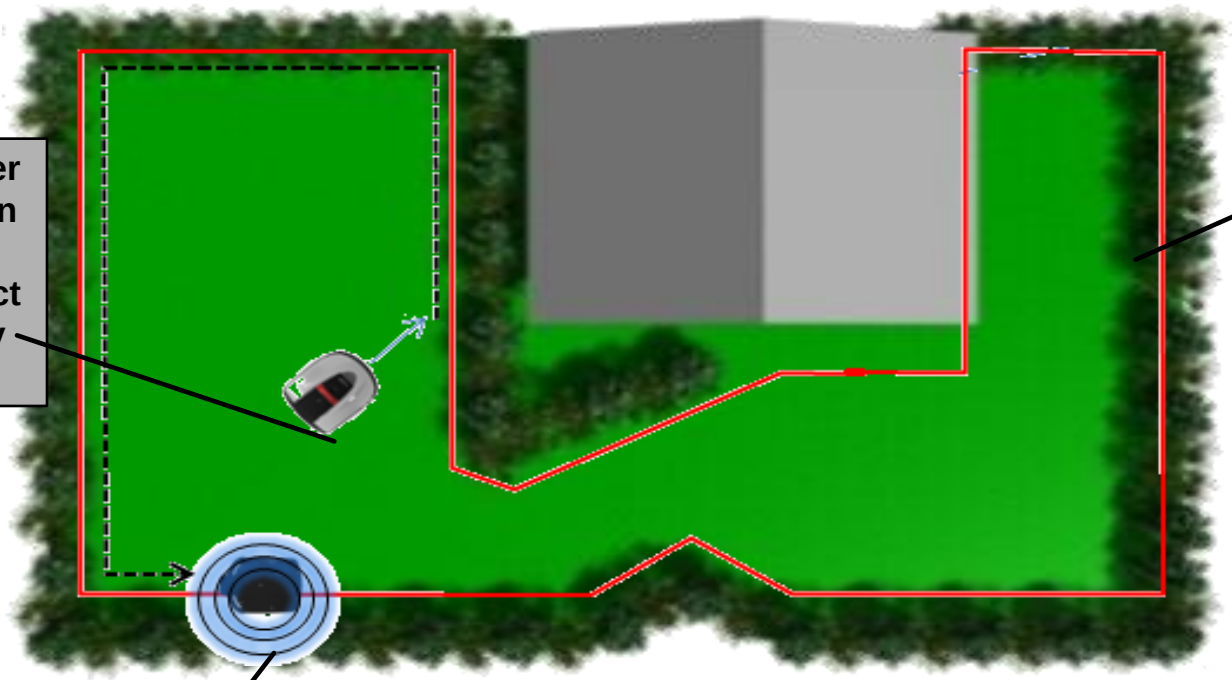
1. Product Concept and Specification

Product Concept

Honda Miimo is a DC (battery) powered mower using a micro-computer, timer and sensors to achieve autonomous and unattended operation within a defined garden area.



Robotic Mower has sensors in the front and rear that detect the boundary wire signal

A boundary or "area" wire is installed around the edge of the garden and is connected to the docking station

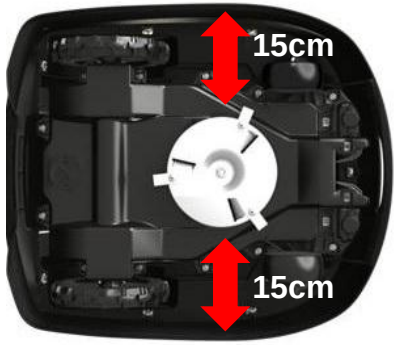
Docking station sends a signal through the boundary wire

Docking station emits a signal that can be detected in an area of approximately 85cm around the station, this signal guides the Robotic Mower in the direction of the station for battery charging

Safety

Meeting the international safety standards

- When lifted up, blade and wheel motors stop; PIN input is needed
- When tilted (over 35º/ 70%) or rolled over, blade and wheel motor stop; PIN input is needed
- When obstructed, moves backwards and changes direction
- When the manual stop button is pressed, blade and wheel motor stop
- Rotating blades are on a safe distance from the outer shell; hand and foot protection



Mowing capacity

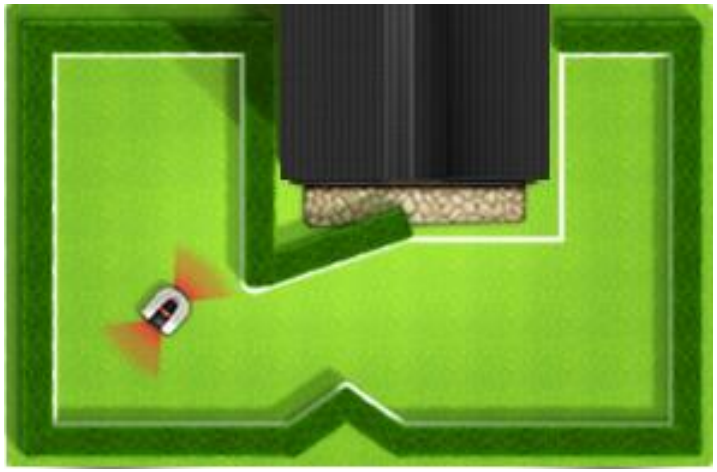
The recommended cutting area is as follows:

Miimo 500:

Garden Area up to 3000m2.
Garden perimeter up to 500m.
(Technically complex gardens with many boundaries and obstacles)

Miimo 300:

Garden Area up to 2200m2.
Garden perimeter up to 300m.
(Less complex garden types with more uniform boundaries and fewer obstacles)

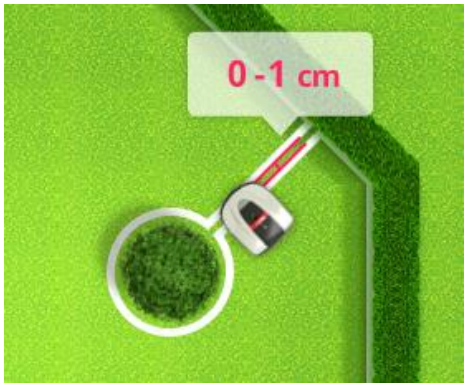


Both models have the same features. Miimo 500 uses a larger battery. This means it can spend more time in the garden cutting and less time going back and forth to the docking station.

Operation

Mowing around boundary island:

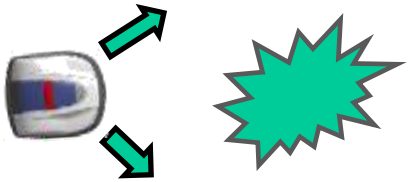
Miimo passes the parallel boundary wires that lead to a boundary island.



Hitting an obstacle :

When the Robotic Mower hits an obstacle, the obstruction sensor is activated, the Robotic Mower reverses and proceeds at an angle to avoid the obstacle.

Reverse 30 cm

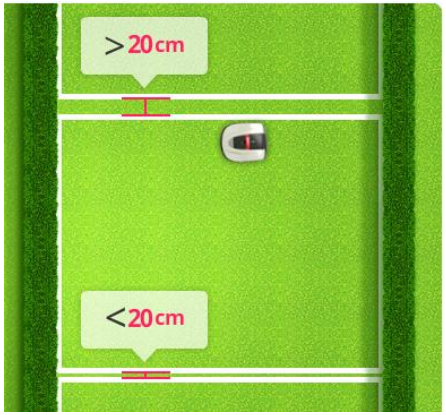


Proceed at random angle forward

Operation

Zone separation:

2 parallel boundary wires with more than 20 cm distance separate an area into zones; the Robotic Mower will not cross these boundary wires.



Lifting and rollover:

When the mower is lifted or rolls over, the lift sensor is activated and all functions stop.

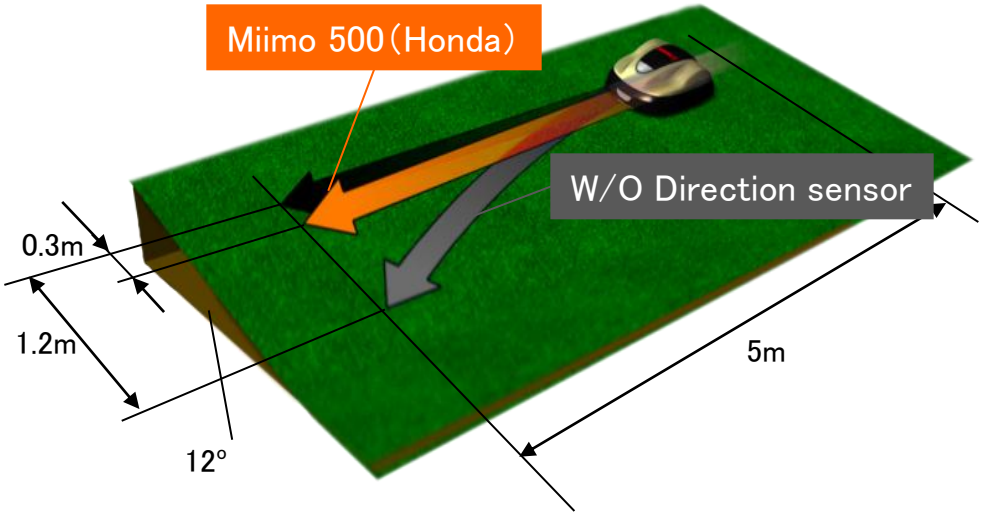
Obstacle crossing, inclination:

When the Robotic Mower runs over an obstacle or crosses a big slope (+25° / 46%), the tilt sensor is activated and the moving direction is changed.

Operation

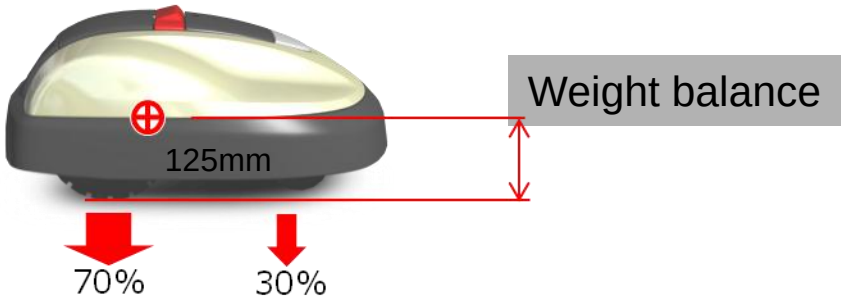
Keeps straight movement on slope

A directional (YAW) sensor allows Miimo to maintain a straight line by controlling the rotational speed of the left and right motors.



Slope control maintained with:

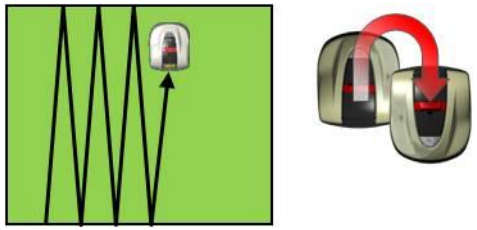
- High traction wheels.
- Best weight balance.
- Powerful drive motors.



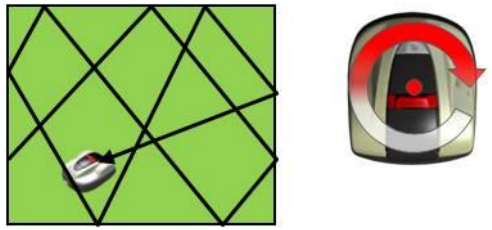
Cutting Patterns

Three cutting patterns are available depending on the shape of the garden

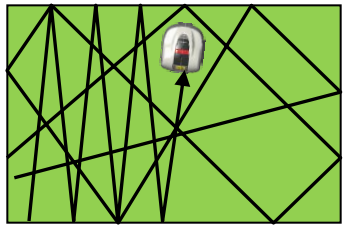
Directional cutting



Random cutting



Mixture of Random and Directional

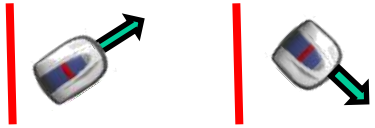


Approach to boundary wire

175°

Approach to boundary wire

Turn (90° to 170°) clockwise - anti-clockwise



Exit and proceed

15 min. Random

15 min. Directional

15 min. Random

.....

Approach to obstacle

Reverse
30 cm

Proceed at random angle forward

2. Construction and Function

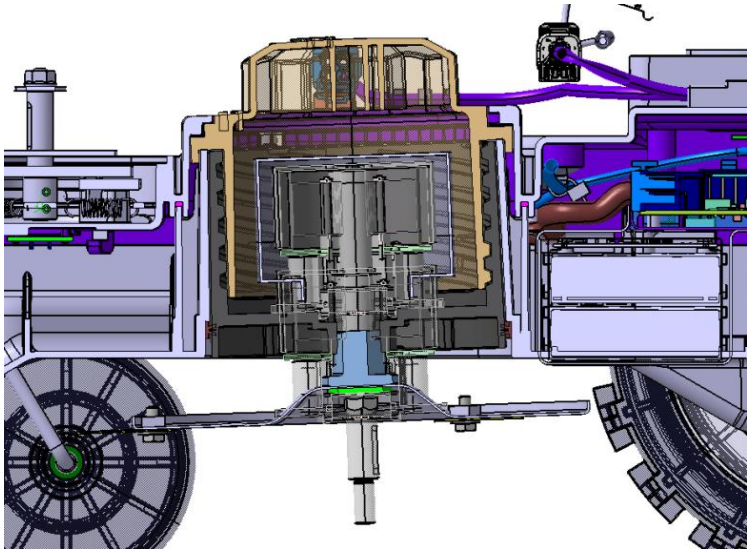
Electric Motors

Powerful Blade Motor

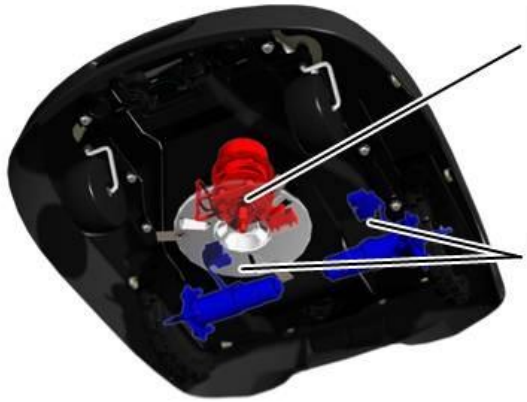
- Brushless DC motor-no maintenance
- No loss of RPM – Power always available to make a clean cut.
- Extra power used to drive the Blade fan

Powerful Drive Motor

- Brushless DC motor-no maintenance
- Slope capability– consistent speed
- Rough terrain – consistent speed
- Longevity – not overworked



Wheel motors



Blade motor 56W

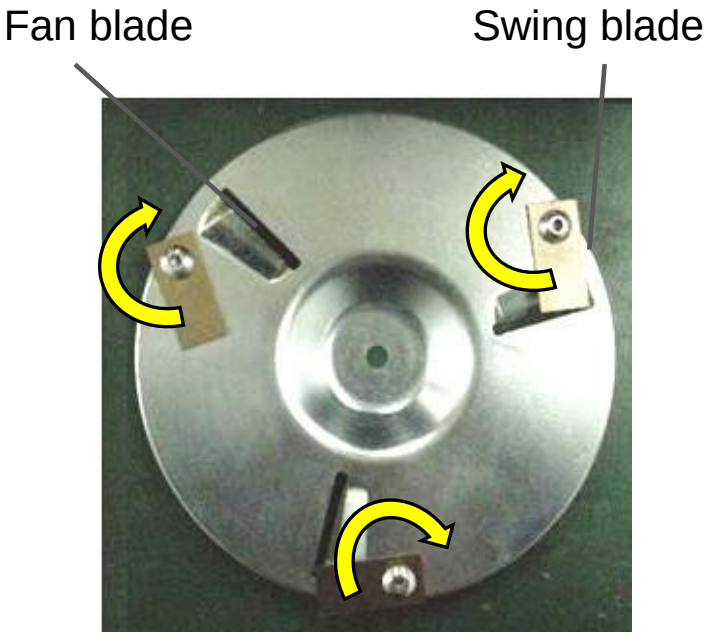
Wheel motors 2 x 25W

Blade Disk / Cutting Blades

The blade disk has a dual function:

- Holding the 3 swing blade construction
- Serving as a fan for good dispersion of grass clippings (mulching system)

Blade disk has 1 rotation direction (clockwise) for good fan operation. Blade disk stopping time within 3 sec. when mower is lifted

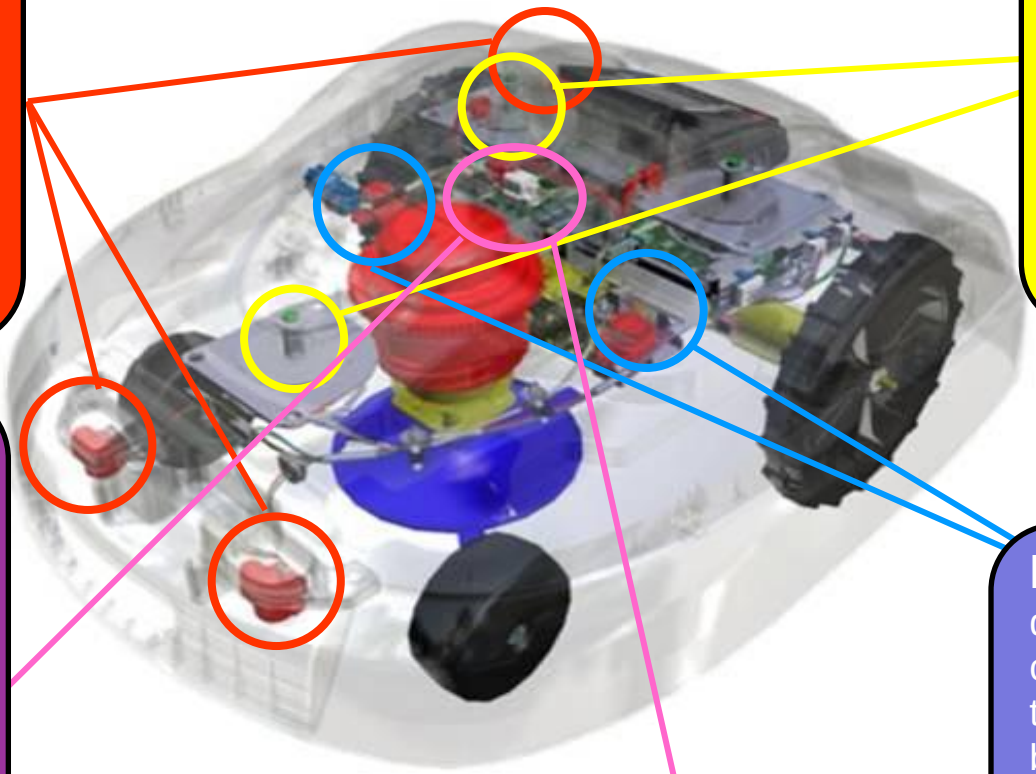


Sensors

Let's take a look at Miimo's sensors.

