Belrobotics
THE GRASS MASTERS

BM-850 Operator's Manual

Software version 5.2

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

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Contents

1 Introduction

This manual provides all the information required to use your BM-850 battery powered robotic lawnmower. Your robot uses the system RTK GPS to accurately determine its position at any time. This allows it to mow following a pattern of straight lines and so operate more efficiently than when following a random trajectory. This robot can be configured to operate without a physical wire surrounding the working area.

This manual includes a description of the robot and all the menu options available from the robot's user interface. Details about how the robot works and its installation are given in the robot's Installation manual.

This manual contains the original instructions.

Your robot is installed by a Belrobotics authorized technician. The configuration of your field is analyzed to determine the most suitable robot. The station and wires are installed, and the robot configured 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/.

BM-850 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 5.2.0.

The current version of the software can be seen by viewing information about the robot on the web portal and the app.

Contact details

For all information contact your dealer.

Related documentation

All related documentation can be found on the MyRobots web portal, in the Documentation section.

2 Conventions used in the manual

 **To charge the battery**	Indicates the start of a procedure to be followed.
blue text (page 6)	A link to another section of the manual.
green text (page 6)	A link to a word in the glossary.
this is less than 5m	italic script for emphasis
1	An entry in the user interface
	Indicates a maintenance operation.
{ }	Indicates a variable parameter value.
Robot Wi-Fi Access	User interface control on the smartphone app
message	Message displayed on the smartphone app

3 Description

The typical components of a BM-850 working setup as installed by your technician are shown in the figure below.

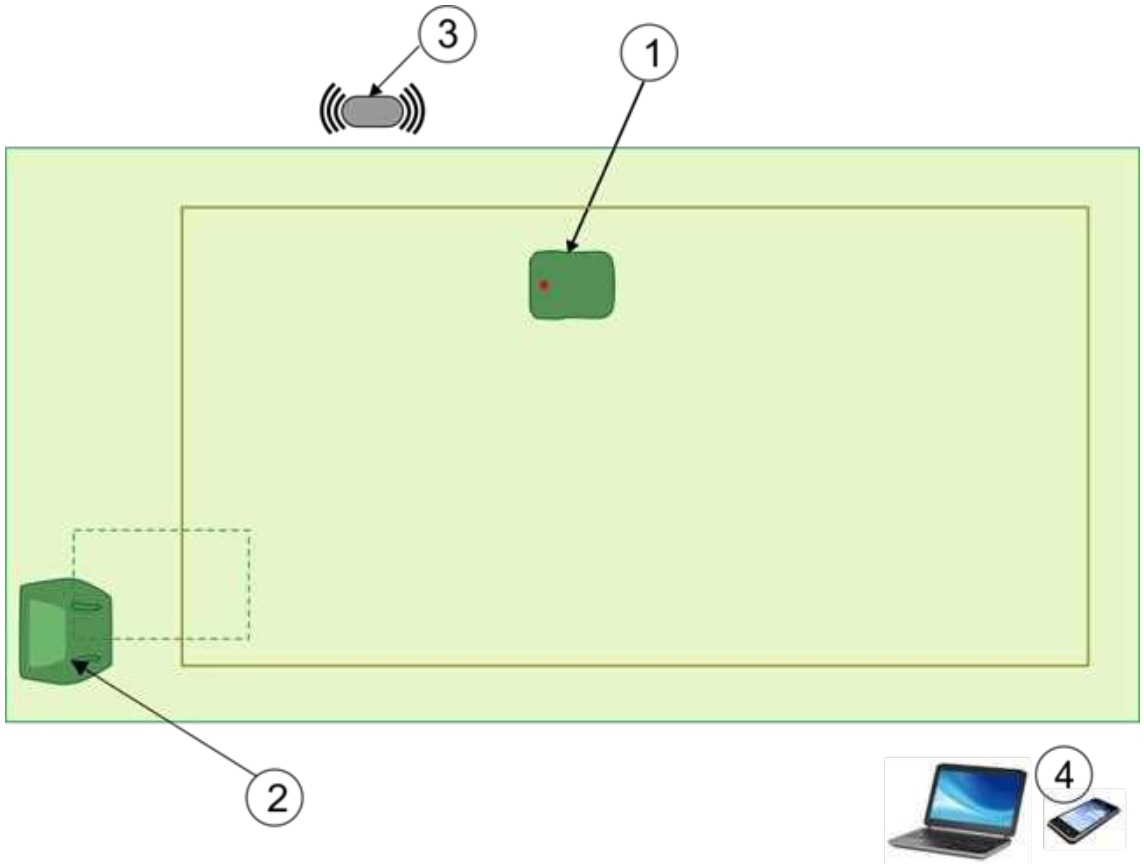


Figure 1: Essential components of a BM-850 installation

This section gives a description of each of these components. For an explanation of how they work together see How BM-850 works (page 18).

1 The robot

For a more detailed description of the robot and its antenna see The robot (page 8). The robot uses sensors to avoid obstacles. For more details see Sensors (page 14).

2 The station

This is where the robot charges its battery or rests when not required to work. For more details see Charge station (page 15). The station is connected to a loop wire, installed underground, which the robot uses to return and leave the station.

3 The RTK base

This transmits corrections to the robot of its position. For details see RTK Base (page 16).

4 A smartphone, tablet or laptop

This enables you to communicate with the robot. For more details see The app and the portal (page 17).

3.1 The robot

Exterior components

Figure 2: Top view of the robot

1. Stop button

This can be hit at any time to stop the robot.

2. Interface

This contains a set of buttons with which to perform basic operations. See Operating your robot (page 28).

3. Obstacle Sensors

These are used to detect an object in the path of the robot. For more information see Sensors (page 14).

4. Charge contact slots

Slots where the charge station arms make contact with the robot.

5. Body

The body shell is attached to the chassis using 4 support points.

Note: The shell must be correctly positioned on the chassis for the robot to operate.

The shell must be removed for most regular cleaning and maintenance purposes. For instructions on removing the shell see Maintenance procedures (page 42).

Note: Never lift the machine using the body shell. Always use the handle shown in Figure 5: Front view without the shell (page 11).

Magnets used for the collision and lift sensors are located on the inside of the shell.

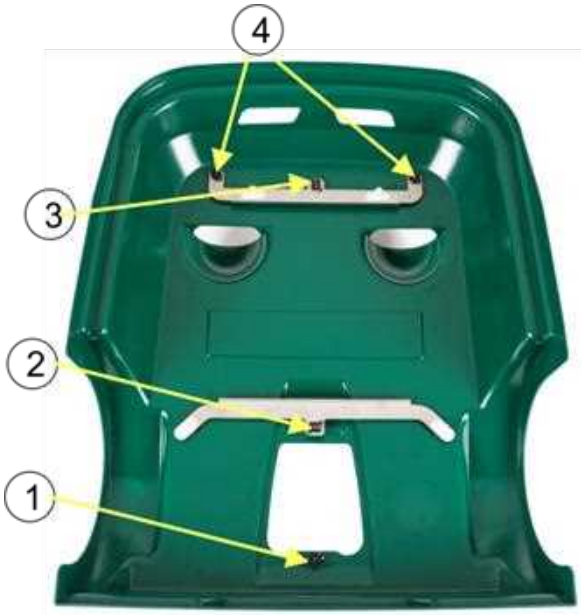


Figure 3: Inside of the body shell

1. Rear lift sensor magnet.
2. Rear collision sensor magnet.
3. Front collision sensor magnet.
4. Front lift sensors magnet.

Robot upper interior components

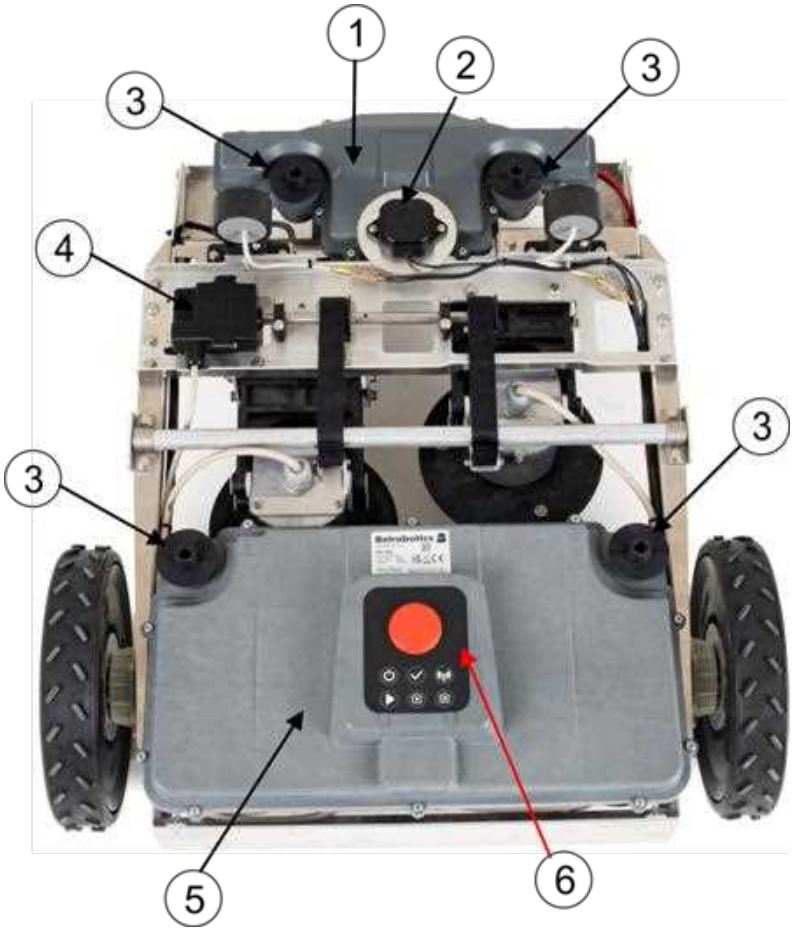


Figure 4: Top view without the shell

1. Front box

This contains the coil and the lift and collision sensors that interact with the magnets inside the shell.

