highlight Border then press ☑.

A screen will appear with a list of configured working parcels.
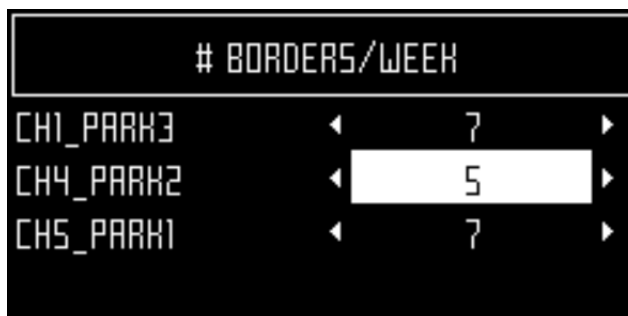
3. Highlight the parcel, then use the left and right arrow keys to scroll to the required number of border modes per week.
4. Press ☑.
5. Press ✖ to return to the main menu.

8.3.4 Cutting height ▸

This command allows you to set height of the blades and *to disable mowing in a specific parcel* (page 55).

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 long, and it will be necessary to increase the mowing height for a few days. By default, the cutting heads will rise automatically when an increased

resistance from long, dense grass is detected. The cutting heads will also be lowered when the resistance has decreased.

The height of the blades can be defined for *each parcel* in which the robot is going to work. The parcel in which the robot is currently located is termed the *actual* parcel.

> **Note:** You should be aware that if the cutting height is set to 25mm or less, this will result in increased wear of the white plastic cover of the anti-friction disc - see *Figure 5: Detail of the cutting head* (page 12). In this case, this part should be inspected frequently (at least every 2 months) and replaced if necessary.

👉 To set the cutting height

1. Press ▤.

2. Press the up 🔺 and down 🔻 arrows to highlight Cutting height then press ☑.

A screen appears, which shows the cutting height *in the parcel in which the robot is located*.

```
┌─────────────────────────────────┐
│         CUTTING HEIGHT          │
├─────────────────────────────────┤
│                                 │
│  Actual              35 mm      │
│                                 │
│  Set target ▸                   │
│                                 │
└─────────────────────────────────┘
```

> **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. *Contact Belrobotics* (page 8).

3. Click **Set target ▸**. A list of configured parcels and their cutting heights are displayed. In this example it can be seen that the Active parcel is LOOP.

```
┌─────────────────────────────────┐
│           Set target            │
├─────────────────────────────────┤
│  LOOP (Active)  ◂   35 mm   ▸   │
│                                 │
│  Parcel 2       ◂   58 mm   ▸   │
│                                 │
│  Parcel 3       ◂   48 mm   ▸   │
└─────────────────────────────────┘
```

4. Highlight the parcel in which the cutting height is to be modified, then use the left and right arrow keys to scroll to the required value. Press ☑ to set the new height.

If the height for the Active parcel is modified, the cutting heads will be raised or lowered. If the height is modified in one of the other parcels, the cutting heads will be raised or lowered *when the robot enters the parcel*.

```
┌─────────────────────────────────┐
│           Set target            │
├─────────────────────────────────┤
│ LOOP (Active)    ◄   48 mm   ►  │
│ Parcel 2         ◄   45 mm   ►  │
│ Parcel 3         ◄   48 mm   ►  │
└─────────────────────────────────┘
```
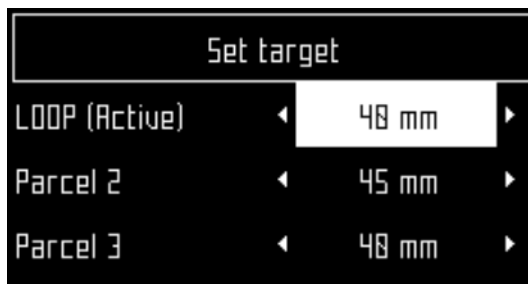
5. Repeat for other parcels.

6. Press ✖ to return to the main menu.

The new height for the active parcel is displayed.

```
┌─────────────────────────────────┐
│         CUTTING HEIGHT          │
├─────────────────────────────────┤
│ Actual              48 mm       │
├─────────────────────────────────┤
│ Set target ►                    │
└─────────────────────────────────┘
```

☞ To disable mowing in a specific parcel

This is useful if there are parcels where there is no grass, such as a loop parcel, or a connecting parcel between two grassy areas. When the robot enters this parcel, the cutting heads are deactivated and the cutting height is set to the maximum cutting height for all configured parcels.