Area sensor
keeps Miimo within the boundary wire away from paths, trees ponds and play grounds etc., and allows Miimo to follow the wire back to the docking station.

Obstruction sensor
is activated when the cover moves a minimum 10mm in relation to the chassis. Miimo then stops and changes direction.



Tilt/Rollover sensor
constantly measures the pitch and roll of Miimo on slopes. If angle exceeds 25 ± 5 degrees, moving direction is changed to safely maintain stability. **If** angle is over 55 degrees, all motors stop.

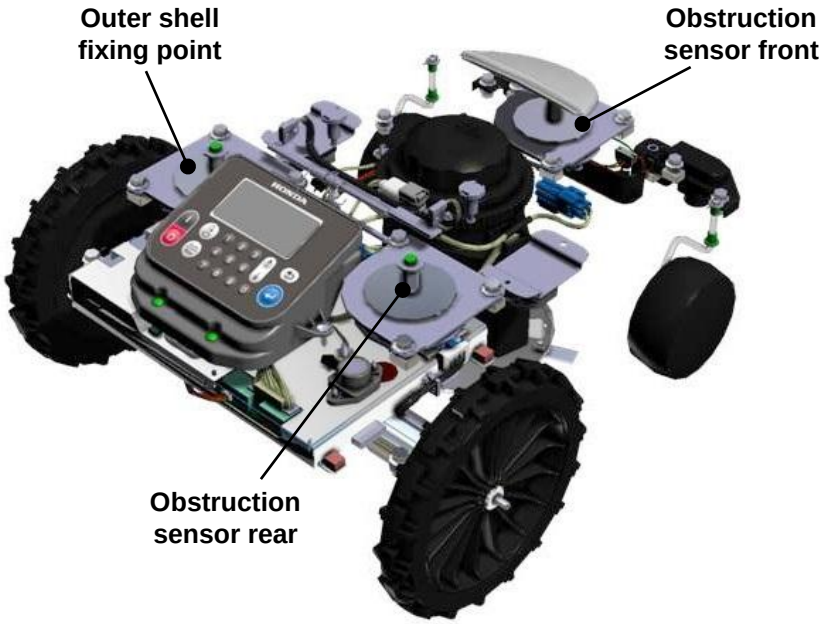
Lift sensors
detect lifting of the cover in relation to the chassis. The blade & wheel motors stop when the sensor is activated.

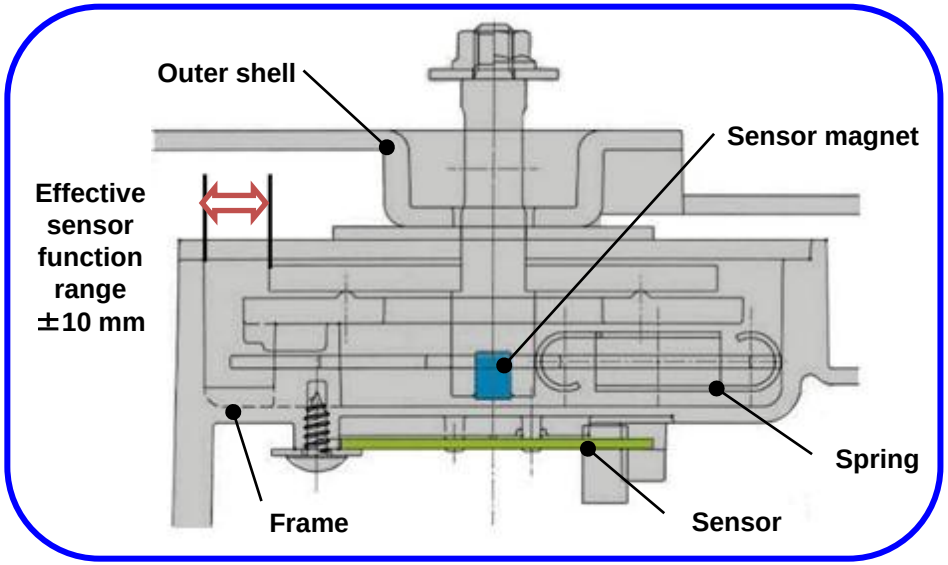
Yaw sensor
constantly controls the straight line movement and steers the left/right wheel motor speed.

Obstruction Sensor

When the Robotic Mower hits an obstacle, the obstruction sensor is activated. The Robotic Mower reverses 30 cm and proceeds at a random angle to avoid the obstacle.

If operation continues for 3 seconds, blade motor stops. If operation continues for 9 seconds, wheel motors stop and there is obstruction detection lock out. Reset is needed with input PIN code.

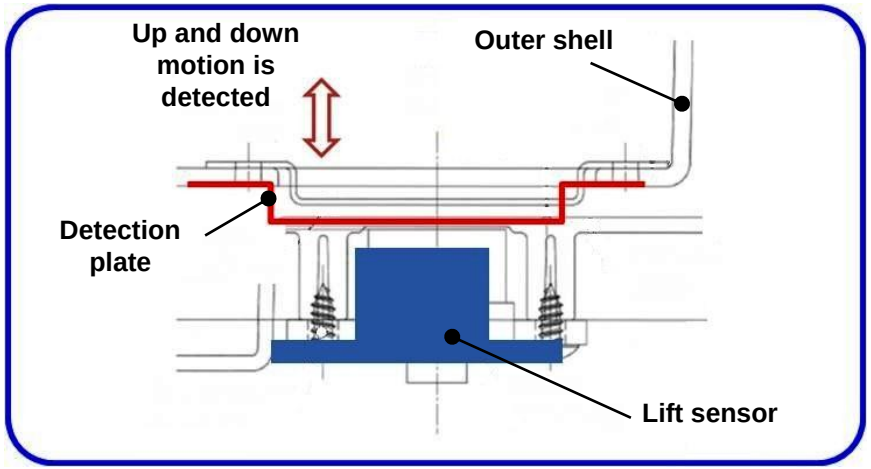


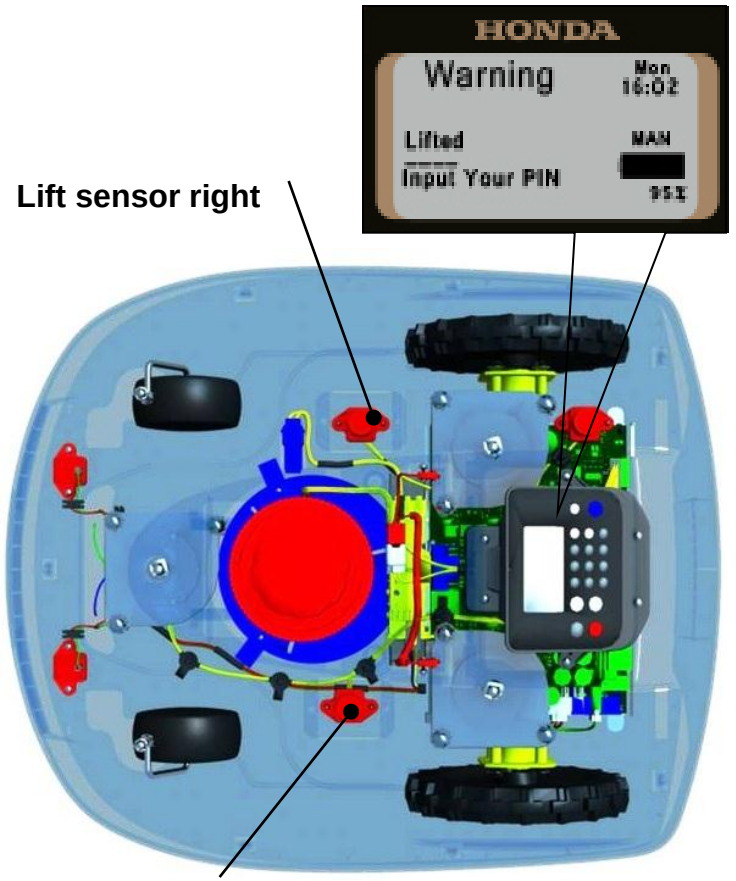


Lift Sensor

Two sensors installed into the frame detect lifting of the cover. The function of blade motor and wheel motors will stop when the cover is lifted.

It locks out when lifting operation continues for 9 seconds. Reset is needed with input PIN code.

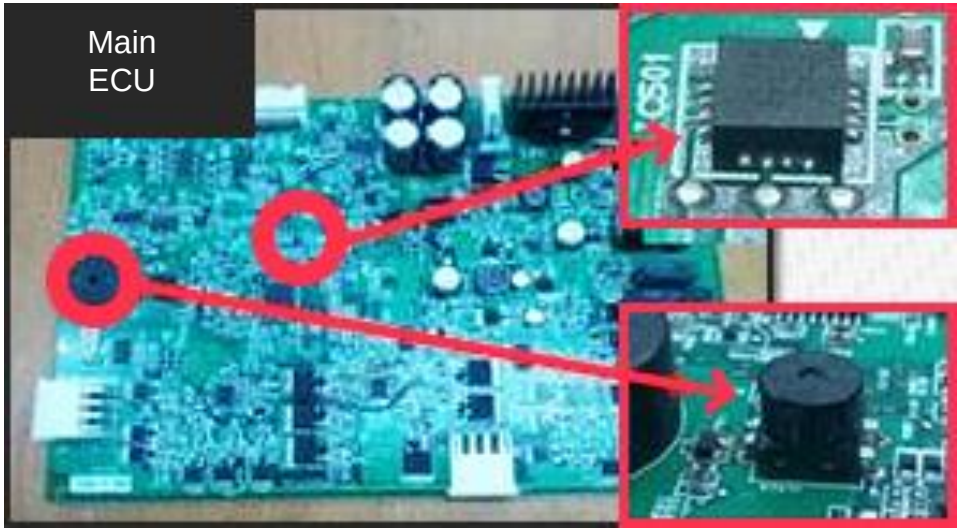


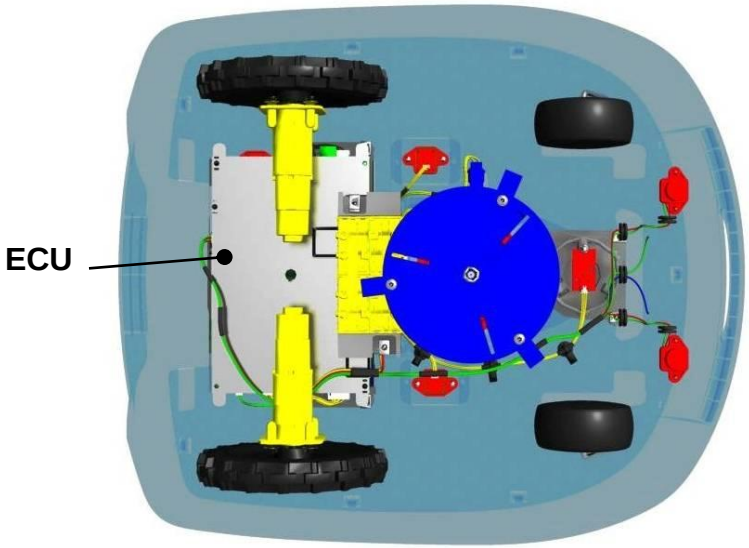


Tilt Sensor

The ECU is equipped with 2 sensors: a tilt sensor and a rollover sensor.

Tilt sensor





Rollover sensor

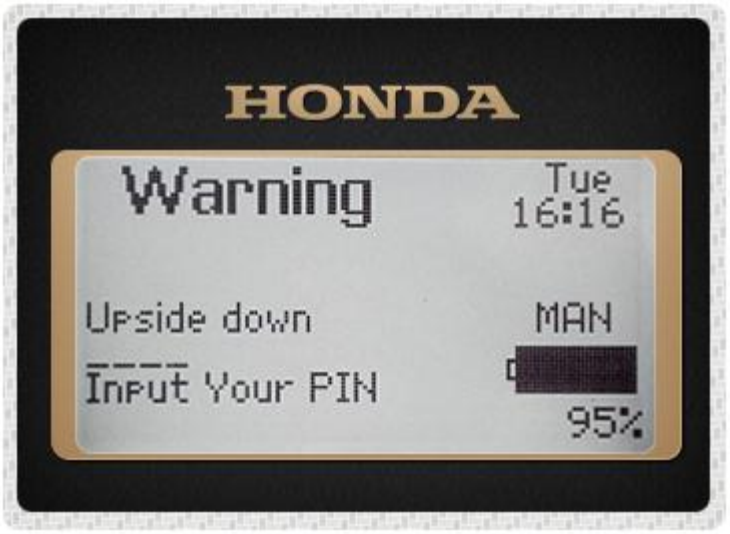
Tilt and Rollover Sensors

Tilt sensor

If the slope angle is 25°/46%, moving direction is changed to avoid bigger slope angle. If slope angle is 35°/70%, blade motor and wheel motors stop (lock out). Reset is needed with input PIN code.

Rollover sensor

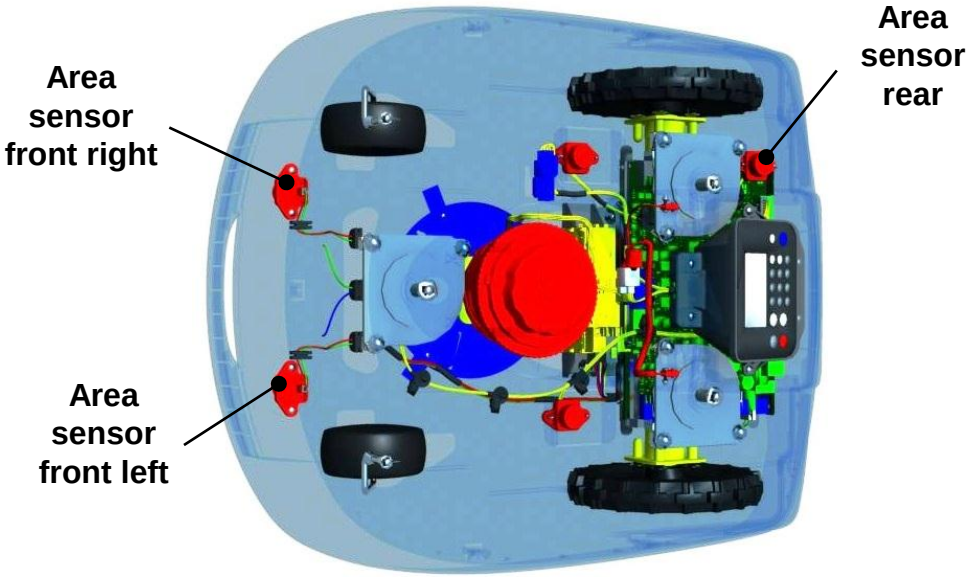
If slope angle is 55°/142%, blade motor and wheel motors stop (lock out). Reset is needed with input PIN code.

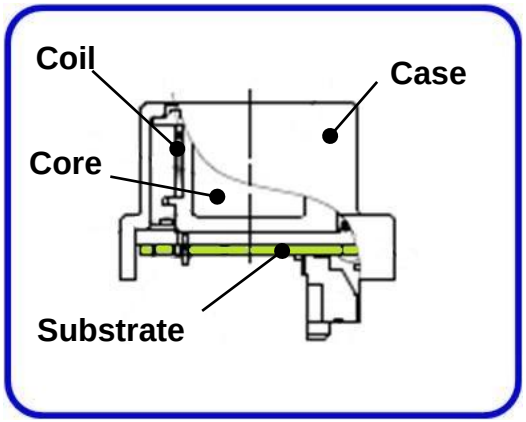


Area Wire Sensor

The direction of the magnetic flux around the boundary wire (+ station signal) is detected by the area sensors.