2. GPS antenna

This is a specific GNSS antenna installed at center front of the shell. It is used to receive data about the robot's global position from satellites.

3. Body shell supports

Rubber supports on which the shell rests.

4. Cutting height motor

This raises or lowers the cutting head to the required height.

5. Rear box

This contains:

- the electronics
- the drive motors for the rear wheels
- the lift and collision sensors that interact with the magnets inside the shell.

6 Keypad

This enables you to control the robot. See Operating your robot (page 28).

Robot front interior components

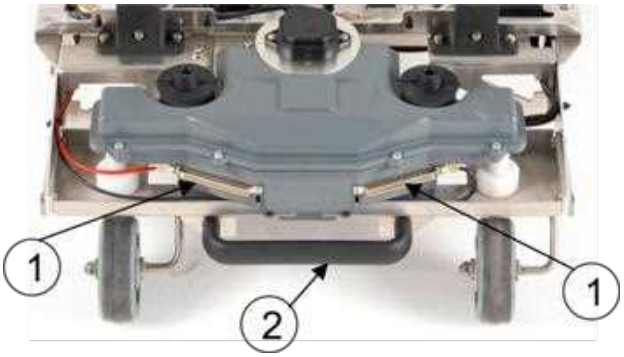


Figure 5: Front view without the shell

1 Charge contacts

These connect with the contact arms on the charge station.

To ensure good contact between the robot and the station, it is important to make sure that the contacts are cleaned regularly and that accumulated grass is removed. See Maintenance procedures (page 42).

2. Handle

Always use this handle to lift the machine.

Robot interior bottom components

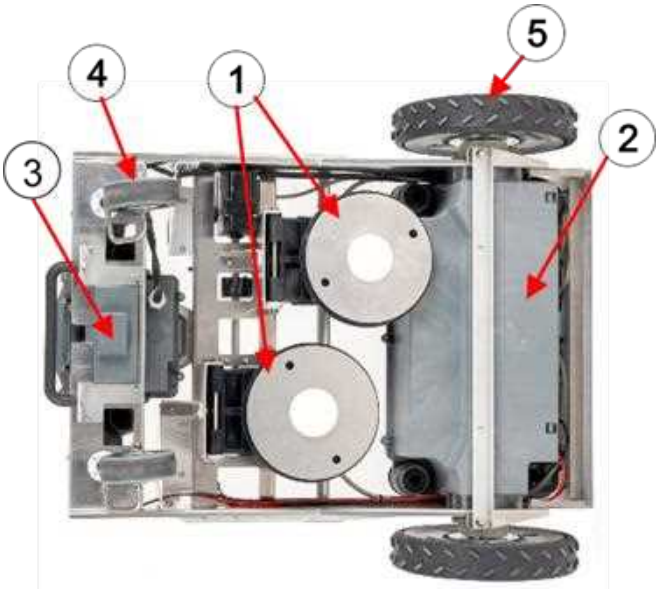


Figure 6: Bottom view of the robot

1 Cutting discs

The robot has two cutting discs, both of which have three blades.

2 Rear box

This contains the electronics and the motors for both the rear wheels.

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

3 Front box

This contains the coil, which is used to sense when the robot is over the wire that forms the loop around the station.

- The robot has 2 cutting heads, each of which has 3 blades.
- The cutting width of each head is 212mm.
- The total cutting width is 400mm.
- The cutting height is 20-80mm.

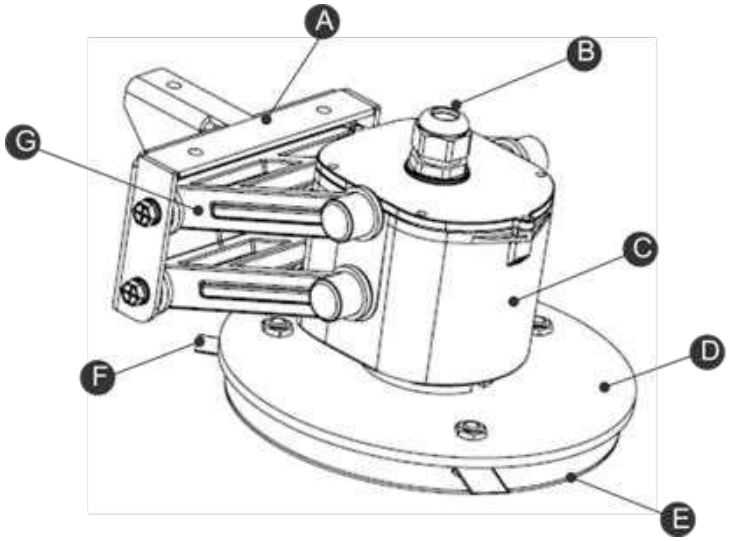


Figure 7: Detail of the cutting head

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

4 Front wheels

Font wheels.

5 Rear wheels

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

On-off switch

The on-off switch is located under the rear right corner and can be accessed by removing the body shell and placing the robot on its back.

When the robot is switched off, the LED on the keypad will be off and will not light again if the on/off switch on the keypad is pressed.

For instructions on removing the lid and accessing the switch, see Maintenance procedures (page 42).

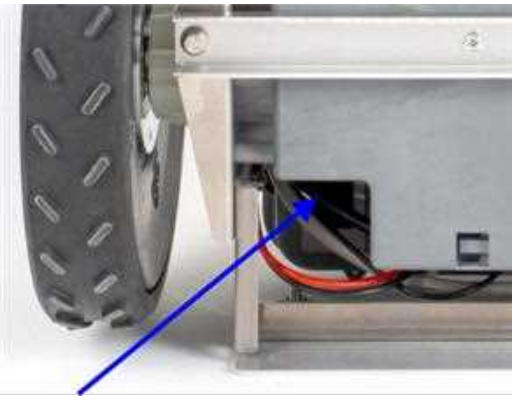


Figure 8: Access to the on-off switch

The robot should be switched off when being stored for the winter.

Labels

Information about the robot is clearly marked on the label. This includes:

- The robot's serial number
- The year of manufacture (in the bottom right corner).

All the symbols are described in Notices (page 52).

3.1.1 Robot options

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.

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.

3.2 Sensors

BM-850 is equipped with various sensors to ensure safe operation.

Obstacle detection sensors

BM-850 is equipped with two obstacle detection sensors (see Figure 2: Top view of the robot (page 8)). These sensors transmit a constant sonar signal (40kHz). When the signal hits an obstacle the reflected waves are received by the sensors and the speed of the robot is reduced to 20cm/s (less than 1km/h).

The robot will gently touch the obstacle then take avoiding action. For an explanation of how the robot uses these sensors to avoid obstacles see how the robot works (page 22).

It is important to clean the sensors regularly to ensure that they operate efficiently (see Maintenance procedures (page 42)). 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 your dealer for help in analysing the problem.

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.

Lift and collision sensors

BM-850 is equipped with two collision sensors. These detect whether the front or the rear of the robot has touched an obstacle. When this happens the robot will move away from the obstacle and then rotate through an angle until it can avoid the obstacle. If this is not achievable, an alarm will be issued.

BM-850 is also equipped with three lift sensors; two at the front and one at the rear. These sensors detect when the body shell has been pushed up from the robot's chassis, which can occur if the robot touches a low object or if someone tries to lift the body. When this happens, the robot will stop mowing and move backwards. If this movement frees the body from the obstacle, the robot will perform a manoeuvre to avoid the object and continue mowing. If not, after a short time the robot will issue an alarm.

These sensors can be seen in Figure 3: Inside of the body shell (page 9)

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.

RTK GPS receiver

This sensor collects data from satellites to determine the robot's precise global location. Corrections to the data received from the satellites are supplied by the RTK base.

Coil

A coil is used to detect a magnetic field. This is how the robot is able to detect and follow the loop wire connected to the charge station.

3.3 Charge station

The charge station will have been installed by the technician. The robot will return to the station when its working schedule is completed or when the battery needs charging.

Figure 9: Robot docked at the charge station

A loop wire is installed underground, and the robot uses this wire to return to and leave the station. The wire overlaps with the working area. See Figure 1: Essential components of a BM-850 installation (page 7).

An LED will indicate the state of the station.

Green - blinking	The wire is operating normally.
Red - blinking	No wire can be detected. This could be because the wire has been cut or that it is too long.
Red - steady	This indicates a problem. Contact your dealer.

Information about the station is clearly marked on the label. This includes:

- The station's serial number
- The year of manufacture (in the bottom right corner).

All the symbols are described in Notices (page 52).

In order for the battery to charge it is important that a good contact is made between the charge arms on the station and the charge contacts on the robot.

This involves:

- Regularly cleaning the contacts
- Removing accumulated grass so that the charge contacts align correctly with the charging arms on the station.

See Maintenance procedures (page 42).

3.4 RTK Base

The robot has an antenna which detects the position of the robot using satellites. The RTK sends corrections on this position of the robot. This means that the robot location is known to a high degree of precision, and therefore accurate mowing in straight lines can be achieved. The communication between the robot and the base is made using either mobile (4G) or WiFi signals. Refer to About RTK GPS (page 48) for more details.

The RTK base has two LEDS that indicate its status

Figure 10: The RTK base

1 The positioning LED

This will blink green when the base is operating correctly and transmitting positioning information to the robot.

2 The error LED

When this is showing red, an error has occurred and you should contact your dealer.

3.5 The app and the portal

In order to use your robot you need to communicate with it either through the Belrobotics smartphone app or the web portal. This allows you to:

- control the operation of the robot,
- modify some operating parameters,
- view any alarms that are generated.

To do this you need to create an account. Instructions for doing this are given in the section Operating your robot (page 28).

4 How BM-850 works

The essential elements of your robot's installation are shown in the figure below.