If the machine should be scheduled to work on a parcel on which the cutting heads are disabled the machine will "work" on this parcel but the cutting heads will not be active.

1. Follow the instructions given above to open the CUTTING HEIGHT screen.

2. Click **Set target ►**.

3. Highlight the parcel where mowing is not required. Scroll through the values using the right/left arrows and select Disabled .

```
┌─────────────────────────────────┐
│           SET TARGET            │
├─────────────────────────────────┤
│ LOOP (Active)    ◄  Disabled  ► │
│                                 │
│ ZONE 1           ◄   58 mm    ► │
└─────────────────────────────────┘
```
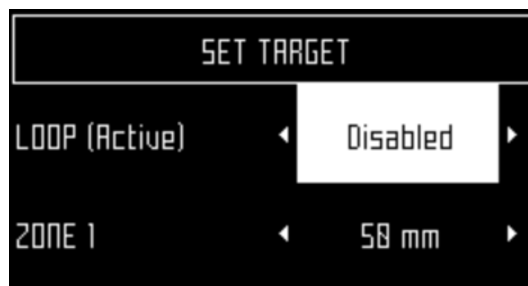
4. Press ✖ to return to the main menu.

8.3.5 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 working. The robot will remain inactive until the system is unlocked.

> **Note:** It is also possible to *enable a PIN code* (page 61) which must be entered before a specific commands can be issued.

👉 To lock the system

1. Press ✲.

2. Press the up ▲ and down ▼ arrows to highlight System locking then press ☑.

```
┌────────────────────────────┐
│         VALIDATE           │
│                            │
│  Are you sure you want to lock the  │
│          sytsem ?          │
│                            │
│   ┌──────┐    ┌──────────┐ │
│   │  OK  │    │  Cancel  │ │
│   └──────┘    └──────────┘ │
└────────────────────────────┘
```
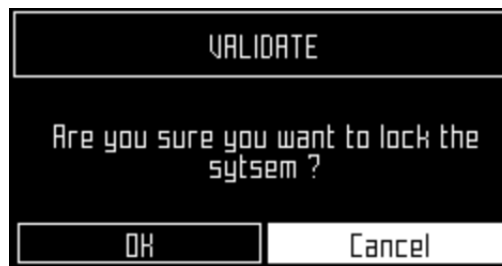
3. Highlight OK then press ☑.

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

```
┌────────────────────────────┐
│         WELCOME            │
│                            │
│       Enter PIN Code       │
│    The system is locked    │
│           ****             │
└────────────────────────────┘
```
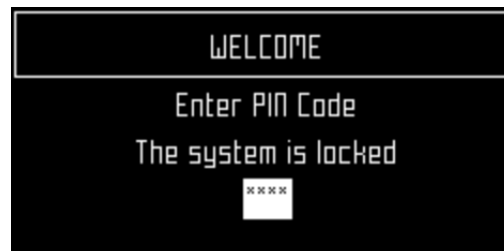
> **Note:** If you do not know or have forgotten the PIN code contact your dealer.

👉 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.

8.3.6 LCD settings

👉 To modify the LCD settings

1. Press ✲ for a few seconds.

```
LCD Settings
Temperature Auto Adj.            ▣
◀ [███████████████████          ] ▶
9          Reverse mode
0          Factory Settings
```
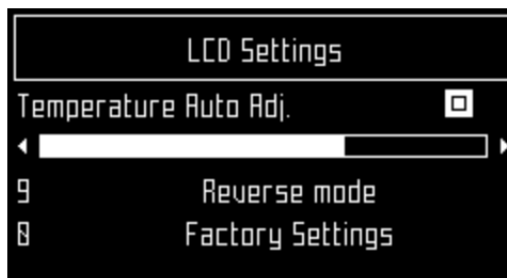
2. Press the right ⊙ and left ⊙ arrow buttons to change the contrast.

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 ✖ to exit this menu.

8.4 The Service Settings menu ☰

This menu will be used primarily by service technicians.

```
Service Settings menu
         ├──────── Regional parameters
         ├──────── Connections
         ├──────── Operations
         ├──────── Device
         └──────── Security
```
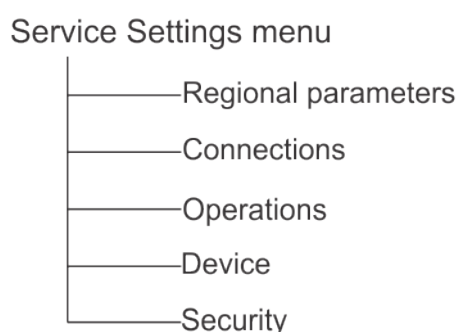
8.4.1 Regional parameters

This menu enables you to set the date format, the robot time zone, the language used in the menus and the unit system.