The Robotic Mower is equipped with 3 area sensors: 2 in front and 1 at the rear.





High Performance Lithium-ion Battery

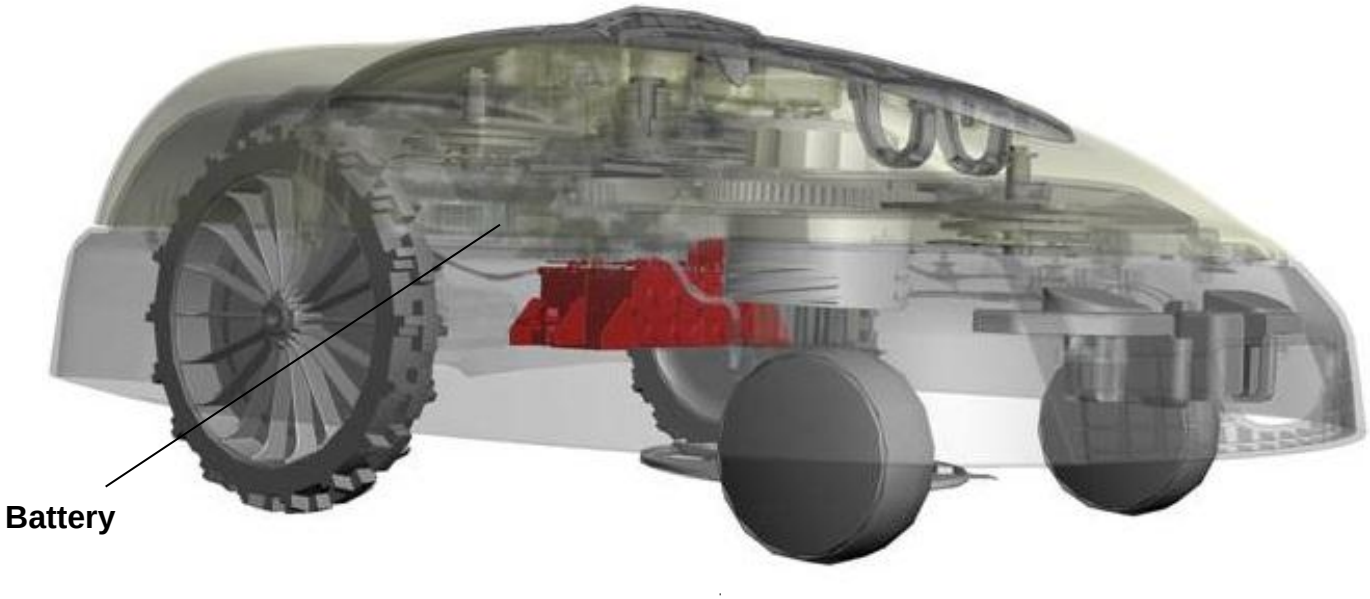
High performance lithium-ion battery is used, lighter in weight and having a larger energy capacity: 1.8Ah for the HRM300 and 3.6Ah for the HRM500.

Battery capacity:

100% = 24.7 V + 0.2 V

0% = 18 V

Charging voltage = + 32 V



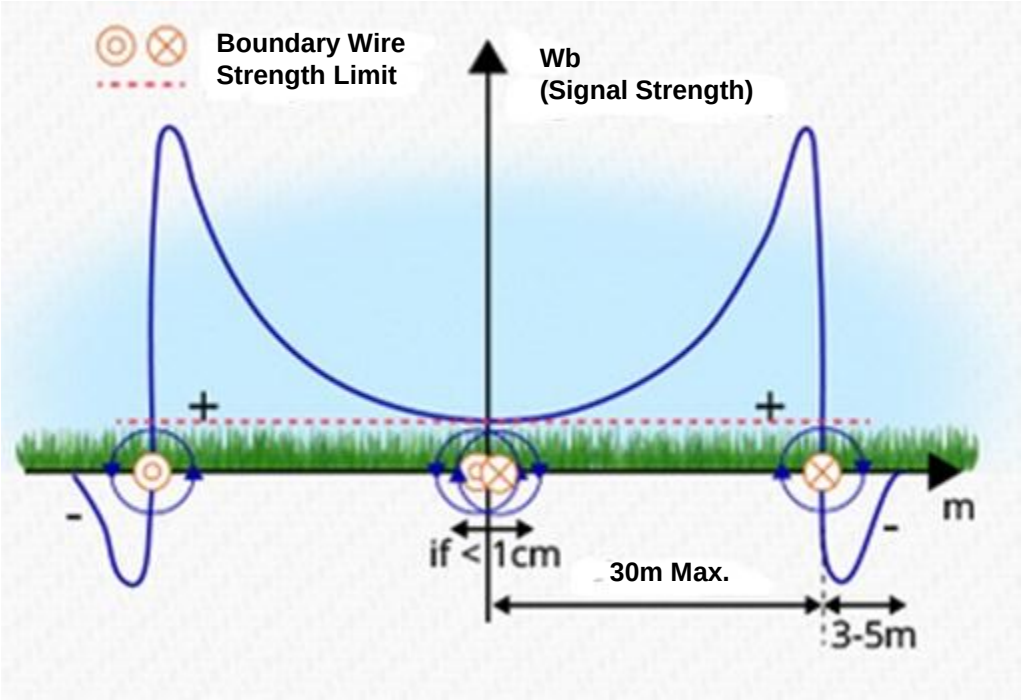
PIN Code

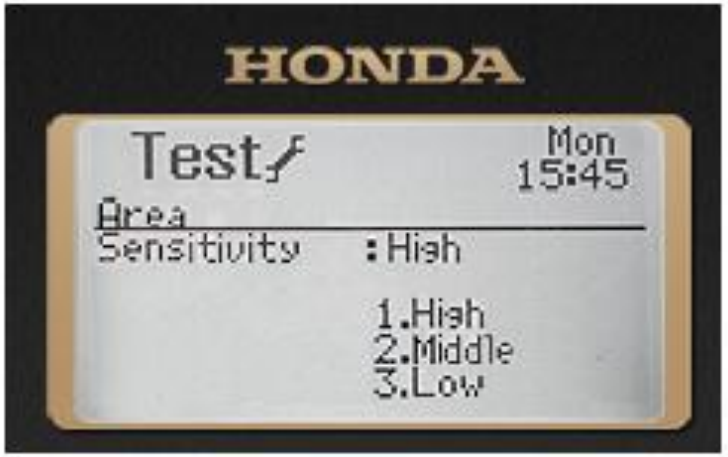
To unlock the display menus, a 4 digit PIN code is needed. Default PIN code is 1234.

Change PIN code to personal PIN code.

Boundary Wire Signal

Maximum distance between boundary wire and mower is 30m; above this distance the magnetic field strength is too weak. Outside the boundary loop wire, the signal strength decreases much faster; after 5m the signal strength becomes zero.





Loop Signal

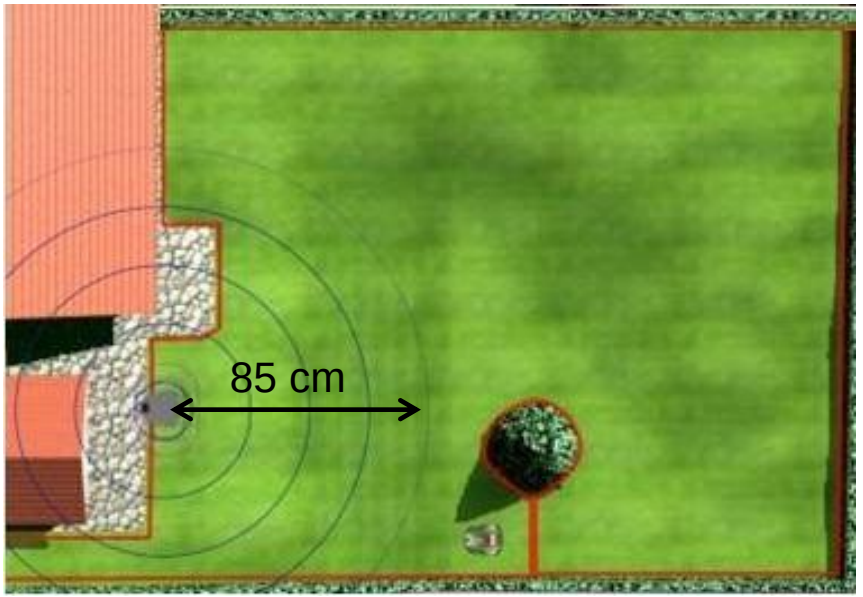
"No loop signal" display when signal strength is too weak or mower is outside the boundary loop wire.

Docking Station Signal

The docking station uses a signal to communicate with Miimo as follows.

The LED indicator turns green when the boundary wire signal is correct, amber (blinking) when interrupted and red when there is a failure.

The docking station emits a finding signal in a perimeter of an average of 85 cm around the station.



Area Sensitivity

The area sensitivity setting can be changed in the test menu (2-4-9-Enter in the main menu).

- High strength reception of signal: 95 cm perimeter
- Mid strength reception of signal: 70 cm perimeter
- Low strength reception of signal: 60 cm perimeter

3. Installation and Setup

Installation & Set Up – Boundary Wire

Maximum length of boundary wire : HRM 300 = 300m / HRM 500 = 500m.

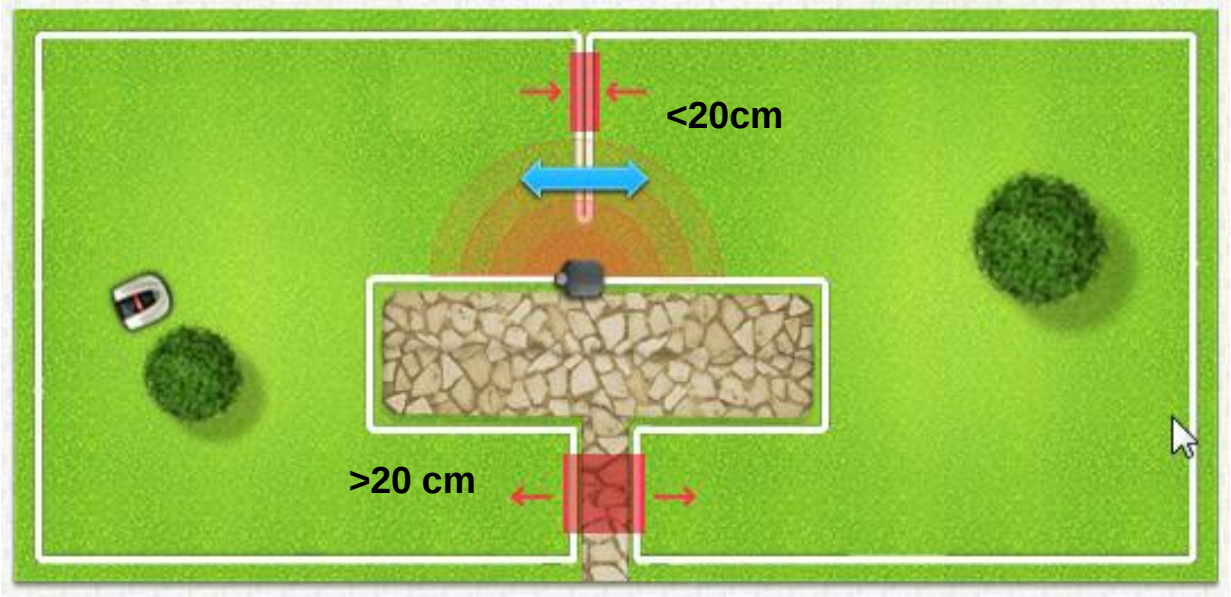
<20cm* parallel wires

Miimo passes the parallel wires when mowing.

Miimo follows the wires when returning to docking station - short cut wire to docking station.

>20cm* parallel wires

Miimo does not pass these parallel wires - area is divided into zones.



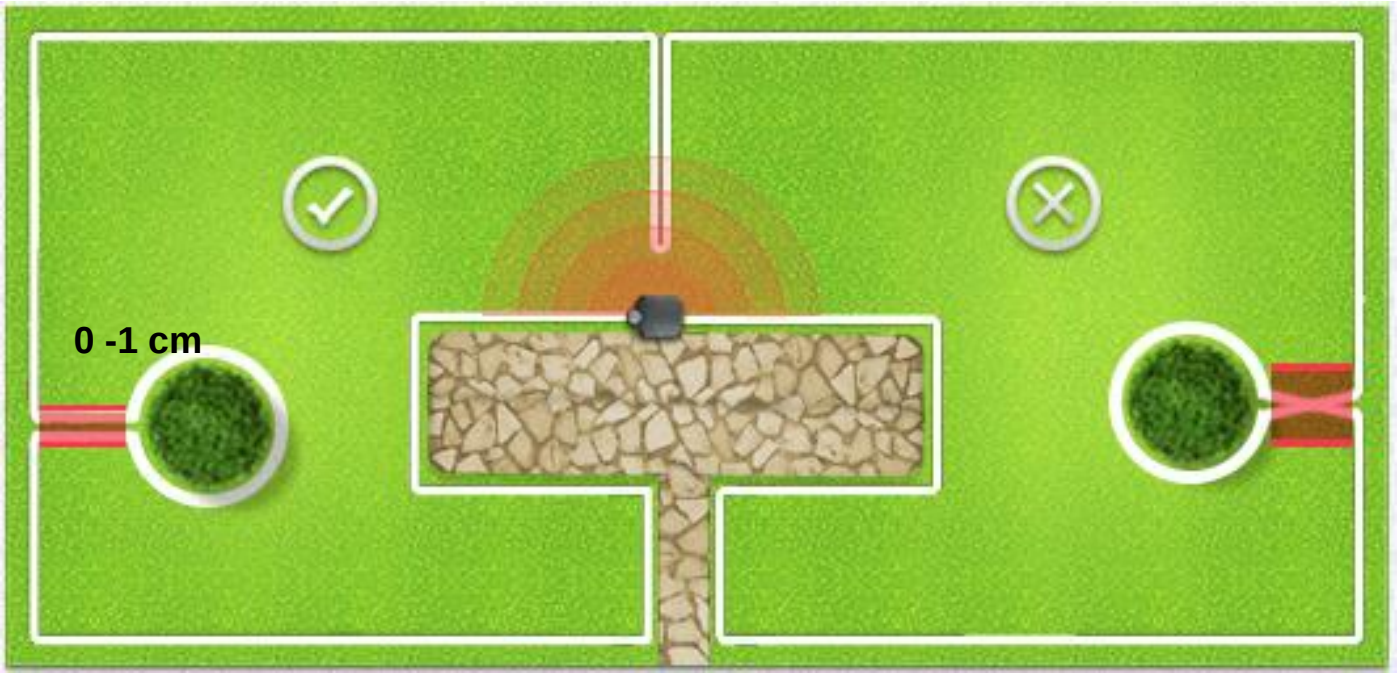
MOWING MODE: The mower passes parallel wires separated by less than 20 cm**.**

* Value varies depending on Wire Offset setting

Installation & Set Up – Boundary Wire

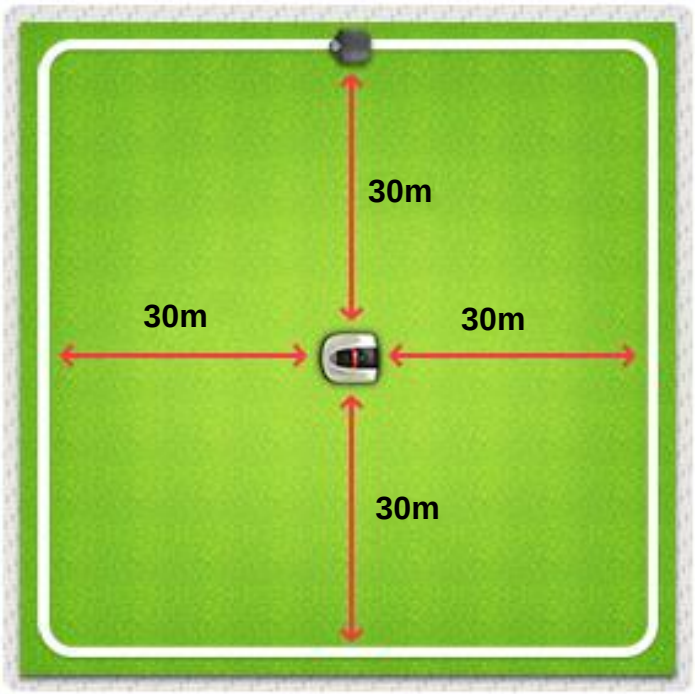
Loop Wire Around Obstacle

- Miimo will always pass these parallel wires
- Parallel wires must not intersect and have distance of 0 - 1cm
- Maximum length of wire 500m (Only for HRM500)
- Distance from obstacles 30 - 50 cm



Boundary Wire

Maximum Distance to Boundary Wire
Max. distance from Robotic Mower to boundary wire at any point (at max. length 500m) is 30m in order to have a good area signal.