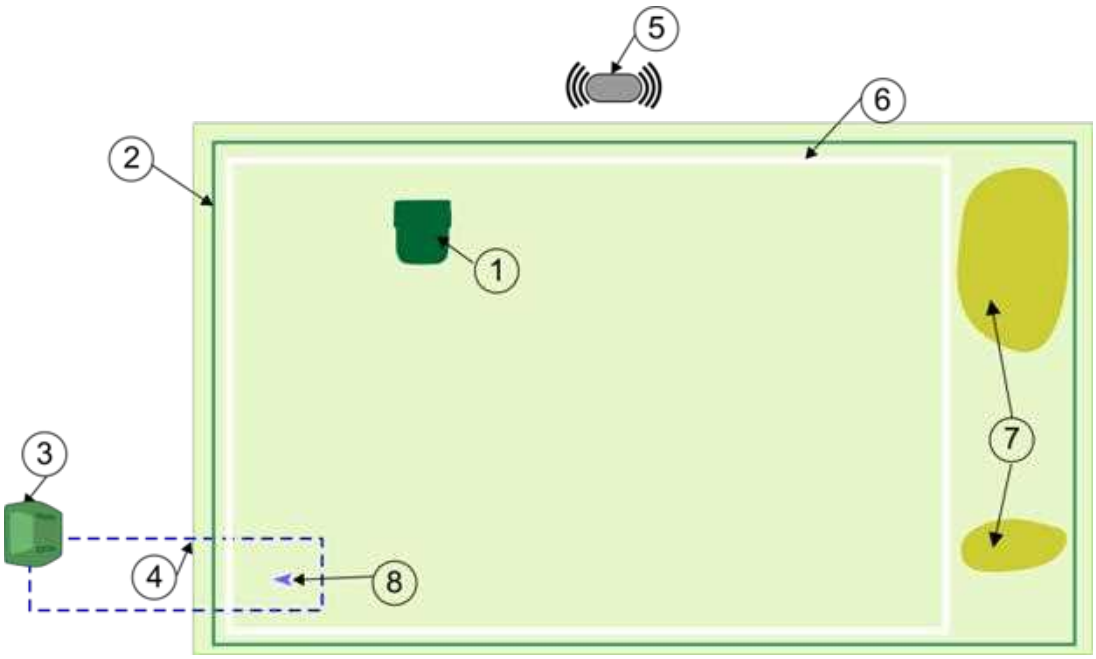


Figure 11: Components of an installation

1 The robot

The robot contains an antenna that connects with GPS satellites in order to determine its geo-location.

2 The GPS Safety Zone

This is the complete area, within the entire site, where the robot mows in straight lines. The GPS Safety Zone is defined by a series of GPS points set during the installation. The robot will not operate outside of this area. The robot can work everywhere in the safety zone, though internal GPS zones may have been defined.

3 The charge station

The robot returns to the charge station whenever the battery needs charging or the working schedule dictates that it should rest.

4 The station loop wire

This is a wire that is laid below the surface which is used to guide the robot when moving to or from the station. The loop wire overlaps with the area that the robot works in.

5 The RTK base

This is a device which also has an antenna that connects with geo-positioning satellites. The base is fixed and knows its position to a high degree of accuracy. It also communicates with the robot either through WiFi or 4G mobile signals.

6 A GPS working area

This is an internal zone within the overall safety zone. This type of zone is typically defined to optimise the operation of the robot by allowing the robot to distribute its work load.

7 NoGo zone

These are areas where the robot is excluded from working. Most typically they contain permanent obstacles, such as plants or buildings.

8 GPS point

This is a point known to the robot that it uses for navigation. Most commonly this is to steer it back to the station from the working area.

Note: It may be that the robot uses a GPS Path (page 57) rather than a GPS point for navigation.

How to see the details of your installation setup (page 33).

When working the robot performs a number of operations:

- Leaving the station (page 19),
- Mowing (page 22),
- Returning to the station (page 23).

4.1 Leaving the station

The robot will leave the station:

- when the battery is charged and it can resume working,
- when a specific command has been issued.
- when the work schedule dictates that it should work,

Note: In all cases it is strongly recommended to define a working schedule for the robot.

The robot will reverse out of the station following the loop wire. It will then stop, turn through 180° and move forwards along the loop wire until it senses that it has entered a GPS Safety Zone.

This GPS Safety Zone, may be the zone in which the robots needs to work, which is the case shown in the figure below where, the loop wire overlaps the working zone.

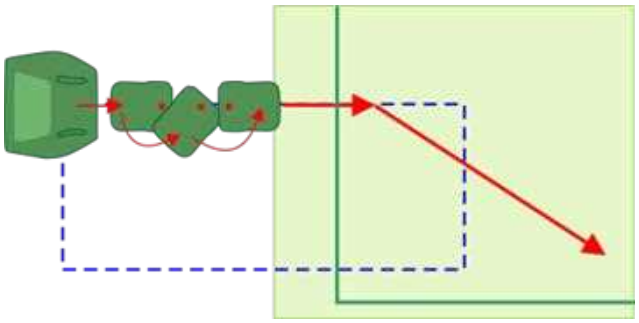


Figure 12: Leaving the station directly into the working zone

However, it may be that the station is situated some distance from the working zone and that the robot needs to follow a path (page 57) in order to reach the working zone. This is illustrated in the example below.

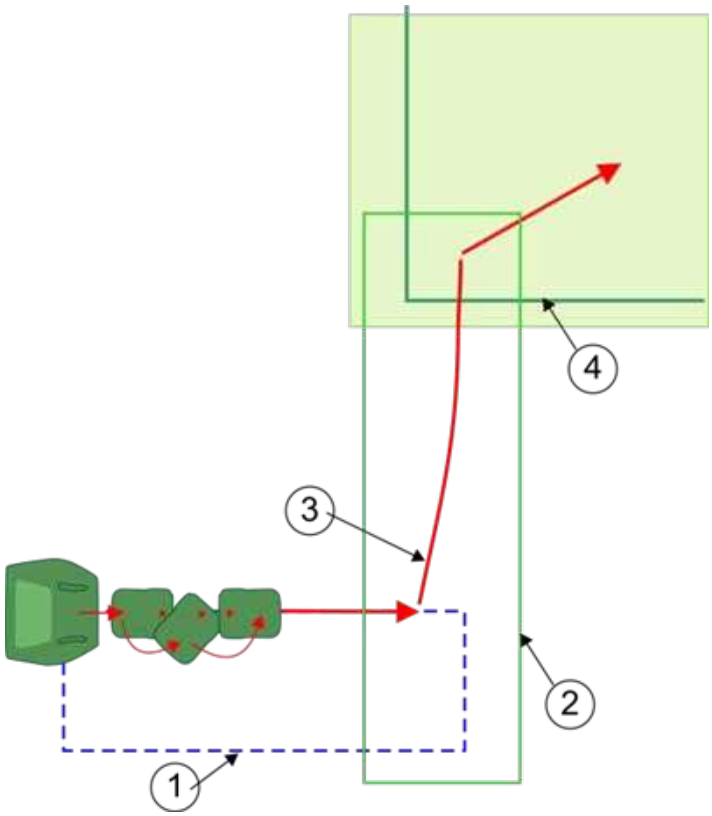


Figure 13: Leaving the station and following a path

In this case the robot follows the loop (1) then enters a small safety zone (2) which surrounds a path (3). The robot follows the path until it enters the safety zone where it is to work (4).

The robot will then move to where it needs to start working. This depends on the number of working zones that have been defined.

A single working area

The robot will continue working along the pattern line it was working on when the previous cycle (page 56) ended. It can start:

- either from the exact point where it stopped working before returning to the station the start of the pattern line, (this is the default option)
- or the start of the pattern line.

This will have been configured by the installation engineer.

Multiple working zones

In this case the robot has to choose in which zone it should work (page 20). .

4.2 Choosing where to work

This topic only applies to an installation where more than one working zone is defined. An example of such an installation is shown in the figure below.

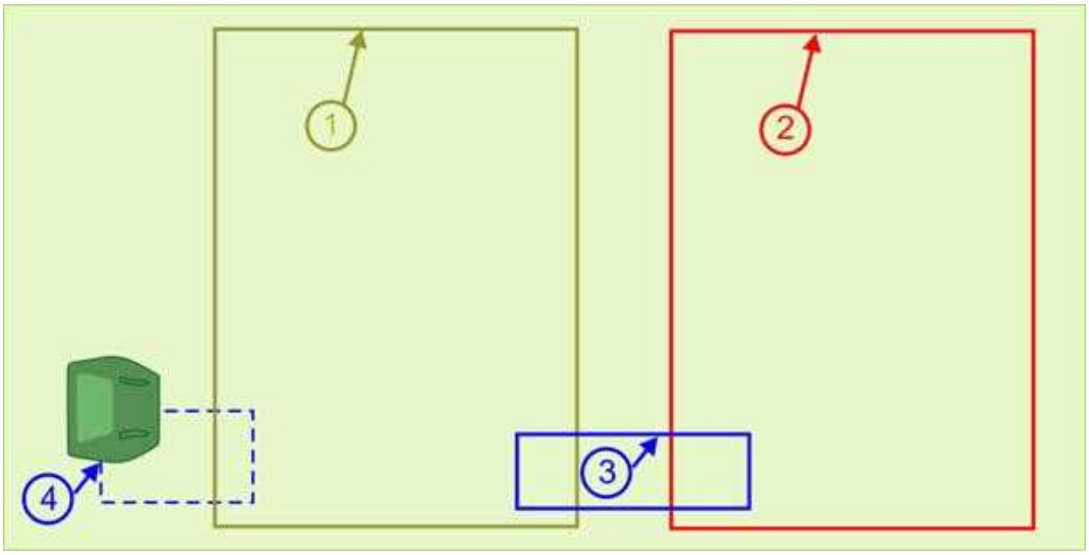


Figure 14: Multiple working zones

In this example there are three safety zones (1,2, and 3) in which the robot can work, as well as the station loop (4).