Date format

The date format can be set to be DD/MM/YYYY (Day/Month/Year) or MM/DD/YYYY (Month/Day/Year)

Time zone

Use the left and right arrow keys to scroll to the required time zone.

Language

Use the left and right arrow keys to select the required language.

Unit system

Use the left and right arrow keys to select the required unit system. The unit of any displayed value is shown.

8.4.2 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 with 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.

```
           CONNECTIONS

IP address ▸
Mode          ◀     Client      ▸
SSID              BelRobotics Guest ▸
```

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

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 59).

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 ☑.

```
               WiFi

BelRobotics ▶
(*) BelRobotics Guest ▸
TP-LINK_AP_DB4E ▸
Wifi-Way-PDA ▸                ▼
```

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 ☑.

8.4.3 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:** Working at too low a temperature can damage the grass.

Edit parcels percentage ▶

This option enables you to view and modify the percentage values (page 75) 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 working in the parcel. A defined *schedule* (page 49) for the robot to work in specific parcels will take priority over these percentage values.

Brake on idle

When this option is checked ON, *at least one* brake will be applied when the robot is stationary. This ensures that the robot does not slide down a slope if

- the robot has stopped because of an alarm,
- the user has manually stopped the robot,
- the stop cover lid is open.

If the brakes have been applied due to this option, you can disable them (or re-enable them again) by pushing **5**. The brakes will also be released when the robot starts to work again normally.

This option need *not* be set if the working terrain is flat, and by default it is set OFF.

Max short cycles allowed

This parameter sets the maximum number of times that the robot will return to the station, after executing a very short cycle, before triggering an alarm. .

8.4.4 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.

Activation code

The activation code is a four-figure code provided on the registration card supplied with each robot.

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.

APN

Id. of the Access Point Network.

MAC address

MAC address.

System version ▶

Software version

The current software version.

Details ▶

Brain Version

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

Bootloader details ▶

This displays a list of software components. The values displayed here should be used when reporting a problem.

Firmware details ▶

This displays a list of software components. The values displayed here should be used when reporting a problem.

8.4.5 Security

The security menu enables you to enable/disable the use of a PIN code.

> 📝 **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.

If a pin code has already been enabled, you need to enter it. You will then see the following screen.

> 📝 **Note:** If you have forgotten the pin code, you need to contact a service technician.

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 ☑.

9 Service and Maintenance

This section deals with regular maintenance and servicing of your Big mow BM2000 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!

9.1 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 all moving parts 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 Belrobotics. 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. Belrobotics declines all liability in case of accident due to the use of non-OEM parts.

Table 2: Maintenance tasks for Big mow BM2000

Component	Weekly	6 months	Annual
Station charge contacts (page 65)	Inspect /Clean		
Body			
Bumper (page 65)	Inspect /Clean		
Sonar (page 65)	Clean		
Robot charge contacts (page 65)	Clean		
Wiring (page 68)		Inspect/Clean	
Mechanical parts			
Front wheels (page 66)	Clean	Inspect	
Front wheel axle (page 66)	Clean		
Cutting head (page 66)	Clean		
Cutting disc (page 67)	Clean		
Blades (page 67)	Inspect	Replace	
Rear wheels (page 68)	Clean		
Battery (page 68)			Charge

9.1.1 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 65)

Every week

- *Clean the charge contacts* (page 65).
- *Clean the bumper* (page 65).
- *Clean the sonar sensors* (page 65).
- *Clean the front wheels* (page 66).
- *Clean the front wheel axle* (page 66).
- *Clean the cutting head* (page 66)
- *Clean the cutting disk* (page 67)
- *Check the cutting blades* (page 67)
- *Clean the rear wheels* (page 68)

Every six months

- *Check the wiring* (page 68).
- *Replace the cutting blades* (page 67)

At the end of the season

- *Battery* (page 68).
- *Wintering* (page 68)

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.
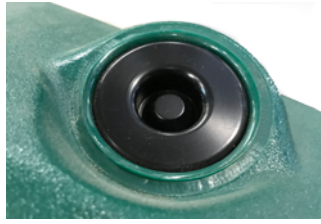
➡️   Remove any mud, grass or dirt and wipe with a damp cloth.