Area Wire Offset
The wire offset setting (20 - 45 cm) determines the distance the mower can pass the boundary wire.

Boundary Wire

Select **System Setup** from the control panel

Select **Manual Mode** Setup

Select **Area**

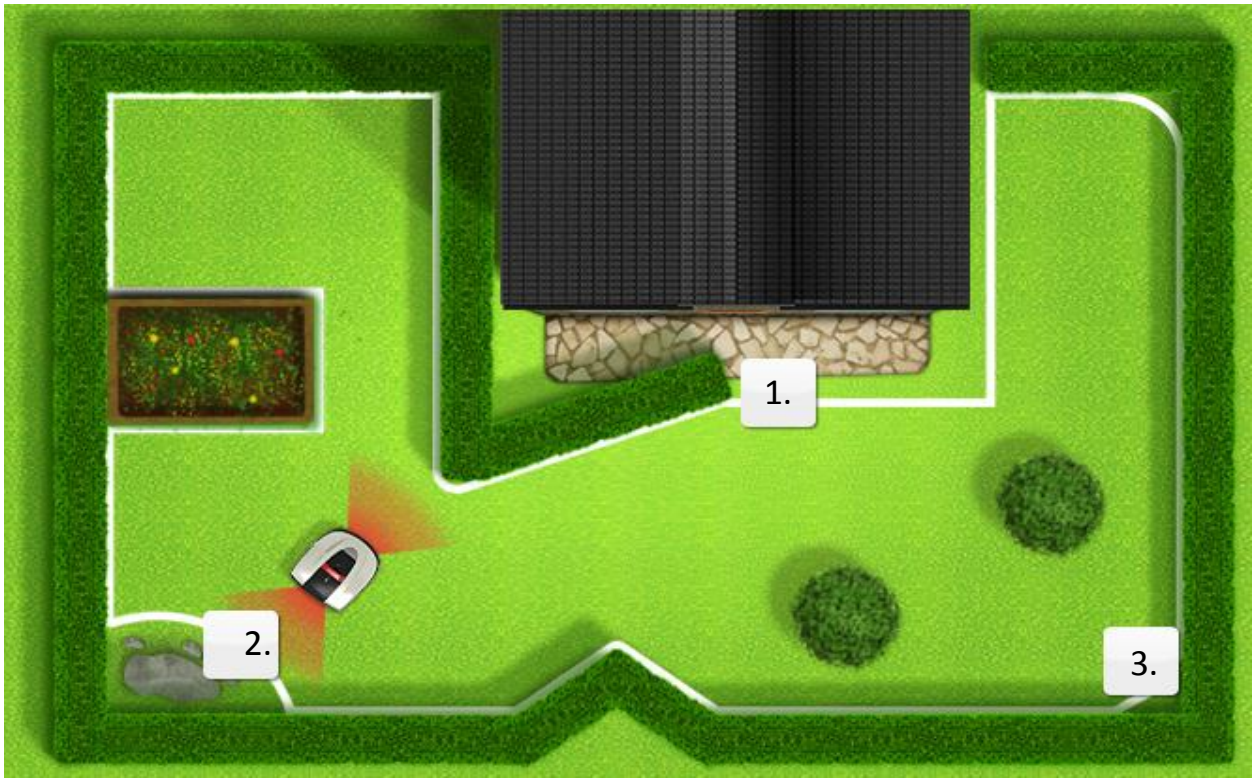
Amend the wire offset setting as appropriate

Boundary Wire Placement

1. Comfort Space: Respect the minimum distances of boundary wire to walls and obstacles to avoid bumping house walls, keep noise low and increase product durability.

2. Efficiency: In a large garden, avoid too many stops by excluding small passages, complicated areas and inclined areas.

3. Corners: Do not include corners of less than 90°, make corners 90° or rounded.



Short Cut Wires

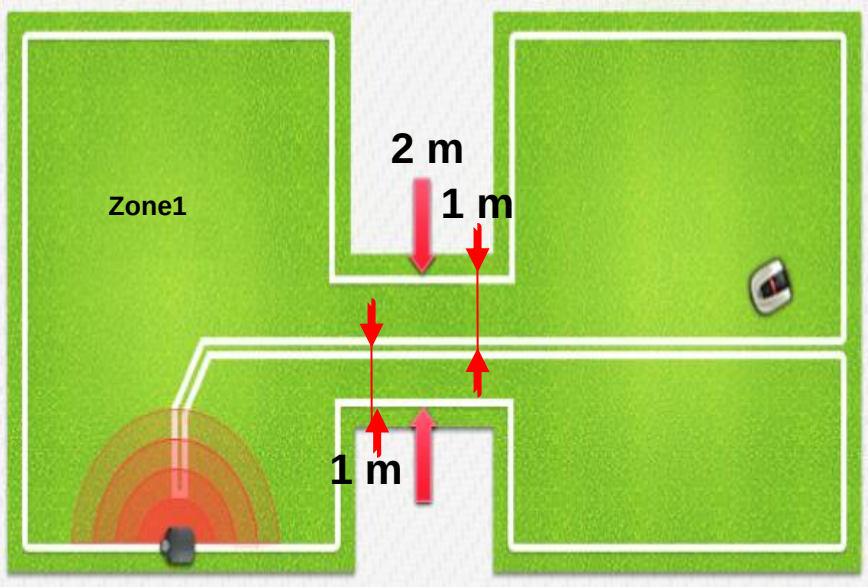
Let’s take a look at some specific issues found in gardens and how to deal with them using short cut wires.

Garden with narrow passage:

Minimum passage width of **1 m** should be respected.

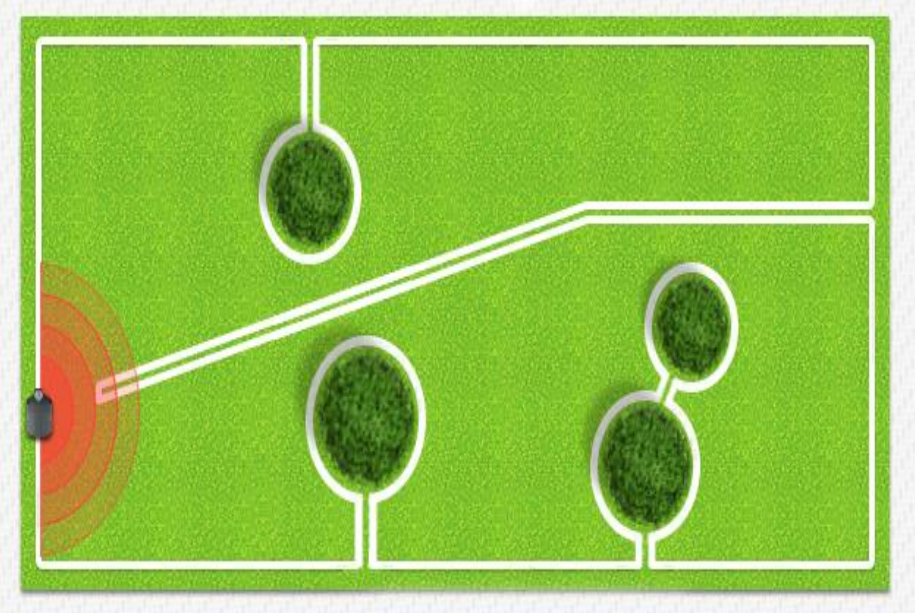
If the Robotic Mower has difficulties to return to the docking station, install a short cut wire through the narrow passage. In that specific case, passage width must be **2m** minimum.

Garden should be separated into zones.



Garden with islands:

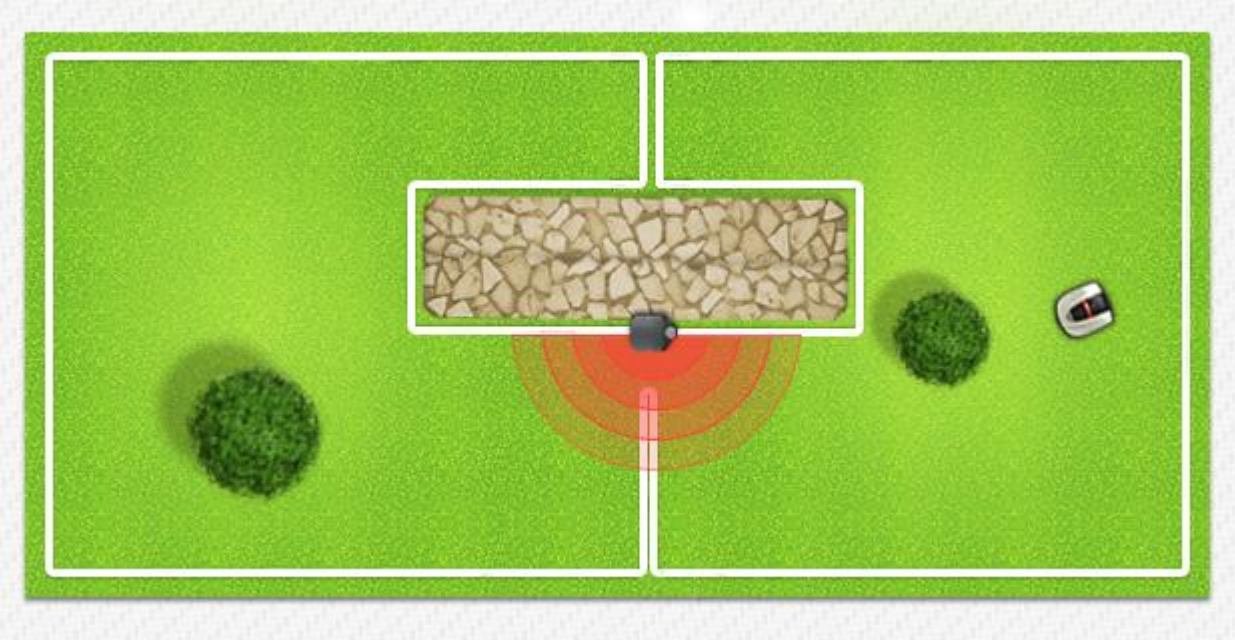
Recommended to install a short cut wire to guide the Robotic out of isolated parts of the garden.



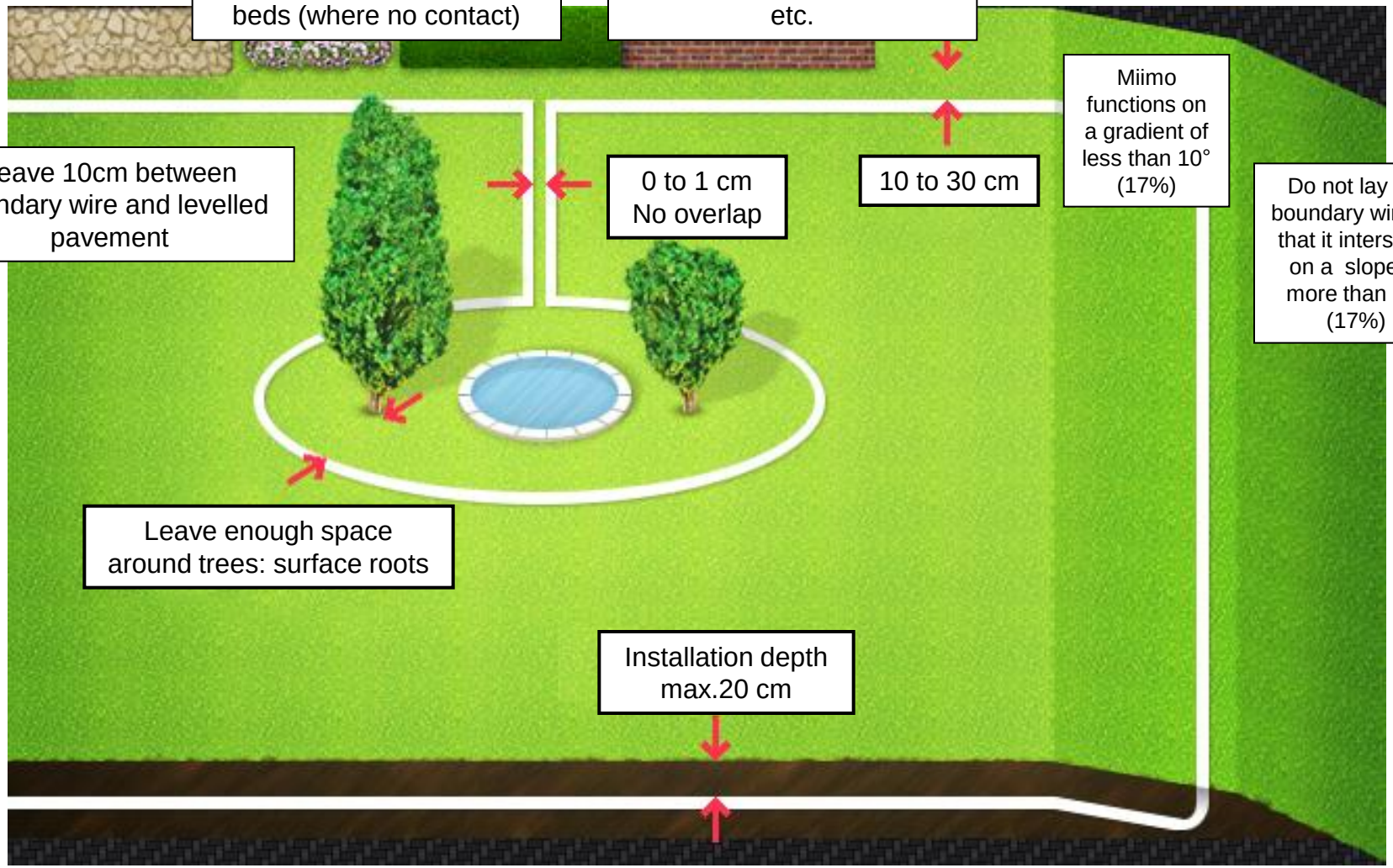
Short Cut Wires

Garden with docking station located on an island:

Recommended to install a short cut wire to guide the Robotic Mower to the docking station island.