It is recommended that a working schedule is defined for a robot. This means, for example, that the robot can be configured to only work during a certain number of hours each day. A schedule can also define in which zone the robot will work at a particular time. The schedule takes the highest priority in deciding when and where it will work.

It may be the case however that the schedule allows the robot to work between 8h and 20h in all zones. In this case, additional conditions must be defined to ensure that the work is suitably distributed over the zones. There are two ways to do this:

- by applying a sequential schedule.
- by assigning the percentage of time to be spent in each zone.

These options are mutually exclusive. The behaviour is different in the two cases.

Sequential scheduling

This is the recommended method of distributing the work load. The robot will mow the zones, one following another. It will complete each zone before starting another. It will mow the border of the zone when the zone is completed.

Work percentage

The robot will choose the zone according to the assigned work percentages. If it needs to return to the station to charge before the zone is complete, it will complete that zone when it continues working. When this zone is complete, it will return to the station and then choose to work in the remaining zone with the highest percentage. The work percentages will have been configured during the installation but they can be modified.

See also: Managing your robot (page 31).

4.3 Mowing

When the robot leaves the station it will move to the point where it needs to start working. This may be the start of the pattern line where it stopped on the previous cycle (point 1 in the figure below), or the exact point where it stopped (point 2 in the figure below). This will have been defined during the installation.

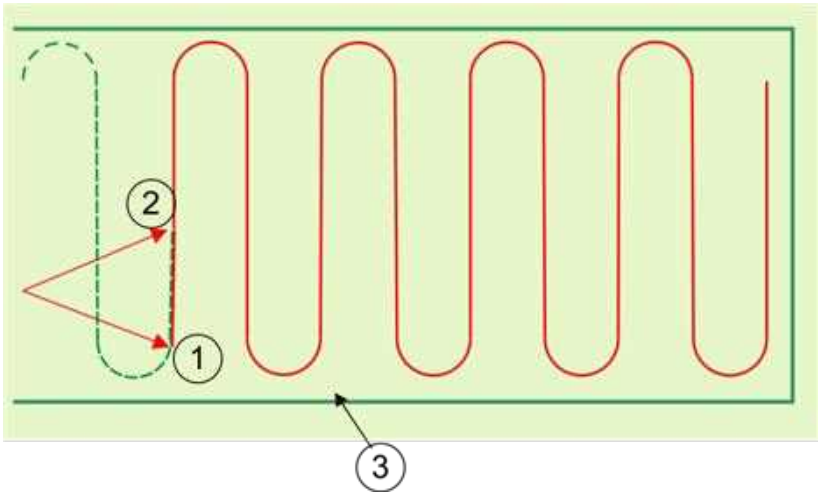


Figure 15: Pattern mowing

The robot will mow the working area (3 in the figure above) in a series of straight lines.

Each time period between the robot leaving the station, mowing and then returning to the station is termed a "cycle" (page 56).

Mowing the border

It can be seen in the figure above, that the robot changes direction just before it reaches the edge of the complete mowing area, thus leaving a short distance uncut. It is necessary that the border of the safety zone is also mowed.

There are two methods that can be used to mow the border:

- Using sequential scheduling. in this case the robot will automatically mow the border when it has finished mowing the working zone.
- Setting the number of times per week that the robot will mow the border. This will have been defined by your dealer, but can be modified. See Setting the number of times the border is mowed (page 34).

Direction of mowing

Your robot will have been configured to mow in a particular direction. On a sports pitch this will normally be parallel to one of the edges. For optimum results however, it is recommended to change the direction when the entire area has been mowed. Typically this alternate direction will be at 90° to the first one, but this change in angle can also be configured for your installation.

Avoiding obstacles when mowing

When the robot detects an obstacle when working in pattern mode, it will move backwards and try to navigate around it using small changes in angle. If this is successful, it will continue along the path it was following.

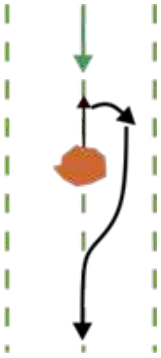


Figure 16: Manoeuvres to avoid a small obstacle in pattern mowing

If this is not successful, it will move backwards and then to the next mowing lane, and continuing doing this until it has passed the obstacle.

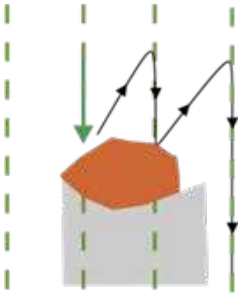


Figure 17: Manoeuvres to avoid a large obstacle in pattern mowing

This does, of course, mean that there is a risk of areas behind the obstacles not being mowed. However, since the direction of mowing changes with each cycle, this may well be remedied on subsequent cycles.

4.4 Returning to the station

The robot will return to the station:

- when the battery needs to charge,
- when the working schedule dictates that it should stop working,
- when a specific command has been issued.

When the robot must return to the station, it turns and starts moving directly towards a specific GPS point. This GPS point may be at the point where the working zone and the loop wire overlap, as shown in the example below.

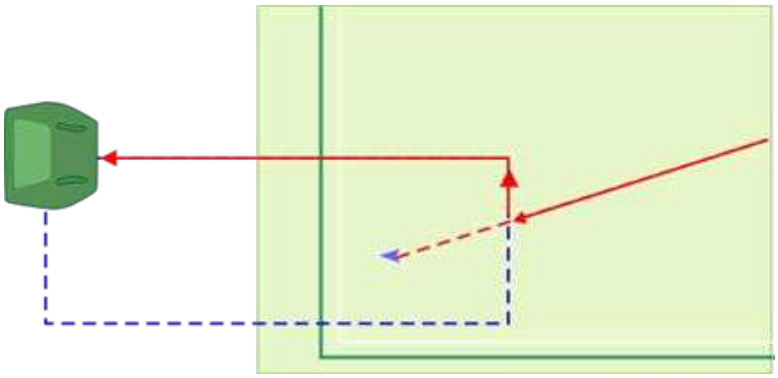


Figure 18: Returning to the station loop

In the case where there is more than one GPS zone, the robot will move towards a GPS point that will lead the robot into a zone that is nearer to the station.

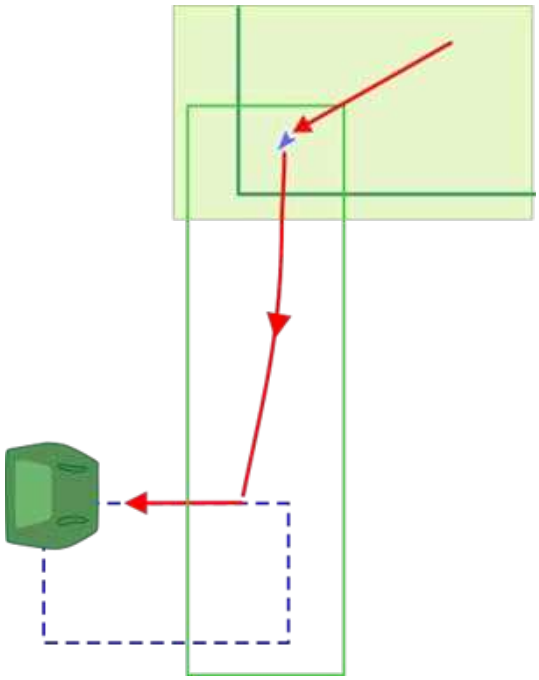


Figure 19: Returning to the station via other zones

GPS points will have been defined during the installation. See Viewing your robot installation setup (page 33).

When the robot senses the loop wire, it will turn and follow the wire until it reaches the station.

For the battery to charge, there must be a good contact between the station arms and the contacts on the robot. If the contact is not made, an alarm is issued. See Maintenance procedures (page 42) for information on cleaning the contacts.

5 Using your robot

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

Before using the robot refer to the Safety measures (page 25).

There are a number of Safety notices (page 26) 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.

5.1 Safety measures

Note: Before starting your robot, check that the working area 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.

5.2 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.

6 Operating your robot

Your robot can be operated through the command buttons on the robot itself, or on the smartphone app or web portal.

Operating the robot from the robot interface

Figure 20: The robot command buttons

Stop

This button is used to stop the robot's current mission. The robot will resume its mission using the mow, charge and stay or charge and mow commands.

Status LED

This LED shows the status of the robot.

	Blinking green	The robot is operating normally.
	Continuous red	Error. The error can be seen on the app and the portal.
	Continuous yellow.	The robot is waiting for a new mission.
	Blinking yellow.	A new mission has been selected. Press  to start the mission.
	Blinking blue/yellow.	The robot is at the station. It will remain there when the battery is charged.
	Blinking blue/green.	The robot is at the station. It will start mowing when the battery is charged.
	Blinking blue/red.	The robot is at the station in alarm.

RTK LED

●	Off.	The RTK GPS signal quality is sufficient for the robot to operate.
●	Continuous or blinking blue.	This indicates low GPS quality or no connectivity. Check that the RTK base is operating. Perform a power off/power on. If the situation does not improve contact your dealer.

On/Off

When the robot is OFF: pressing this button for a few seconds will switch the battery power on.

When the robot is ON:

- Pressing this button for 1-2s (until the status LED blinks red) will shut down the software and then turn the power off.
- Pressing this button for 2-4s (until the status LED blinks yellow) will release the brakes.
- Pressing this button for more than 7s (until the status LED is continuous red will force power off, without shutting down the software.

Confirm

This button is used to confirm a command that has been issued.

+ Work

Pushing these buttons in sequence will start the robot mowing as long as the schedule and any other conditions allow it.

This operation can also be executed from the app or the portal.

+ Charge and work

Pushing these buttons in sequence will force the robot to return to the charging station and then continue mowing after the battery is charged.

This operation can also be executed from the app or the portal.

+ Charge and stay

Pushing these buttons in sequence will force the robot to return to the charging station and stay there until a new instruction is issued.

This operation can also be executed from the app or the portal.

Operating the robot from the smartphone app or web portal

Note: In order to fully manage your robot you must have access to it through the app or the web portal.