📝   **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.
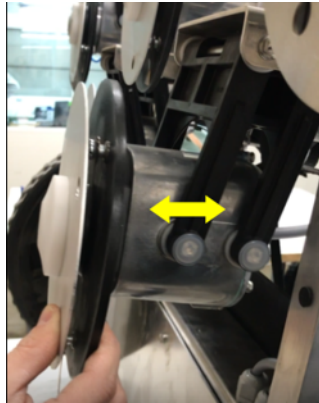
See also: *adjusting the height of the cutting head* (page 53).

Clean the cutting disk

This procedure should be performed *weekly*. This is especially important if the cutting height is set to 25mm or less. If this is the case, the wear on the anti-friction disc is increased and will need to be replaced at least every 2 months.

➡️ 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 essential for a satisfactory mowing operation. The service life of the blades depends on a number of factors. See *Blade replacement* (page 69) for information on these factors and means of improving the life of blades.

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

Big mow BM2000 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 4: 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

9.1.2 Blade replacement

The frequency with which blades needs to be replaced depends on the robot type, its use and the ground it is working on. Since the condition of the blades is essential for satisfactory mowing it is recommended that you check this part of your robot each week after installation and at the beginning of each new mowing season.

The pantograph allows the blade to follow the curves of the ground. If the pantograph is not operating correctly, blades can become blunt or break. The pantograph should be checked and cleaned regularly.

There are also a number of ways in which you can prolong the life of your cutting blades.

Do not cut long grass in a single pass. This can blunt the blade edge prematurely. It is advised to set the cutting height to 5 mm or 10 mm less than the height of the grass and to proceed in several passes. This is particularly important during the first mows of the season.

Make sure the terrain is even. If the terrain has severe bumps or dips in it, the cutting head may not be able to follow the contours of the terrain and blades my hit the ground. Try to even out the terrain and if necessary exclude very uneven patches from the mowing area.

Furrows may appear near the charging station. It is therefore recommended to level the ground near the station or lay artificial turf.

Remove molehills. When the robots hits a molehill, the blades slow down or may stop. Once past the molehill, the blade returns to a normal speed. The resistance of the earth and the changes in speed might loosen the screws (or damage the screw hole).

Avoid bare patches. The presence of bare patches within a grassy zone will cause the rotational speed to change. If this speed shift occurs too often it may damage the pivot and the screw hole. To avoid this problem you can raise the cutting height so that the robot is cutting less grass and speed differences are diminished. Alternatively the bare patches can be re-seeded.

Avoid contact with nylon ground marker. These can cause bluntness. It is recommended to lower them below your cutting height.

Avoid low solid obstacles in the grass. These include sprinklers, stones, roots... Stones and other moveable objects should be removed. To avoid permanent solid objects such as sprinklers, set the cutting height to be higher than the obstacle, or adapt the mowing area to avoid them.

Removable goals are another example of a solid obstacle which can not be detected by the robot. Make sure they are removed before the mowing is scheduled.

Remove tall weeds near the peripheral wire. Tough tall plants can blunt or damage the bladeIt is therefore preferable to keep clear the areas around your peripheral cables.

10 Technical specifications Big mow BM2000

Capacity

Maximum mowable area (*1* (page 70))	24,000m^2
Recommended mowable area (*2* (page 71))	20,000m^2
Number of sports fields per robot	1-3
Mowing width	1033mm
Speed	3.6km/h
Maximum slope	30%

Cutting

Number of cutting heads	5
Number of cutting blades	15
Low cut (minimum)	22mm
High cut (maximum)	100mm
Adjustment of cutting heads	Electronic
Maximum noise level (measured at 5m)	52dB(A)

Battery

Type	LIFePo4
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	71kg
Length	1110mm
Width	1278mm
Height	515mm

Software and monitoring

Security PIN code	Yes

GPS location	Standard
Robot management via server and app.	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	Yes
Type of mowing	Random
Multiple starting zone	Yes
Multi field (optional)	Yes
Multi robots/ station	No

Safety

Lift sensors	Yes
Reverse sensors	No
Bumper	Electronic
Deflectors on the cutting heads	Yes

(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.

11 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 handing 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.

12 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)

RTK: Real Time Kinematic

GNSS: Global Navigation Satellite System

PoE: Power over Ethernet

RTCM: Radio Technical Commission for Maritime Services (a Real-Time GNSS Data Transmission Standard)

13 Glossary

Border mode

When the robot cuts the grass at the very edge of the field. This is done a number of times per week.