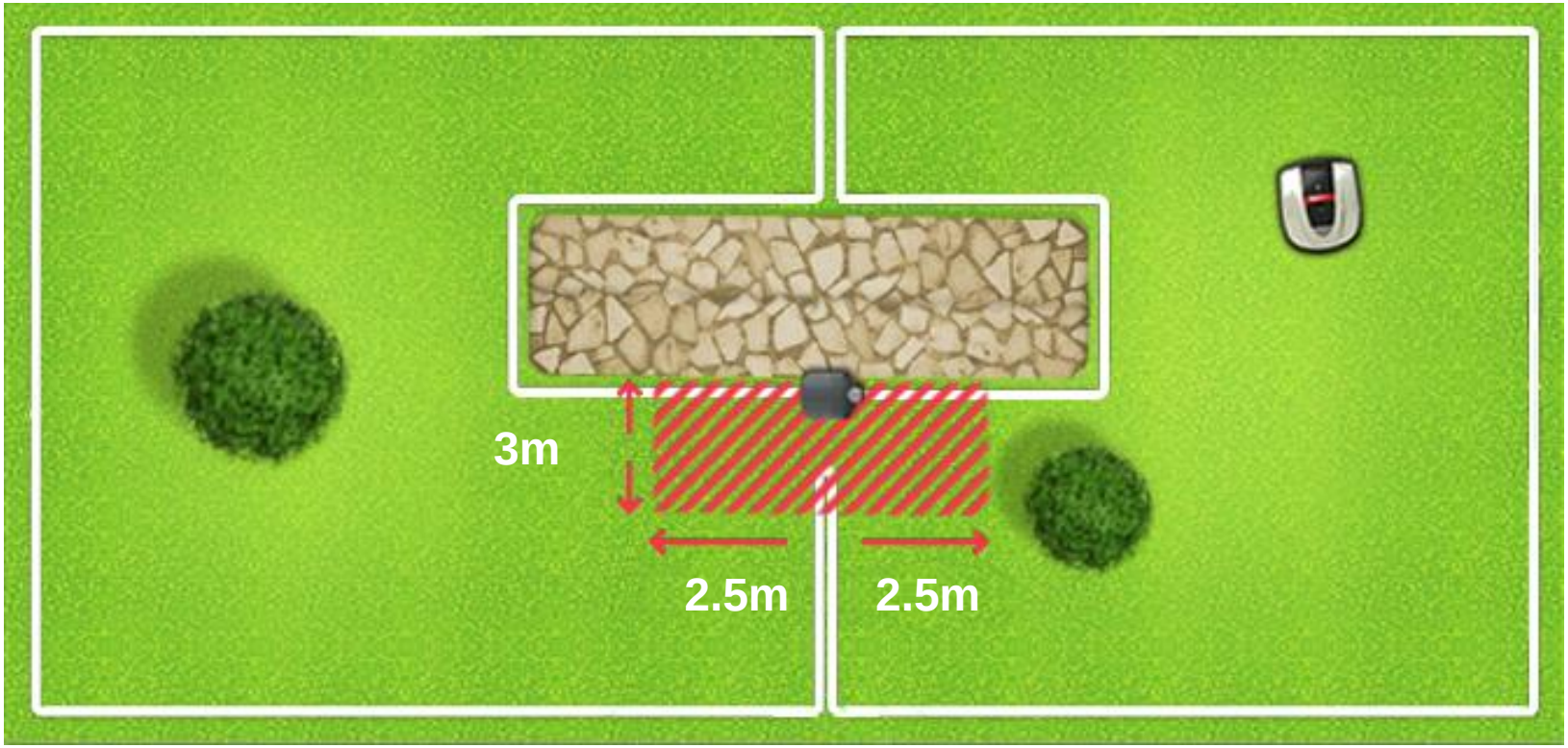
Installation and Set Up - Summary



Docking Station Installation

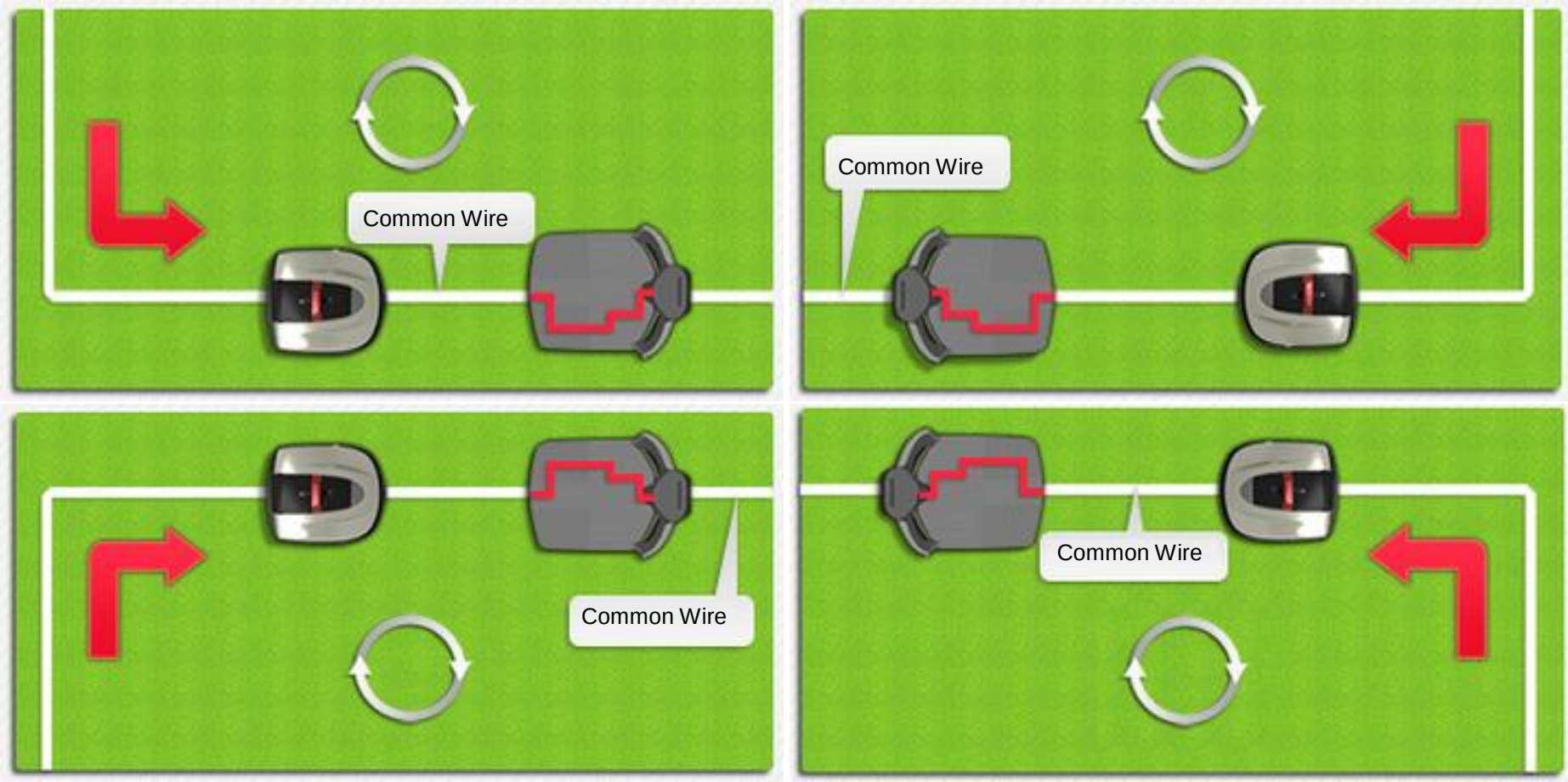
Assure a 2.5m straight area of boundary wire both sides of the docking station.

Assure a zone of 3m free of obstacles around the docking station.



Docking Station Installation

Install the docking station in line with the boundary wire in a clockwise or anti-clockwise direction. Route the wire in the provided guide at bottom side of the docking station; this guide steers the Robotic Mower perfectly to the charging contacts.

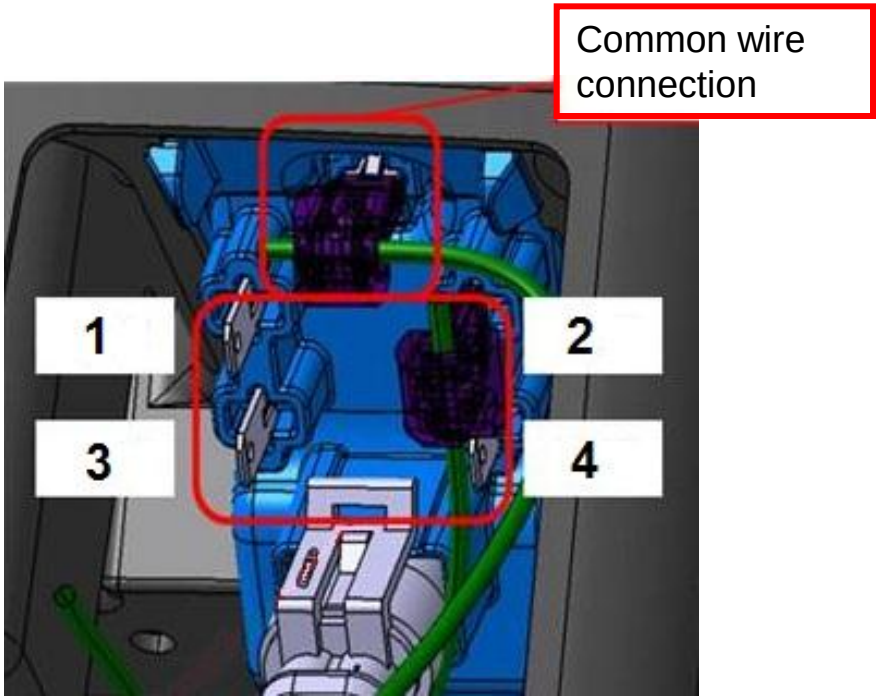


Creating an ‘Inside Loop’

Connect the wires as illustrated to create an 'inside loop' signal for the mower. If connected opposite, the mower will give an outside loop wire signal.

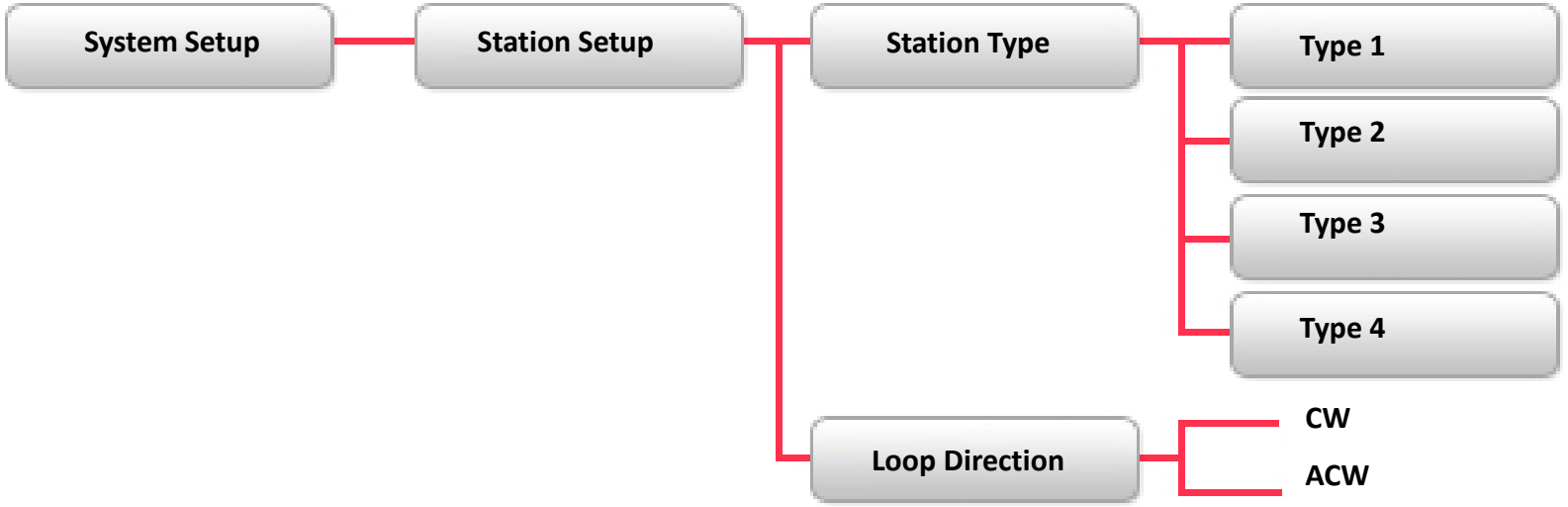
The connectors type 1 - type 4 give the choice in 4 different station signal set-ups for neighbouring lawns.

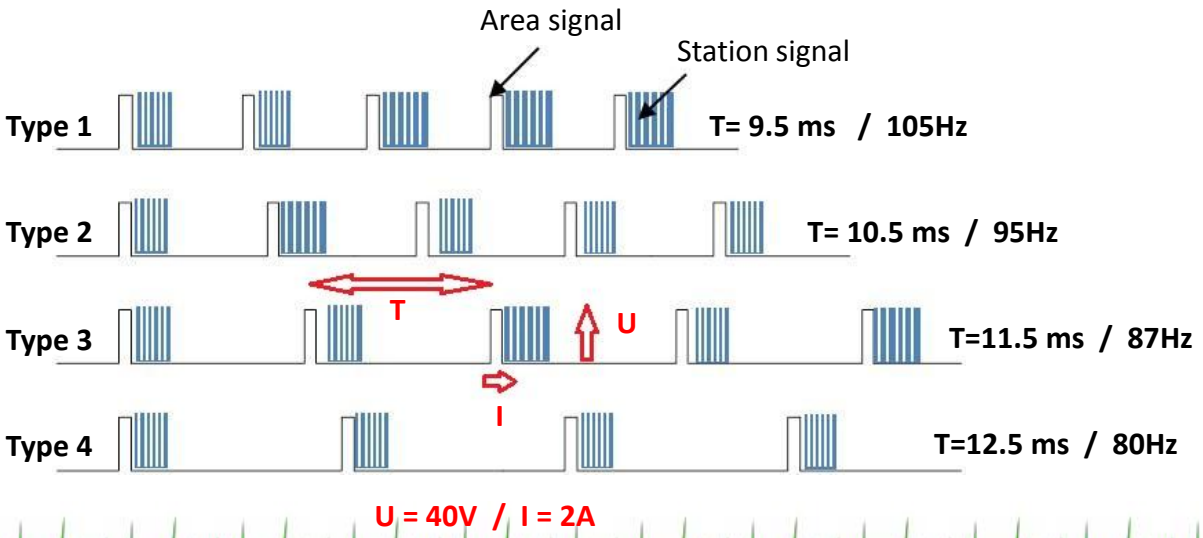
Accordingly the station type must be set up in the program



Docking Station Installation

Docking station installation can be managed via Miimo's display panel as indicated below.

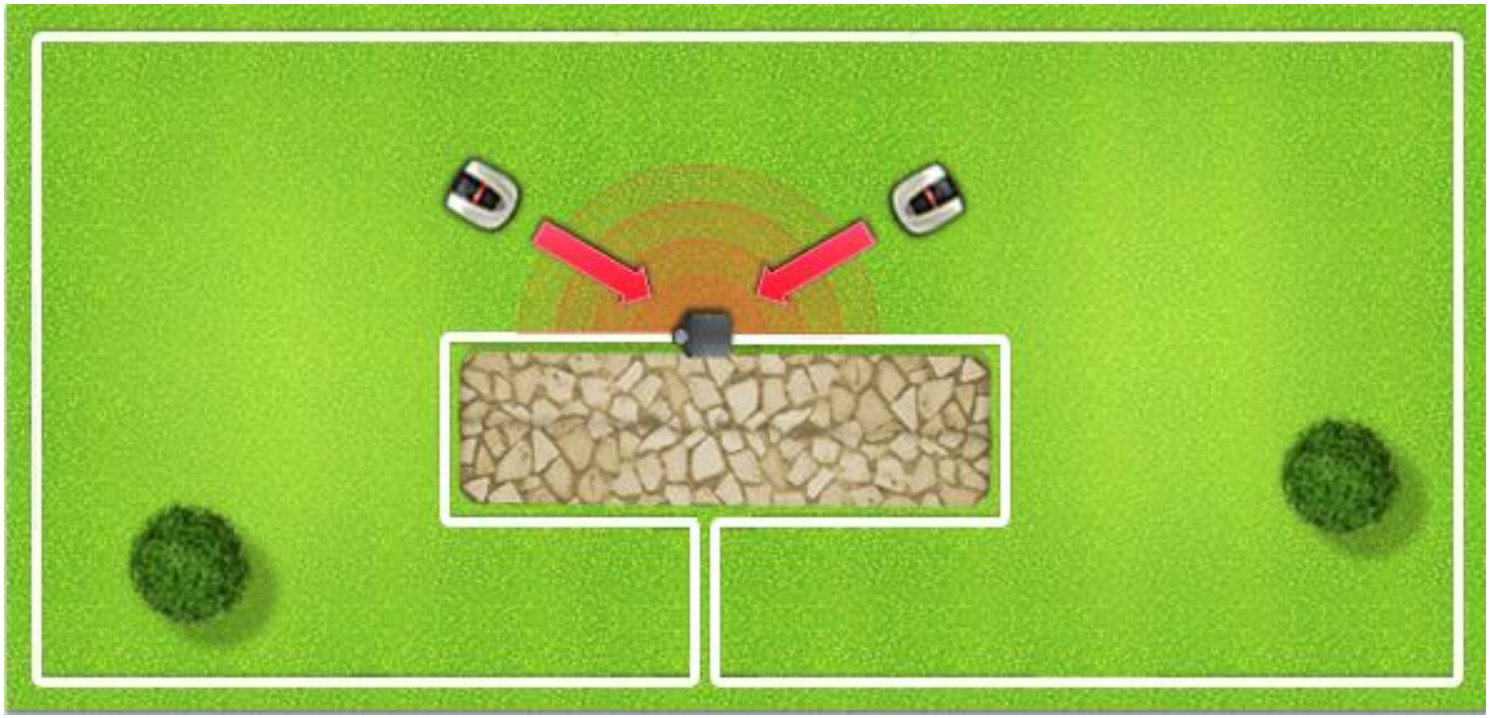




A specific area signal and station signal (type 1 to 4) is emitted so that the mowing area can be specified as type 1 to type 4.

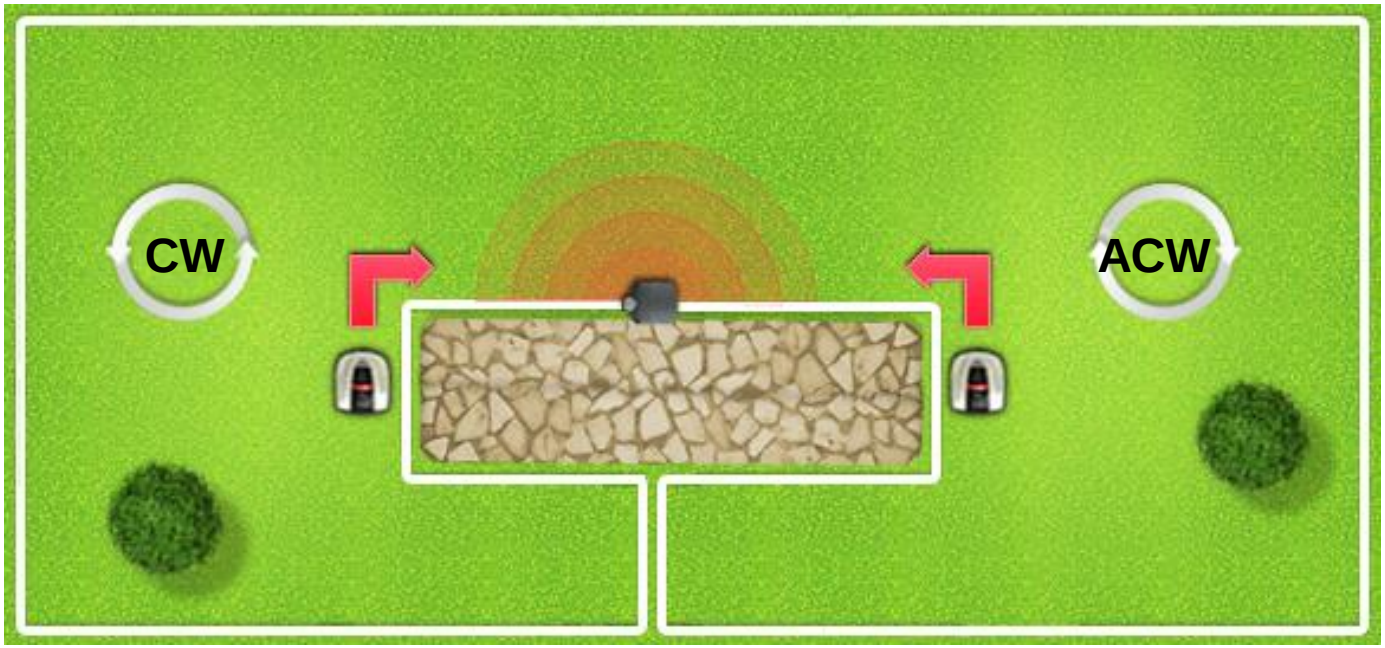
Direct Return to the Docking Station

The mower looks for the station, while cutting grass, for 5 minutes before boundary wire trace. If the mower comes across the station, it will return to the station directly.