Download the Belrobotics app. The web portal is available from https://myrobot.belrobotics.com

To access the app or the web portal you need a user login. Your Belrobotics dealer can provide you with this. Alternatively you can create your own login by following the instructions on the registration card you received with the robot.

1. Login to either the app or the web portal.
2. Select the robot in the fleet list.

3. On the web portal click on Actions at the bottom of the page.
4. Choose the command

Tap  to force the robot to start mowing, even if it is not scheduled to be working.

Tap  to force the robot to return to the charging station and stay there until a new instruction is issued.

Tap  to force the robot to return to the charging station and then continue mowing after the battery is charged.

7 Managing your robot

The basic operating commands can be executed either from the robot itself or from the smartphone app or web portal. This section describes how you can manage and configure your robot in order to optimise its operation.

Configuration parameters (page 31) are available on the web or the app.

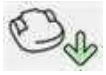
- Viewing your robot installation setup (page 33).
- Setting the blade cutting height (page 39).
- Editing a schedule (page 36).
- Using sequential scheduling (page 36).
- Setting the work percentage (page 35).
- Setting the number of times the border is mowed (page 34).
- Viewing alarms (page 37).
- Adjusting the cutting height automatically (page 39)
- Managing blocked cutting heads (page 39)
- Seeing how much time the robot spends working and charging (page 38).

The operation of the robot is enhanced by following the maintenance procedures (page 42).

7.1 Configuration parameters

The operation of your robot can be optimised by adjusting a number of parameters.

To access the parameters on the portal

1. Logon to the portal and select your robot.
2. Click on  .
3. Click  to download the latest configuration parameters from the robot.
4. Click  .

The Parameters editor window will appear. The configuration parameters are accessed through three tabs. The list of parameters is given below.

To access the parameters on the app

1. Logon to the app and select your robot.
2. Tap on the robot.
3. Tap Settings  .
4. Tap  to be sure that you have the latest configuration parameters available on the robot.

List of configuration parameters

Table 1: Global parameters

Parameter	Description	Details
Robot name	The name of the robot.	Can be edited.
Robot type	The type of robot.	For information only.
Battery type	The type of battery	For information only.
Language	The language used by the robot's technician.	For information only.
Min Working temperature	Sets the lowest temperature that the robot will operate at.	Adjust the minimum temperature to the required value.
Cutting head #	Disables a cutting head. Normally all the heads should be used. When there is a problem with a cutting head, this allows you to disable it.	See Disabling cutting heads (page 40)
Cutting height auto adjustment	When this option is checked ON, the robot will automatically raise the height of the cutting heads when it detects increased resistance. The heads are lowered again when resistance has decreased.	See Optimising cutting the grass (page 39)

Table 2: Parcel parameters

Parameter	Description	Details
Work percentage	Sets the proportion of time the robot spends in the parcel.	See Setting the work percentage (page 35).
Sequential scheduling	TBD	TBD
Cutting height	Sets the height at which the grass will be cut.	See Optimising cutting the grass (page 39).
Cutting heads disabled	Allows you to disable the use of the cutting head in a parcel. (This is usually in the loop parcel.)	
Return direction	The direction in which the robot follows the loop wire	For information only.
# Borders per week	The number of times the robot mows the border of the parcel.	See Setting the number of times the border is mowed (page 34).
Channel	The channel used in the station.	For information only.

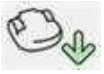
Parameter	Description	Details
Min/Max Cycle Time	The minimum and maximum times that the robot will work in a parcel	Not applicable.

Table 3: Station parameters

Parameter	Description	Details
Station Reference	The reference for the station.	For information.
Charge	Indicates that the station is used to charge the robot.	For information.

7.2 Viewing your robot installation setup

Figure 11: Components of an installation (page 18) shows an example of a installation setup. You can see the installation setup for your robot on the web portal.

1. Login to the portal and select the robot.
2. Click on  .
3. Click  to download the latest configuration parameters from the robot.

   A schematic layout of the installation is shown, showing how the station, the loop and the different working zones are connected.
4. Click on  (Edit GPS Configuration).

You will see a geographical layout of the robot's installation, which includes:

- the station,
- the GPS zones where the robot works (GPS parcels),
- GPS point(s) which the robot uses to return to the station,
- GPS Paths if they have been defined,
- NoGo zones, if they have been defined.

You can toggle the display of any of the items by clicking on the eye  .

7.3 Setting when the robot works in different areas

By default there are at least two areas that have been defined for your installation. These are:

- the area contained within the wired loop which the robot uses to return to the station,
- one or more GPS defined zones in which the robot will work (see Figure 11: Components of an installation (page 18)).

Note: The robot can not work within the station loop area.

When there is just one working zone, you can specify when the robot works here by defining a working schedule. This will have been defined at installation, but you can edit the schedule (page 36) if necessary.

When there is more than one working zone, there are various ways in which the robot can distribute its time between these zones. This will have been defined at installation but it is possible to modify these settings if necessary. The options are:

- The robot will follow a schedule which specifies exactly when it should work in a particular zone. If necessary you can edit the schedule (page 36).
- Either: the robot will be configured to follow sequential scheduling. This is the recommended method for this type of installation. When this option is selected, the robot will automatically mow the border of the zone after the complete zone has been mowed.
- Or: the robot will work in the different zones according to a defined percentage of time. If necessary you can modify this. See Setting the work percentage (page 35).

To see whether your robot is using a sequential schedule or a work percentage, see Configuration parameters (page 31) (Parcel parameters).

7.4 Setting the number of times the border is mowed

As it was explained in the how the robot works, the robot does not mow right up to the edge of the working area. It is therefor important that the robot is scheduled to mow the border of the field at least 2 times per week.

Note: If the robot is configured to use sequential scheduling, the border is mowed automatically when mowing the working zone is complete.

Setting the number of times the border is mowed using the smartphone app

1. Logon to the app and select the robot.
2. Tap 
3. Tap  to be sure that you have the latest configuration parameters available on the robot.
4. Select the working area for which the border mowing is to be set.
5. Tap Settings  .
6. Adjust the **# Borders / Week** using the buttons 
7. Close the Robot Parameters Editor.
8. Tap  to upload the new setting to the robot.

Setting the number of times the border is mowed using the web portal

1. Login to the portal and select the robot.
2. Click on  .

3. Click  to download the latest configuration parameters from the robot.

   A schematic layout of the installation is shown, showing how the station, the loop and the different working zones are connected.
4. Click on  (Edit parameters).
5. Select the Parcel Parameters tab.
6. Enter the required number of times per week that the border is to be mowed.
7. Click X to close the Parameters editor window.
8. Click  to upload the new setting to the robot.

7.5 Setting the work percentage

When the robot works in more than one zone, the method it uses to distribute the work load between them can be specified by defining the percentage of time that it works in each zone. This is not the only method that can be used (see Setting when the robot works in different areas (page 33)).

The method used will have been set at installation.

> **Note:** When a schedule is defined, this always has the highest priority in determining when and where the robot will work.

It is possible to switch between using a Work percentage and using a sequential schedule. See Setting when the robot works in different areas (page 33).

This procedure describes how to modify the work percentage.

To modify the work percentage using the smartphone app

1. Logon to the app and select the robot.
2. Tap 
3. Tap  to be sure that you have the latest configuration parameters available on the robot.
4. Select the working area for which the work percentage is to be set.
5. Tap Settings  .
6. Adjust the **Work percentage** using the slider.

   > **Note:** the total percentage for all the working zones must add up to 100%.
7. Close the Robot Parameters Editor.
8. Tap  to upload the new setting to the robot.

> **Note:** When using this method to distribute the work load it is also necessary to set the number of times the borders are mowed each week (page 34).

To modify the work percentage using the web portal

1. Login to the portal and select the robot.
2. Click on  .
3. Click  to download the latest configuration parameters from the robot.

   A schematic layout of the installation is shown, showing how the station, the loop and the different working zones are connected.
4. Click on  (Edit parameters).
5. Select the Parcel Parameters tab.
6. Enter the percentage of time that the robot is to work in a particular zone (parcel).

   Note: the total percentage for all the working zones must add up to 100%.
7. Click X to close the Parameters editor window.
8. Click  to upload the new setting to the robot.

Note: When using this method to distribute the work load it is also necessary to set the number of times the borders are mowed each week (page 34).

7.6 Using sequential scheduling

When the robot has more than one working zone, this method can be used to distribute the robot's work load. This is the recommended method.

When using this method, the robot chooses where to work by selecting each working zone sequentially. This is done taking into consideration the schedule that has been defined for each zone. Once the robot has finished mowing a zone, it then mows the border of that zone before moving one to the next zone.

The method chosen will have been set up at installation.

You can see which method is being used on either the app or the web portal.

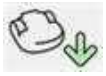
7.7 Editing a schedule

Defining a working schedule means that you can control exactly when the robot is to work in a specific area. This means that you can guarantee that the robot will not be working when the area is in use, or during the night for example which is safer for nocturnal animals. If you don't define a schedule, the robot will work all of the time when it is not at the station charging the battery.

Your technician will probably have defined a schedule when the robot was installed. These instructions enable you to modify it.

To edit the schedule using the web portal

1. Login to the portal and select the robot.

2. Click on  .
3. Click  to download the latest configuration parameters from the robot.

   A schematic layout of the installation is shown, showing how the station, the loop and the different working zones are connected.
4. Click on  (Edit schedule).

   For each day of the week a column is displayed for each working zone (excluding the station loop), with the start and the end of the working period shown in specific colour.
5. Drag the start and/or the end point to the time required.
6. When the schedule is as required, click X to close the Parameters editor window.
7. Click  to upload the new schedule to the robot.