Cycle

A cycle is a working session of the robot. It starts when the robot leaves the station and ends when it returns to the station or there is an problem that halts the working cycle.

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 portal.

GPS Navigation Zone

This is an RTK GPS zone that is defined by the border discovery process. it encompasses the entire working area. Sub-zones can then be created by copying and editing this zone to optimise the efficiency of the robot.

GPS point

A specific point within a parcel that the robot uses to return to or leave a station. The point is defined by its latitude and longitude. The robot takes a direct route to this point then follows the trackborder and the loop wire to return to the station.

GPS zone

A GPS zone is defined by set of GPS coordinates. It allows a wired parcel to be sub-divided without having to use additional wires and channels.
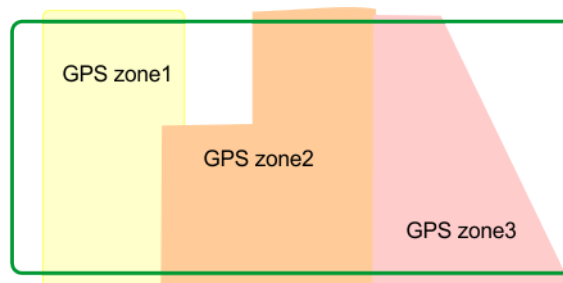
Figure 49: GPS zones in a wired parcel

This provides greater flexibility in defining working areas since the robot can be scheduled to work with optimum efficiency over the zones.

Idle

A robot will enter idle mode, if the current mission has been ended using the Stop button. By default the robot will enter the sleep mode after 15 minutes.

Island

A loop in the peripheral wire specially installed to prevent the robot working inside it. The peripheral wire is taken around the obstacle and the approach and return wires laid next to each other.

Map

Map of the robots routes on the portal

Mapping

The information built up by the robot using GPS data.

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 which defines the area in which the robot works. 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.

Robot status values

Off

Robot has been switched off.

Off After Alarm

Robot has switched itself off after an alarm.

Alarm

Robot is in a state of alarm.

Staying

Robot is waiting at a charge station.

Charge

Robot is charging the battery.

Heading for unload station

Robot is going to the drop pit station to unload balls. This status starts when a robot decides to return to the station.

Heading for charge station

Robot is going to the charging station. This status starts when the robot decides to return to the station.

Leaving station

Robot is leaving the station and starting to work.

Site

The entire area which includes the area in which the robot works.

Sleep

A robot will enter sleep mode 15 minutes after an alarm has occurred which has not been cleared. After 2 days in sleep mode, the robot will enter the OFF mode. This will also occur if the battery charge level reaches a low level. When in sleep mode the robot uses minimal power to reduce the risk of the battery.

The robot can be brought out of sleep mode by:

- clearing the alarm and switching the robot on, using the button on the LED screen,
- pushing the robot to the charging station, if the battery is flat,
- sending a remote wakeup command via the web portal.

Start zone

A defined position within a parcel which determines where the robot will start working.

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.

Subscription

A means to access the functionality of the web portal. There are four types of subscription.

Free: this is available for 2 months after installation for a robot using RTK or 2 years for a robot *not* using RTK.

Basic: the subscription type for a robot *not* using RTK. All the functionality of the web portal are available.

PremiumRTK: the subscription type for a robot using RTK. All the functionality of the web portal are available for this type of robot. This subscription is *essential* if the robot is to operate using RTK GPS.

Offline: this type of subscription is free, but provides on limited functionality on the web portal.
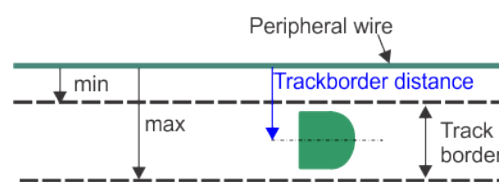
Terrain

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 in which the robot works. The robot follows the track border when leaving or returning to a station unless it is using GPS.

There is no track border specified for a wire that acts as a "return to station loop (page 76)".

Figure 50: 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.
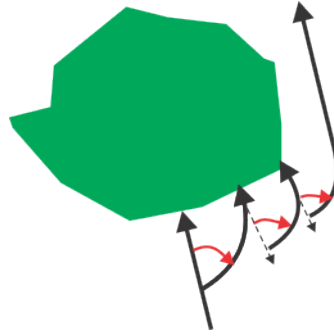
Figure 51: Maneuvers to avoid an obstacle within the track border

Trackwire

Movement of the robot along the loop wire as it enters and leaves the station.

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