Line Trace then Return to the Docking Station

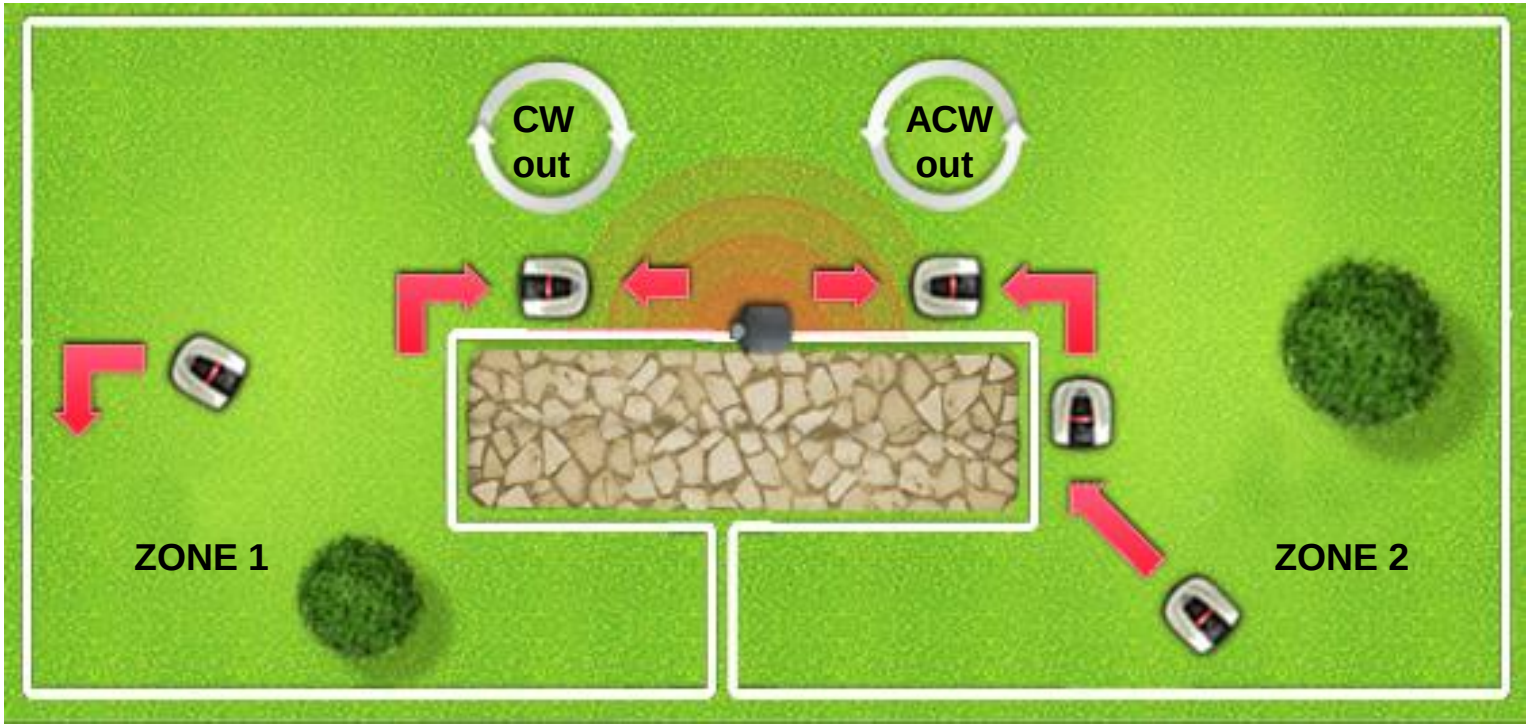
Quick Mode
When the remaining capacity of a battery decreases to approximately 30%, the mower stops mowing and returns to the station by using boundary wire trace. The mower alternately selects the direction to return the station between CW and ACW



Zone Control Situation

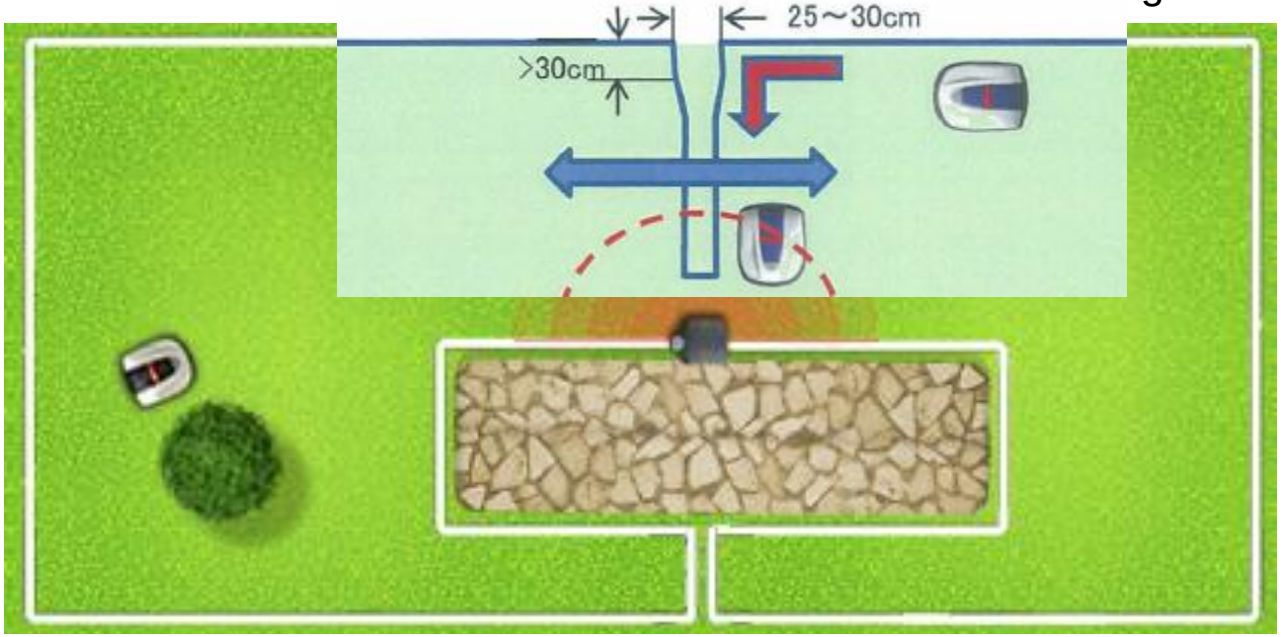
Custom Mode

In a garden separated into zones, the mower will follow a particular return method. If the mower has moved to Zone 1 from the station in a clockwise direction, it will return to the station in an anti-clockwise direction and vice versa.



Using Single Short Cut Wire

In a garden with a large circumference or complex shape, installing a short cut wire (20cm parallel wires) into the boundary wire can drastically shorten the time the mower takes to return to the docking station.



MOWING MODE: the mower passes parallel wires separated less than 20 cm (± 30° from perpendicular)

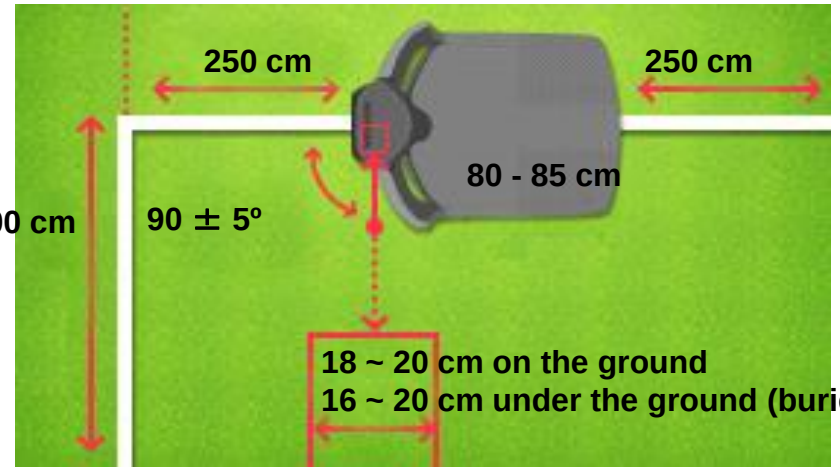
SEARCHING & RETURNING HOME MODE: the mower can trace parallel wires separated 20 cm – short cut wire.

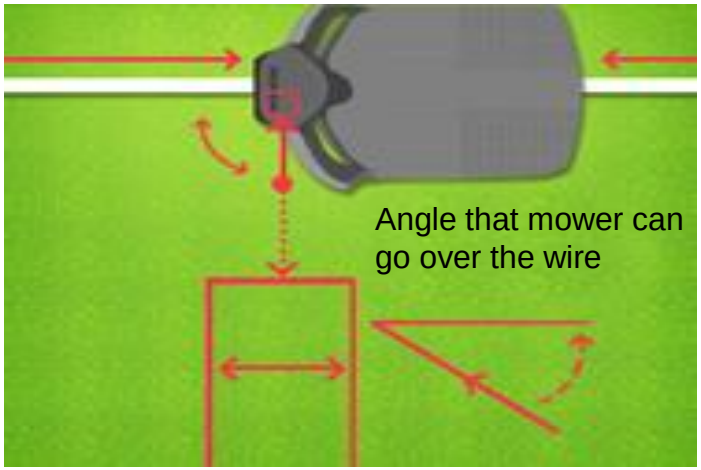
Moving Around Obstacle

If the Robotic Mower meets an obstacle (parallel wires 0-1cm) when returning to the station, it follows the loop around the obstacle 2 turns before continuing to the docking station.

Single Short Cut Wire Installation

Install the short cut wire as illustrated below.





"N"mark in Honda

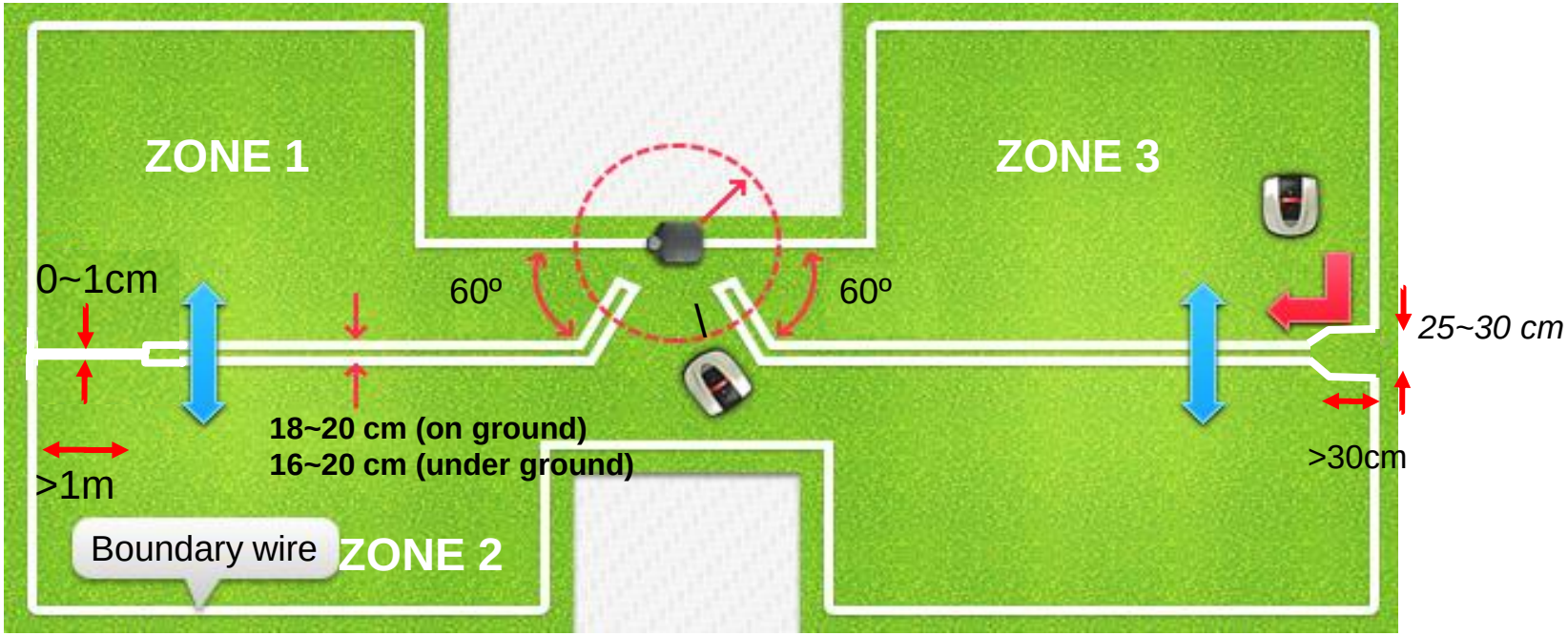
wire width
18~20 cm

wire offset [cm]	Angle [deg]
>35	30°

- **Passage return width should be <50cm**
- **Sensitivity should be set to High or Middle**

Using Dual Short Cut Wire

A maximum of 2 short cut wires can be included into the boundary wire loop. Install the short cut wires as illustrated below.



A passage of 1m width with parallel wires 0 to 1cm has to be made on one or the other short cut wire to allow the mower to cross the shortcut wire when going to Zone2.

MOWING MODE: the mower passes parallel wires separated less than 20 cm

SEARCHING & RETURNING HOME MODE: the mower can trace parallel wires separated 20 cm – short cut wire

Dual Short Cut Wire Installation

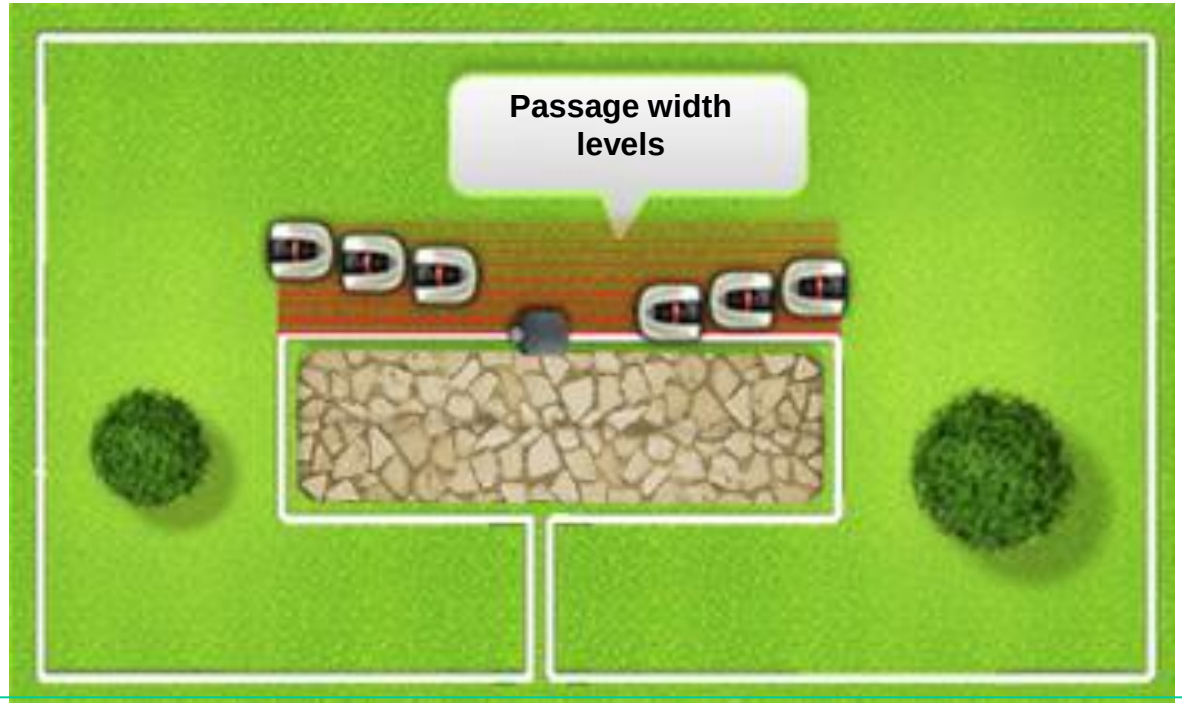
Install the short cut wires as illustrated below.