To edit the schedule using the smartphone app

1. Logon to the app and select the robot.
2. Tap 
3. Tap  to be sure that you have the latest configuration parameters available on the robot.
4. Select the working area for which the schedule is to be edited.
5. Tap Schedule  .
6. To modify the schedule click on the lock icon  if necessary.
7. Drag the start and the end time to the required values for each day.
8. Click the lock icon again to lock the new schedule.
9. Close the Scheduler window, then tap  to upload the new schedule to the robot.

7.8 Alarms

Alarms are triggered for a number of reasons. Notification can be sent to you by email or SMS when an alarm occurs.

To configure notifications on the portal

1. Logon to the portal.
2. Click 
3. Select **Notifications**.

To configure notifications on the app

1. Logon to the app.
2. Select the robot.
3. Tap 

4. Select **Configure Notifications**.

If you do not receive a notification, you can see details about an alarm on either the app or the web portal.

To see the details of an alarm on the app

1. Logon to the app and select the robot.
2. Tap on the alarm to see details.

To see the details of an alarm on the portal

1. Login to the portal and select the robot.
2. Click on the Alarms tab (bottom of the page).

   This will present a list of recent alarms as well as a map showing where they occurred.

If something physical needs to be done to resolve the problem, you need to give the robot a command to start it again.

7.9 Working cycles

You may be interested to know how much time your robot needs to mow a specific area and how much time it needs to charge its batteries. Remember that the time required to mow a particular area will depend on conditions and the length of grass that needs to be cut.

The most information about this can be found on the web portal.

1. Login to the portal and select the robot.
2. Click on 

.
3. Click on **C** 

at the top of the page.

   This will display the robot's activity in terms of its work cycles (page 56). Full details on these are given in the MyRobot manual.
4. Click on a cycle.

This will open a map that shows what the robot was doing during this cycle.

Figure 21: Area mowed in a particular cycle

Here you can see the area that was mowed between the start and the end time. By selecting successive cycles you can build up a picture of how long it takes to mow the complete area.

7.10 Optimising cutting the grass

To optimise the performance of your robot and have the best quality grass, it is important that:

- The robot is cleaned regularly to remove accumulated grass.
- The cutting blades are in good condition.
- The cutting blades are set to the correct height.
- The cutting head is not blocked.

The height to which the grass cut will depend on the needs of your terrain. The longer the length of the grass that needs to be cut, the harder the robot has to work. This will deplete the battery faster. When the grass is long (>150mm) it is better to raise the height of the blades to shorten the length that is cut, then gradually reduce the blade height to the required level.

- To manually set the blade height using the app (page 40)
- To manually set the blade height using the web portal (page 40)

It is also possible to set an operating parameter that makes this adjustment automatically.

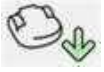
- To automatically set the blade height using the app (page 39)
- To automatically set the blade height using the web portal (page 39)

If a cutting head becomes blocked with grass, it is possible to Disabling cutting heads (page 40) until the head can be properly cleaned.

To automatically set the blade height using the app

1. Logon to the app and select the robot.
2. Tap 
3. Tap  to be sure that you have the latest configuration parameters available on the robot.
4. Tap 
5. Make sure that **Cutting Height Auto Adjustment** is ON  .
6. Close the Robot Parameters Editor.
7. Tap  to upload the new setting to the robot.
8. Make sure the blade height is set to the ultimately required height (page 40).

To automatically set the blade height using the web portal

1. Login to the portal and select the robot.
2. Click on  .
3. Click  to download the latest configuration parameters from the robot.

   A schematic layout of the installation is shown, showing how the station, the loop and the different working zones are connected.

4. Click on  (Edit parameters).
5. Click on the Global Parameters tab.
6. Make sure that **Cutting Height Auto Adjustment** is ON  .
7. Make sure the blade height is set to the ultimately required height (page 40).

To manually set the blade height using the app

This procedure is best carried out when the robot is not working.

1. Logon to the app and select the robot.
2. Tap 
3. Tap  to be sure that you have the latest configuration parameters available on the robot.
4. Tap Settings  .
5. Tap  .
6. Set the cutting height to the required value.
7. Tap  to transfer the new setting to the robot.

The new blade height will be used when the robot starts working again.

 To manually set the blade height using the web portal

This procedure is best carried out when the robot is not working.

1. Login to the portal and select the robot.
2. Click on  .
3. Click  to download the latest configuration parameters from the robot.

   A schematic layout of the installation is shown, showing how the station, the loop and the different working zones are connected.
4. Click on  (Edit parameters).
5. Click on the Parcel Parameters tab.
6. Set the cutting height to the required value.
7. Click X to close the Parameters editor window.
8. Click  to upload the new setting to the robot.

The new blade height will be used when the robot starts working again.

Disabling cutting heads

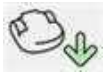
If there is a problem you can disable cutting heads which means that the robot can return to the station

To disable a cutting head on the app

BOTH cutting heads must be disabled.

1. Logon to the app and select the robot.
2. Tap 
3. Tap  to be sure that you have the latest configuration parameters available on the robot.
4. Tap Settings  .
5. Tap  to be sure that you have the latest configuration parameters available on the robot.
6. Tap Settings  .
7. Select the parcel (working zone) in which the cutting heads are to be disabled.
8. Tap Settings  .
9. Slide **Cutting Heads Disabled** on  .
10. Close the Robot Parameters Editor. Tap  to upload the new setting to the robot.

To disable a cutting head on the portal

1. Login to the portal and select the robot.
2. Click on  .
3. Click  to download the latest configuration parameters from the robot.

   A schematic layout of the installation is shown, showing how the station, the loop and the different working zones are connected.
4. Click on  (Edit parameters).
5. Click on the Global Parameters tab.
6. Change the setting.
7. Click X to close the Parameters editor window.
8. Click  to upload the new setting to the robot.

8 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 - contact your dealer.

8.1 Maintenance procedures

In order to clean and perform many of the other maintenance tasks it is necessary to remove the body shell.

To remove and replace the body shell

The body rests on the chassis at the four points indicated in the figure below.

Figure 22: Body shell attachment points

To remove the body shell

1. Lift the body to disconnect it from the chassis at one of the attachment points.
2. Repeat this for each of the other attachment points in sequence.
3. Lift the entire body shell off the chassis.

To replace the body shell

1. Place the body shell on top of the chassis, aligning it using the hole for the keypad.
2. Gently press down on one of the attachment points until it clicks into position on the rubber support.
3. Repeat this for each of the other attachment points in sequence.

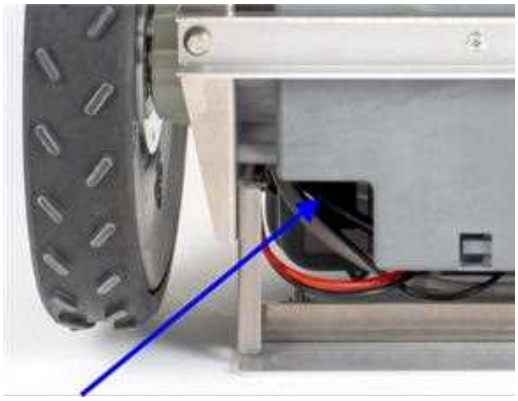
Note: The robot will not operate unless the body shell is correctly in position.

Switching the robot on and off

When working on the robot it is recommended that it be switched off. This can be done from the keypad by pressing  for a few seconds.

At the end of the working season, the robot should be switched off using the main switch.

To access the main switch you need first to remove the body shell (as described above). The switch is located at the rear of the robot on the right hand side. It is most easily accessed by turning the robot onto its back.



Daily maintenance

Remove accumulated grass (page 44).

Weekly maintenance

Clean the wheels (page 44).
Clean the sonar sensors (page 44).
Clean the charge contacts (page 45).
Clean the cutting head (page 45).
Clean the body shell (page 45).
Clean the cutting head (page 45).
Clean the cutting disk (page 46).
Check the cutting blades (page 46).

Six monthly maintenance

Replace the cutting blades (page 46).
Check the wiring (page 47).

8.1.1 Daily maintenance

Remove accumulated grass

During periods of wet weather it is important to ensure that mud and grass do not accumulate on the robot: on the wheels and the cutting heads in particular. These should be inspected and cleaned daily.

Figure 23: Grass accumulation

Note: If too much grass accumulates on the wheels, contact between the station and the robot may be impaired.

The grass can be removed using a brush, though using compressed air is preferable.

Note: Take care if you are using a wire brush that you do not damage any of the cables.

8.1.2 Procedures to be performed every week

Clean the wheels

As mentioned above excessive grass accumulation on the may mean that the robot does not align correctly with the charge arms on the station and it can not therefore charge its battery.

It is therefore important to remove any mud and grass with a brush or compressed air on a regular (daily) basis especially in periods of wet weather.

Check each week that the wheels rotate easily and that there is not too much play. If there is a problem, contact your dealer.

Clean the sonar sensors

The sonar sensors need to be kept clean if they are to operate properly. They ALL need to work properly, if any are not operating properly an alarm is issued.

1. Stop the machine.
2. Switch it off using a long push on the button on the keypad.

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

Note: Do NOT use water.

Clean the charge contacts

In order for the robot to charge its battery a good contact needs to be established between the charge contacts on the robot and those of the station. If contact is not established the alarm | Failed to dock | will be triggered.

This may be due to the fact that the wheels have too much grass on them (see above), or that the contacts have corroded.

1. Stop the machine and move it away from the station. .
2. Switch it off using the button  on the keypad.
3. Remove the body shell (see above).

   The charge contacts on the robot are at the front of the machine.

4. Rub the contact surfaces with fine grade sandpaper, grade 120 or higher until they are bright and shiny.
5. Replace the lid (see above).
6. Rub the contacts on the station's charge arms until they are bright and shiny.

Clean the body shell

Clean away the mud and the grass using a brush and/or a spatula. If compressed air is available this is more effective.

Do NOT use water.

Clean the cutting head

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.

Clean the cutting disk

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 it 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 your dealer.

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.

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 (see below).

⚠ **Warning:** Cutting blades are sharp and should be handled with gloves.

8.1.3 Procedures to be performed every six months

Replace the cutting blades

Blades should be replaced every every six months or whenever they are damaged.

⚠ **Warning:** Cutting blades are sharp and should be handled with gloves.

1. Rotate the disc, so that the screw head holding the blade is visible.

2. 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.

3. 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.

Check the wiring

Visually inspect the wiring under the robot. If any problems are detected, contact your dealer.

8.1.4 Wintering

At the end of the mowing season:

- Clean the robot.
- Switch the main switch off (see above).
- Arrange for the robot 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. The battery level can be seen on the web portal and the app.
4. Start the robot and check that it comes back normally to the charging station

9 Appendices

9.1 About RTK GPS

Standard GPS positioning data retrieved from satellites using GNSS (Global Navigation Satellite System) is accurate to between 5m and 10m. This is because the signal received from a satellite is distorted due to atmospheric and environmental conditions. Higher precision positioning can be achieved by using an RTK (Real-Time Kinematic) technique.

This technique involves the use of an RTK base placed in a fixed position, which receives GNSS signals from satellites. Since the base is fixed, the data it receives relates to its precise location.

The robots are also fitted with antennas, which receive GNSS signals from satellites in order to determine their position. Both the RTK base and the robots receive the GNSS signals from satellites in different constellations (GPS, GLONASS, Galileo, BeiDou). Since the robots are moving however, the evaluation of their position is less precise than that of the fixed base.

The RTK base computes correctional data for each of the satellites and sends these to the robot. The robot is then able to use these corrections to achieve a positional accuracy of between 2cm and 3cm. With such accurate positioning, the robot is able to follow a defined pattern and cover the field in a series of straight lines.

Communication between the robot and the RTK base using WiFi can be made over a distance of up to 200m if there are no obstacles in the way. When using WiFi, one base can communicate with up to 5 robots.

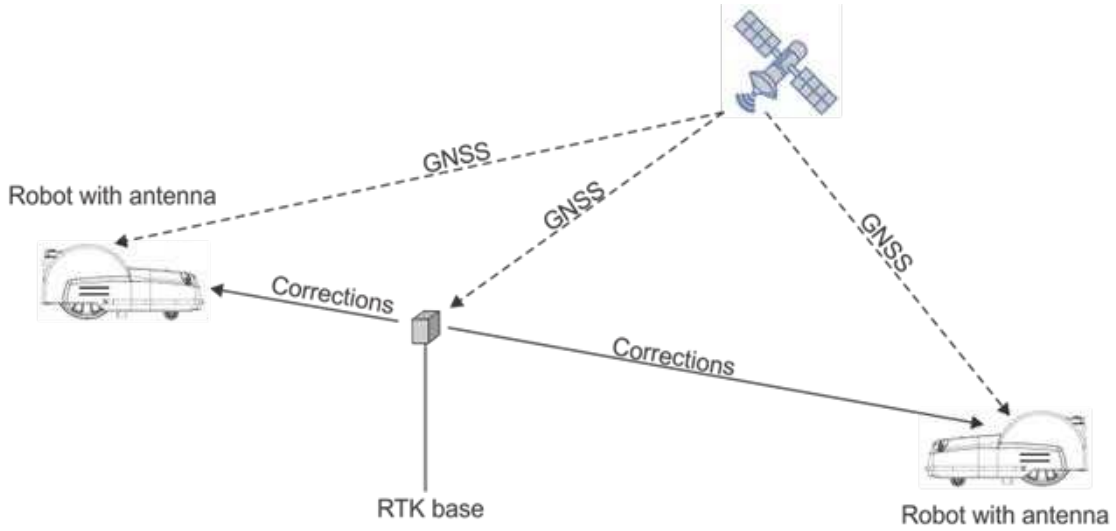


Figure 24: Transfer of corrections using WiFi

Corrections can also be made via the Belrobotics cloud using 4G. In this case, obstacles do not impede the transfer of correctional data and the base can connect to an unlimited number of robots at distances of up to 15km.

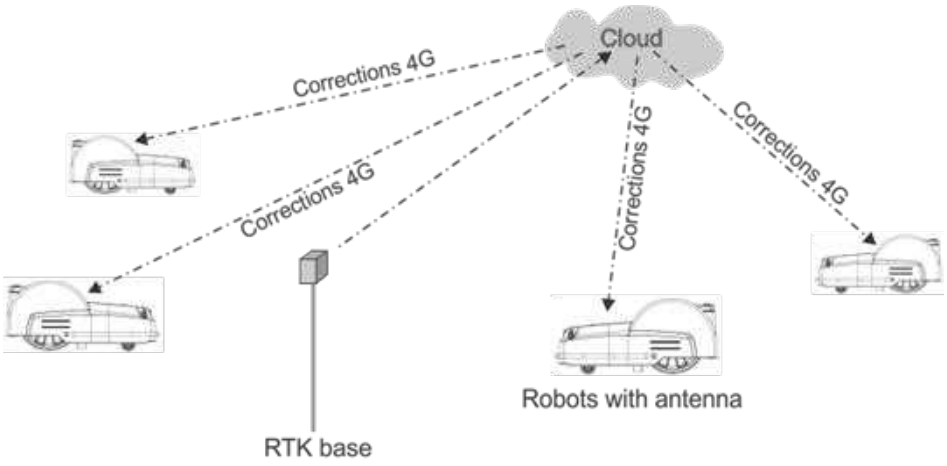


Figure 25: Transfer of corrections using 4G

One base station can feed corrections to multiple robots, but each robot must receive corrections from only 1 base station to keep corrections consistent.

9.2 Technical specifications BM-850

Capacity

Maximum mowable area (1 (page 49))	30000m^2
Recommended mowable area (2 (page 51))	8000-22000m^2
Number of sports fields per robot	1-2
Mowing width	400mm
RTK Pattern Overlap	50mm
Speed	1m/s
Maximum slope	<5% under normal operating conditions. 30% for limited lengths of time.

Cutting

Number of cutting heads	2
Number of cutting blades	3 per cutting head (6 in total)
Low cut (minimum)	20mm
High cut (maximum)	70mm
Mowing width	400mm
Adjustment of cutting heads	Electronic
Maximum noise level (measured at 5m)	52dB(A)

Battery

Type	LI-FePo4

Nominal Voltage	25.6V
Nominal Capacity	8.55Ah
Nominal charge current:	7.6A
Energy	194.56Wh
Working temperature range	Between -20°C and +60°C
Typical mowing time	100-120 minutes
Typical charging time	55 minutes
Manufacturer	STL Technology Co Ltd
Registered trade name or make	STL
Manufacturer's postal address	1, West 15th Street (CTIP), Cianjhen Dist., Kaohsiung City 806011, Taiwan (R.O.C.)
Web address	www.stl-tech.com
Email address	stl@stl-tech.com

Weight and dimensions

Weight	25kg
Length	871mm
Width	700mm
Height	320mm

Software and monitoring

Security PIN code	Yes
GPS location	RTK
Robot management via server and app.	Standard

Intelligence

Sonar detection of obstacles	Multiple. Height 400mm, diameter 70mm.
Return to station via GPS	Yes
Type of mowing	Patterned
Multiple starting zone	Yes
Multi field (optional)	Yes
Multi robots/ station	No

Safety

Lift sensors	Yes
Collision sensors	Yes

Reverse sensors	No
Tilt sensors	Yes
Rollover sensors	Yes

(1) 3 times per week complete mowing of the area working 24hours/day.

(2) 3 times per week complete mowing of the area during 8 hours/day (night schedule only).