- Passage return width should be <50cm
- Sensitivity should be set to High

“N"mark in Honda

Passage Width (Return & Out): Countermeasure for Wheel Tracks

Passage width is the distance Miimo keeps from the boundary wire when returning to the docking station (return) or when moving to zone 1 to 5 (out) in custom mode set up. There are 11 levels (0 to 10) for passage width. The maximum width of passage depends on the length of the boundary wire ~ signal strength. If narrow passage width is selected (close to the boundary wire), mower tracing speed becomes slower in order not to surpass the boundary wire. The robotic mower will randomly selected different passage width levels, in the selected range, when returning to the docking station.

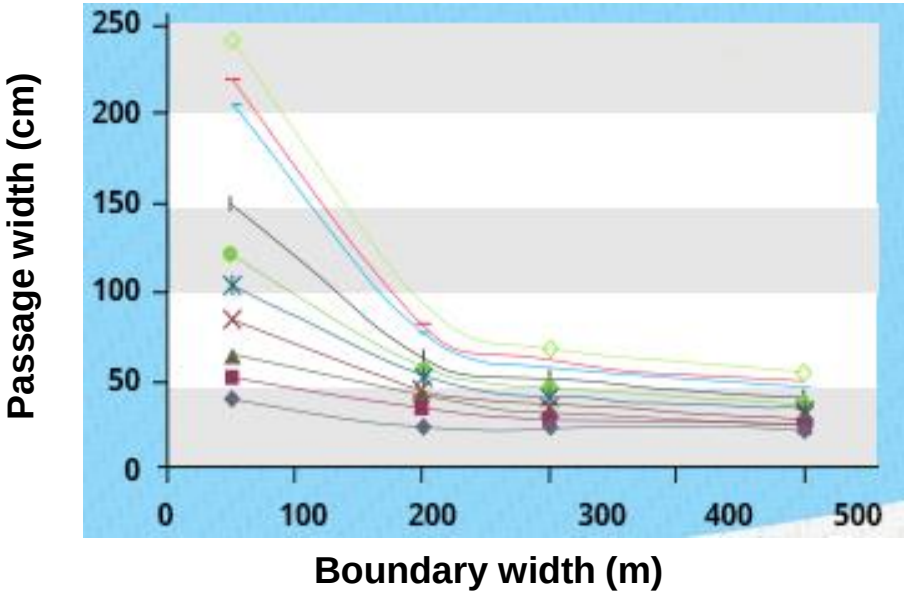


Open garden type: No narrow passages or obstacles. Use the maximum passage return width level to avoid wheel traces in the lawn.

Passage Width: Countermeasure for Wheel Tracks

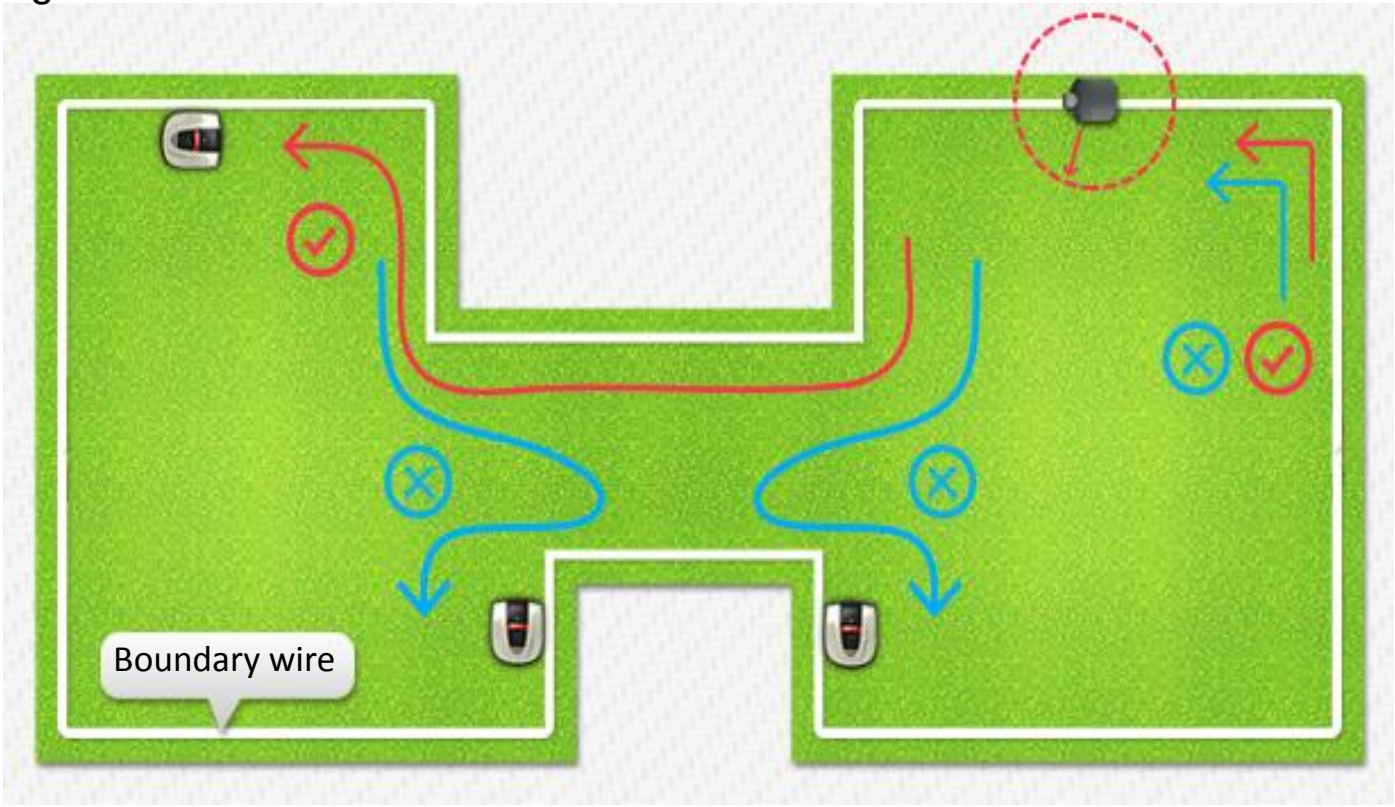
The passage width levels are variable with the total length of the boundary wire.

Setup	Boundary wire length			
	50 m	200 m	300 m	500 m
10	240 cm	90 cm	65 cm	55 cm
09	220 cm	80 cm	60 cm	50 cm
08	205 cm	75 cm	55 cm	45 cm
07	150 cm	60 cm	50 cm	40 cm
06	120 cm	55 cm	45 cm	35 cm
05	100 cm	50 cm	40 cm	30 cm
04	80 cm	45 cm	35 cm	25 cm
03	65 cm	40 cm	30 cm	25 cm
02	50 cm	35 cm	25 cm	25 cm
01	40 cm	25 cm	25 cm	25 cm



Passage Width: Countermeasure for Wheel Tracks

Default setting is level 3. A maximum passage width of 80cm should be respected in all installations. Over 80cm passage width is critical for passing by the station signal (85cm) when returning to docking station and for missing exit or entry of narrow passages.



Note: If passage out width levels are set for the different zones, the passage return width level should be equal to the smallest set level of passage width out.

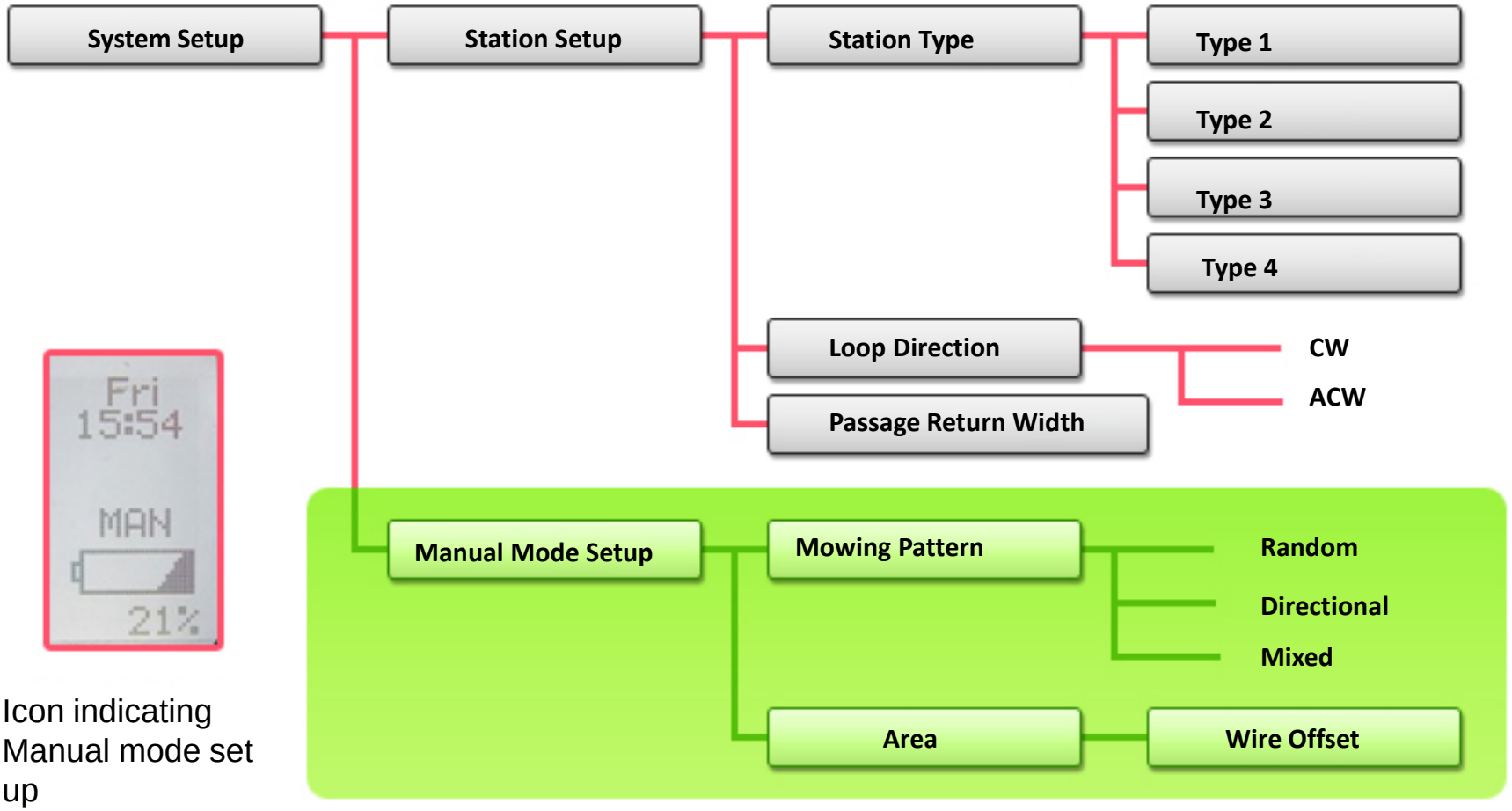
Manual Mode Setup

The manual mode requires manual activation of the mower:

- No timer can be set, manual activation
- Mower does not return to the docking station, keeps mowing till empty battery
- Mowing pattern can be set up
- Wire offset can be set up

Manual Mode Setup

Take a look at the image below to see how manual mode set up and its features are accessed from Miimo's display panel.



Icon indicating Manual mode set up

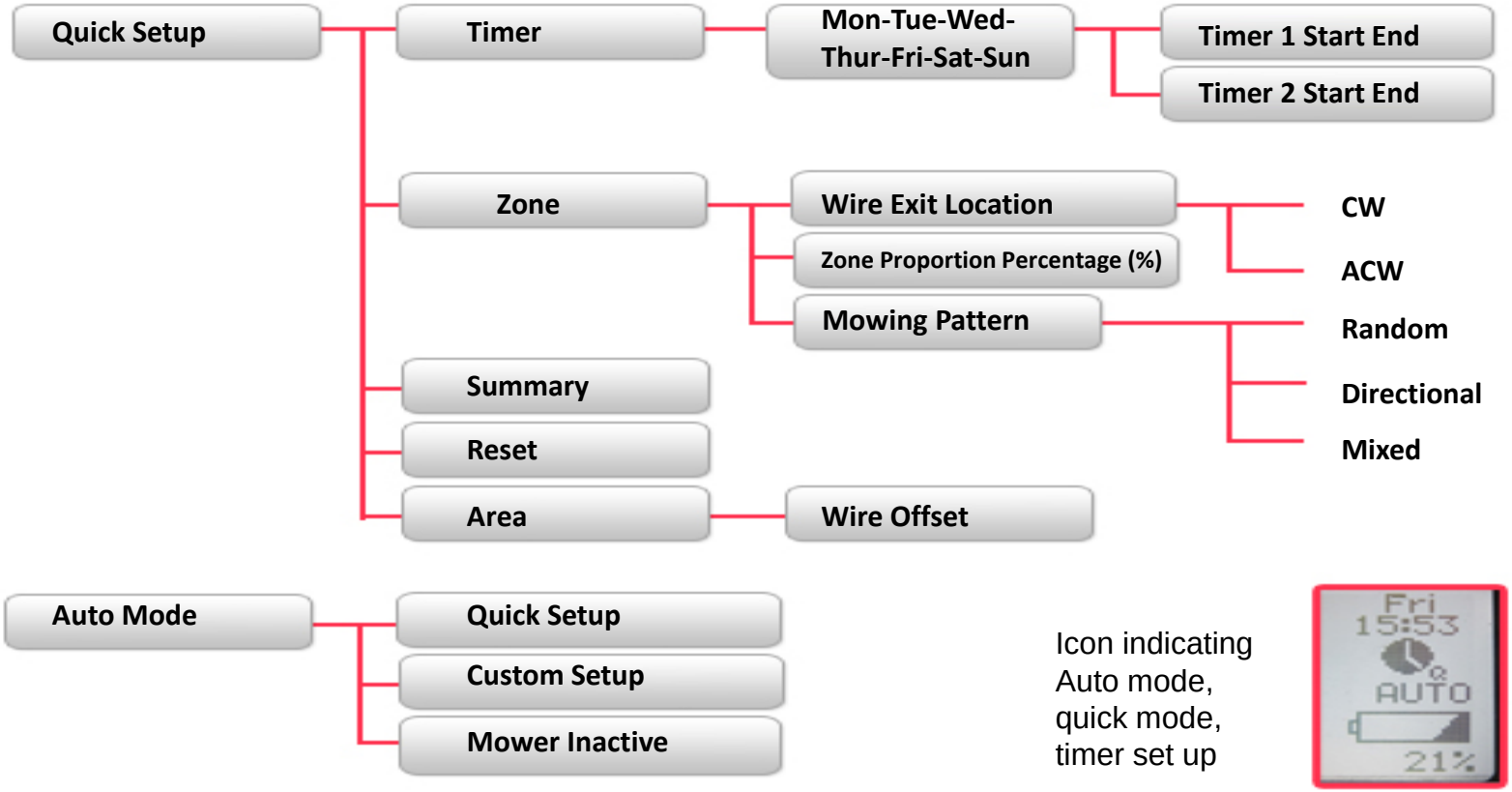
Quick Mode Set Up

The quick mode is an Auto mode with the following programmable functions:

•Mower returns to the docking station when recharging is needed or mowing time has elapsed
•2 separate zones with zone proportion can be set up: zone proportion input (%) is for zone 2
•Set up of wire exit location (Clockwise or Anti-clockwise) for zone 2
•2 timer sequences can be set for 7 days of the week
•Wire offset, equal for both zones, can be set up
•Mowing pattern, equal for both zones, can be set up

Quick Mode Set Up

Take a look at the image below to see how quick mode set up and its features are accessed from Miimo's display panel.