Dimensions

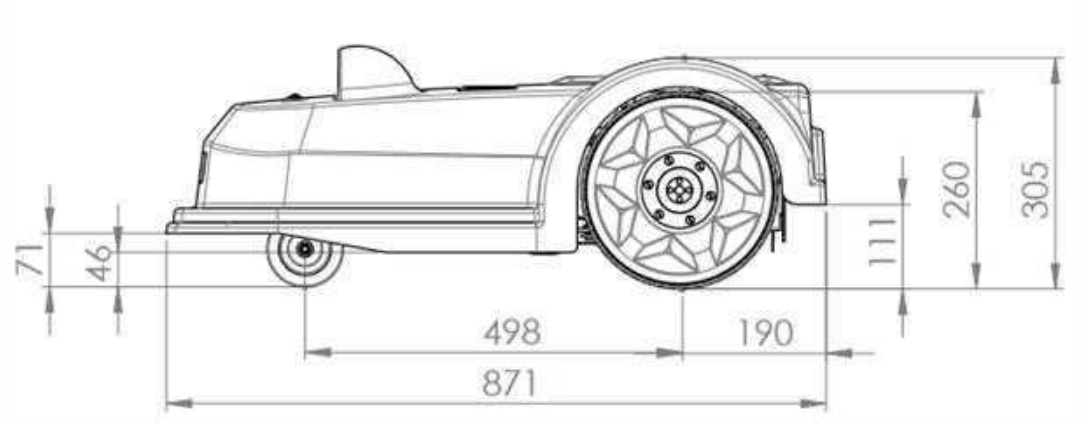


Figure 26: Robot length dimensions

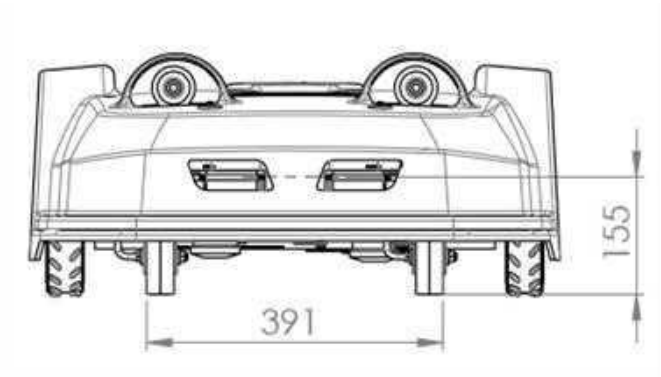


Figure 27: Robot front width dimensions

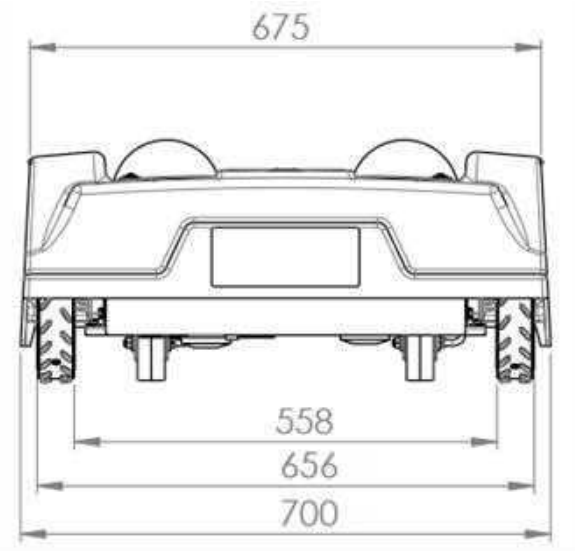


Figure 28: Robot rear width dimensions

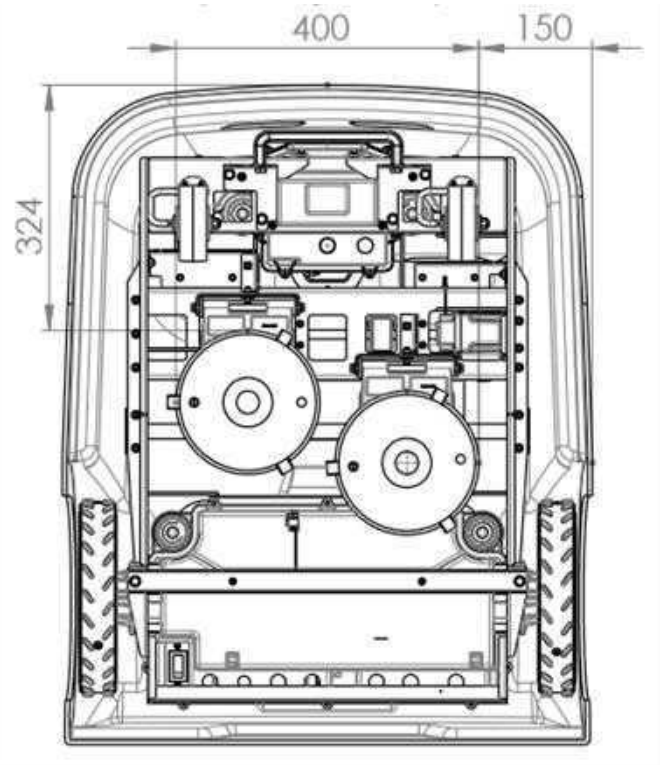


Figure 29: Robot bottom dimensions

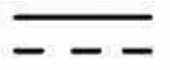
9.3 Notices

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.

The protection of the product is ensured by double insulation and does not require a safety connection to electrical earth (ground).

United Kingdom Conformity Assessed



Direct current

Alternating current

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.

9.4 Declaration of conformity

YAMABIKO BELROBOTICS ECHO shindaiwa

Declaration of Conformity

Manufacturer:	Yamabiko Europe SA
Address:	Avenue Lavoisier 35, 1300 Wavre Belgium
Representative:	Richard Glaser, CERTIFICATION EXPERTS B.V.
Address:	Amerlandseweg 7, 3621 ZC Breukelen, The Netherlands

We, YAMABIKO Europe SA, declare under our sole responsibility that the hereunder specified products conform to the following directives.

Product Name:	Battery powered robotic lawnmower
Brand:	Belrobotics / Echo
Sales Model:	BM850®; TM850®;
Serial Number:	BRSM000101 and above; EESM000101 and above;

DIRECTIVES	CATEGORY	HARMONIZED STANDARDS/PROCEDURE
2006/42/EC	**Machine Directive**	
	Safety robotic mowers	EN 50636-2-107:2015+A3:2021
	Safety household appliance	EN 60335-1:2012+A15:2021
2014/35/EU	**Low Voltage Directive**	
	Voltage directive for charging station & RTK base	EN 60335-1:2012+A15:2021
2014/30/EU	**Electromagnetic Compatibility**	
	Emission	EN 55014-1:2021
	Harmonic emission	EN 61000-3-2: 2014 & 61000-3-3:2021
	Immunity (ESD + rad. disturbance)	EN 55014-2:2021
2014/53/EU	**Radio Equipment Directive**	
	Spurious Tx : GSM900/1800	ETSI EN 301 489-52 v1.2.1 ETSI EN 301 511 v12.5.1
	Spurious Tx : LTE	ETSI EN 301 908-13 v13.2.1
	Spurious Tx : GNSS	ETSI EN 301 489-19 v2.2.1 ETSI EN 303 413 v1.2.1
	Spurious Tx : Wi-Fi	ETSI EN 301 489-17 v3.2.6 ETSI EN 300 328 v2.2.2
	Spurious Tx : Peripheral wire	ETSI EN 301 489-01 v2.2.3 ETSI EN 303 447 v1.3.1
2006/66/EC	**Battery Directive**	
2011/65/EU	**Restriction of the use of hazardous substance**	IEC 63000:2016+AMD1:2022
2000/14/EU	**Noise emission from outdoor equipment**	< 70 dB (A)

Wavre, Dec 3rd 2023

Mani Bhushan
Regulatory & Compliance Officer
YAMABIKO EUROPE SA

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Web www.yamabiko.eu ▫ E-mail info@yamabiko.eu ▫ VAT BE 0477.194.468

YAMABIKO BELROBOTICS ECHO shindaiwa

Declaration of Conformity (UK)

Manufacturer: Yamabiko Europe SA
Address: Avenue Lavoisier 35, 1300 Wavre Belgium

Representative: UKCA Experts Ltd.
Address: Dept 302, 43 Owston Road, Carcroft, Doncaster, DN6 8DA, United Kingdom

We, YAMABIKO Europe SA, declare under our sole responsibility that the hereunder specified products conform to the following directives.

Product Name: Battery powered robotic lawnmower
Brand: Belrobotics / Echo
Sales Model: BM850®; TM850®;
Serial Number: BRSM000101 and above; EESM000101 and above;

LEGISLATION	CATEGORY	HARMONIZED STANDARDS/PROCEDURE
Supply of Machinery (Safety) Regulations 2008	**Machinery Directive**	
	Safety robotic mowers	EN 50636-2-107:2015+A3:2021
	Safety household appliance	EN 60335-1:2012+A15:2021
Electrical Equipment (Safety) Regulations 2016	**Low Voltage Directive**	
	Voltage directive for charging station & RTK base	EN 60335-1:2012+A15:2021
Electromagnetic Compatibility Regulations 2016	**Electromagnetic Compatibility**	
	Emission	EN 55014-1:2021
	Harmonic emission	EN 61000-3-2: 2014 & 61000-3-3:2021
	Immunity	EN 55014-2:2021
Radio Equipment Regulations 2017	**Radio Equipment Directive**	
	Spurious Tx : GSM900/1800	ETSI EN 301 489-52 v1.2.1 ETSI EN 301 511 v12.5.1
	Spurious Tx : LTE	ETSI EN 301 908-13 v13.2.1
	Spurious Tx : GNSS	ETSI EN 301 489-19 v2.2.1 ETSI EN 303 413 v1.2.1
	Spurious Tx : Wi-Fi	ETSI EN 301 489-17 v3.2.6 ETSI EN 300 328 v2.2.2
	Spurious Tx : Peripheral wire	ETSI EN 301 489-01 v2.2.3 ETSI EN 303 447 v1.3.1
2006/66/EC Restriction of use of Hazardous Substances Regulations 2012	**Battery Directive** **Restriction of the use of hazardous substance**	IEC 63000:2016+AMD1:2022
Outdoor Noise Emission Regulation 2001	**Noise emission from outdoor equipment**	< 70 dB (A)

Wavre, Dec 3rd, 2023

Mani Bhushan
Regulatory & Compliance Officer
YAMABIKO EUROPE SA

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Web www.yamabiko.eu ▫ E-mail info@yamabiko.eu ▫ VAT BE 0477.194.468

9.5 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)

9.6 Glossary

Border mode

This refers to when the robot mows the border of the working area. This must be done regularly. This must be set by either configuring the robot to mow the border a certain number of times per week, or through the implementation of sequential scheduling where the robot automatically mows the border as soon as the area has been mowed.

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.

Discovery

Discovery is the term used to describe the process of defining the border of a GPS working zone or a NoGo zone. It involves the robot moving around the border and GPS way points being created at regular intervals along the border.

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 loop wire to return to the station.

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 a 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.

NoGo zone

GPS defined NoGo zones are regions on the field defined by GPS coordinates where the robot can never enter during any of its autonomous operating states. GPS defined NoGo zones are used to exclude zones from the working area of the robot that cannot be detected during border discovery. Use of GPS defined NoGo zones allows the robot to calculate the most efficient mowing pattern in advance. GPS defined NoGo zones are used to exclude obstacles, typically done by islands and pseudo islands.

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 creating NoGo zones around them.

Parcel

An area to be mowed within a peripheral wire. At least one parcel is associated with one wire.

Several parcels can be defined.

Path

A path is a set of GPS way points that enable the robot to navigate between zones. It is contained within its own GPS safety zone. The path must have points defined in the areas where the zones overlap.

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.

RTK GPS zone

The working area for a robot performing pattern mowing. The RTK GPS zone is defined by the robot making a tour of the peripheral wire.

Schedule

The schedule defines exactly when and where the robot will work at a specific time of day.

Sequential Schedule

This is a configuration parameter. When set, the robot mows each of the working zones is sequence and mows the border after the zone is finished.

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.

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.

Terrain

An area of grass surrounding the field that is not to be mowed.

Trackwire

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

Belrobotics THE GRASS MASTERS