Icon indicating Auto mode, quick mode, timer set up

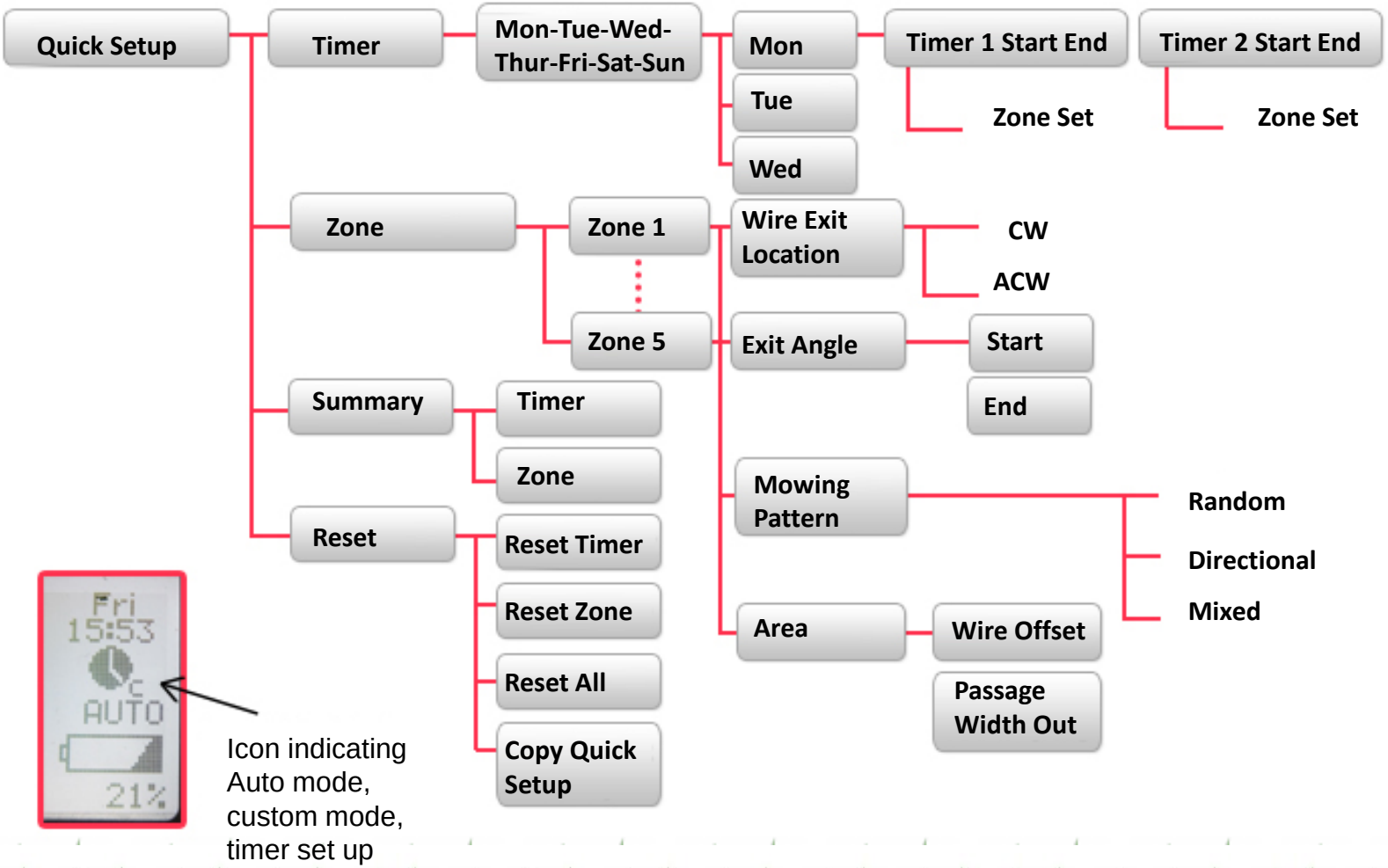
Custom Mode Set Up

The Custom mode is an Auto mode with the following programmable functions:

•Mower returns to the docking station when recharging is needed or mowing time has elapsed
•5 separate zones can be set up
•2 timer sequences for each zone/day of the week
•Wire exit location, wire exit angle and mowing pattern can be set up for each zone
•Wire offset and passage width out can be set up for each zone

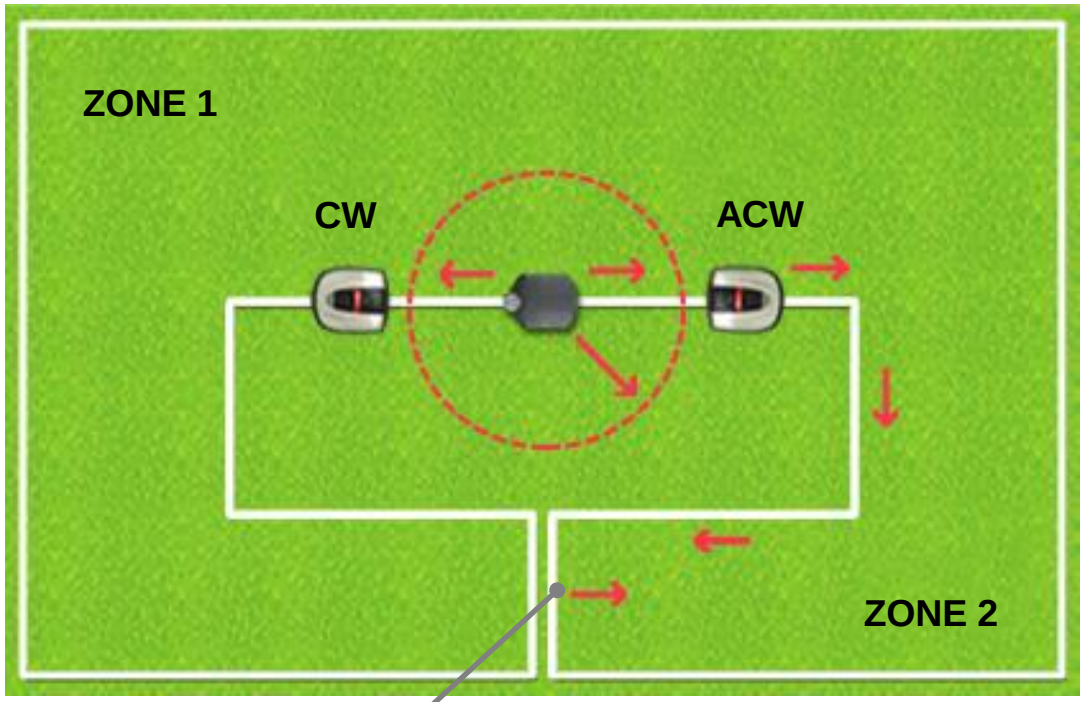
Custom Mode Set Up

Take a look at the image below to see how custom mode set up and its features are accessed from Miimo's display panel.



Quick Mode: Zone 1 & 2 Set Up

In quick mode set up, the proportion (%) of cycles spent in Zone 2 can be set (i.e. 4 out of 8 cycles in total). The Robotic Mower will respect this zone proportion after each return to the station.

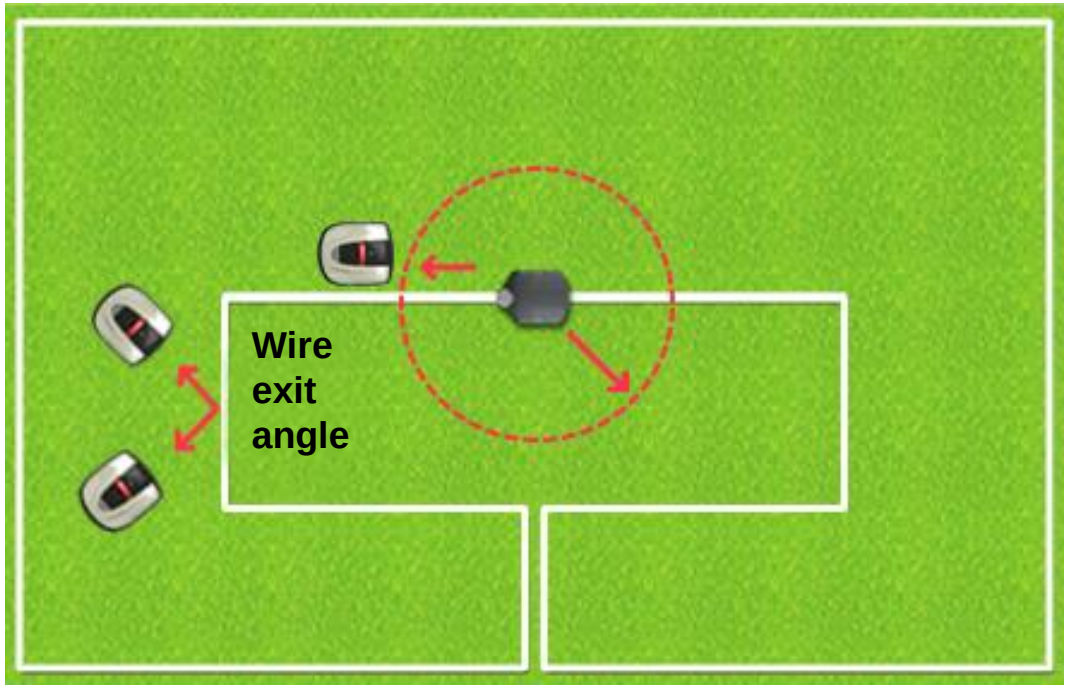


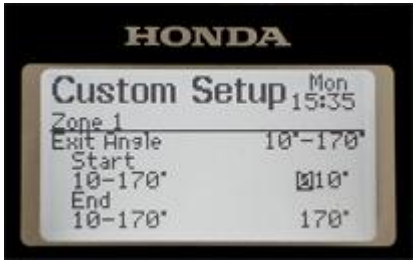
Wire Exit Location

Set the distance to reach zone 2 and start mowing, after leaving the station in a CW or ACW direction.

Custom Mode: Wire Exit Angle

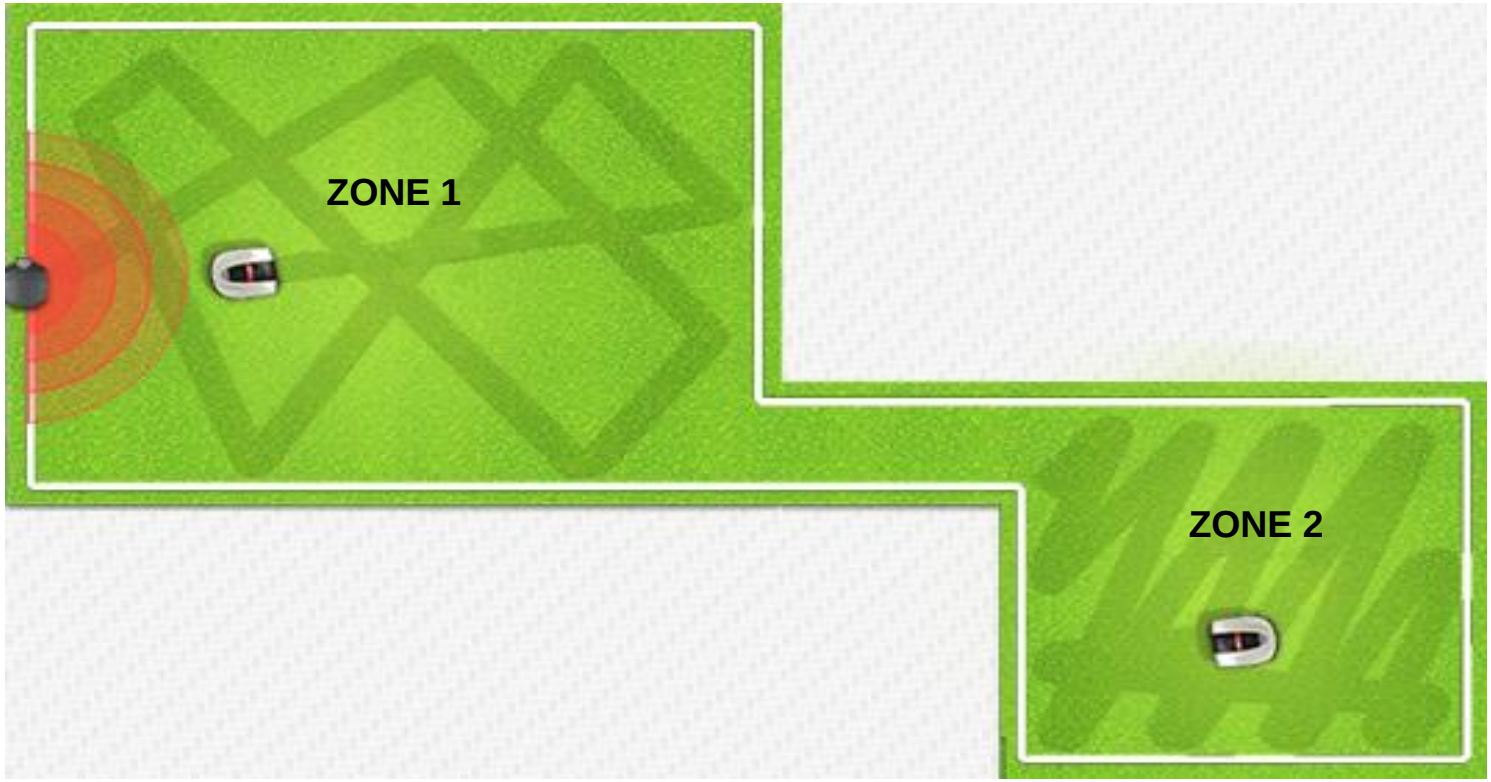
To reach the specific zones in a garden easily, a different exit angle (10° - 170°) from the wire exit location can be set for each zone.





Custom Mode: Zone Mowing Pattern

For each of the 5 zones a specific mowing pattern can be set up, allowing the user to select the best mowing method for each part of the garden.
Directional: narrow areas, obstacle free
Random: large open areas, standard setting
Mixed: large areas, complex shapes



4. Display Functions

The Test Menus

Area Wire Signal Strength Test

The Test menu is used to confirm that the installation is working correctly. The tests can be activated through the Main Menu screen by selecting the Test sub-menu. Click play to move through the steps in this process.

To test for area wire signal strength, first select '**4. Test**' on the key pad menu to enter the test menu.

…followed by '**1. Check area wire**'

Press the **return** button after each selection.

The Test Menus

Area Wire Signal Strength Test

The test runs automatically and the signal strength is displayed.

Use the **return** button to navigate back to the **main menu**

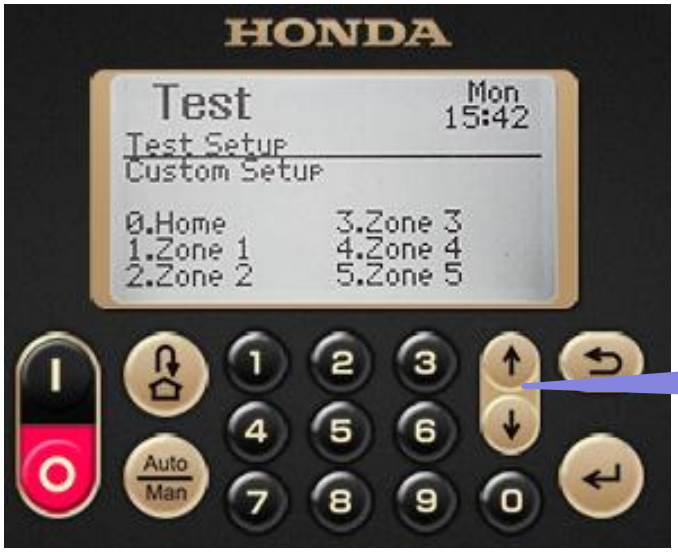
The Test Menus

Individual Zone Tests

Each of the zones that have been set up during the installation can be individually checked using the Check Setup sub-menu. Click play to move through the steps in this process.

From the **test** menu select '**2**', then press '**Enter**'.

This enters the **Custom Setup** menu.



From this menu select the zone to be tested.

Use either the arrow keys or the numeric key pad to select the desired zone and confirm the selection by pressing '**Enter**'.

The Test Menus

Individual Zone Tests.

Confirm the Start Test in the display by pressing the '**Enter**' key.

Close the cover.

Miimo will now travel to the selected zone and carry out a short mowing test.

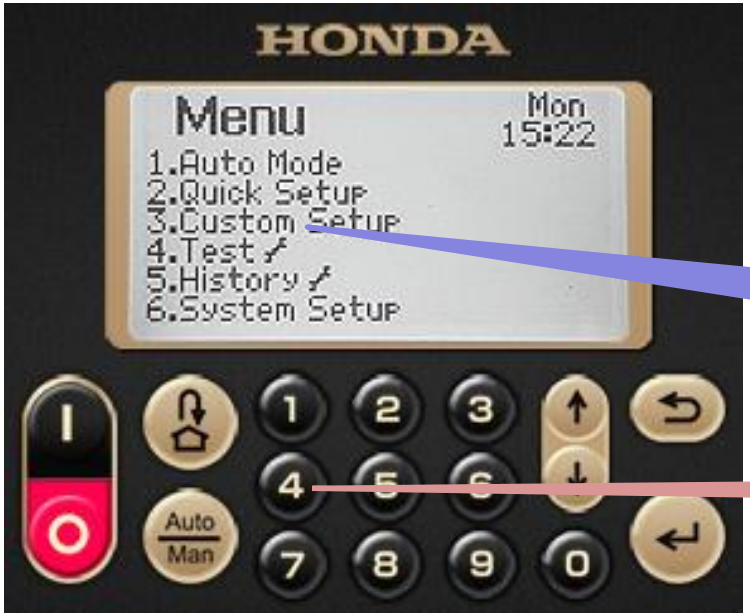
When the test is complete, confirm the completion and return to the **Setup** menu by pressing the '**Enter**' key.

Dealer Mode

Dealers are able to access extra features from the Menu screen. Click play to move through the steps in this process.

Whilst in the Menu screen extra features can be accessed by the dealer.

These are made available by pressing and holding the following buttons in the following sequence: **2-4-9-Enter**.



Confirmation is given by the spanner symbol appearing next to the Test and History menu options.

Select '**4 Test**'.

Dealer Mode

The **Test** menu now includes extra set up and test options.

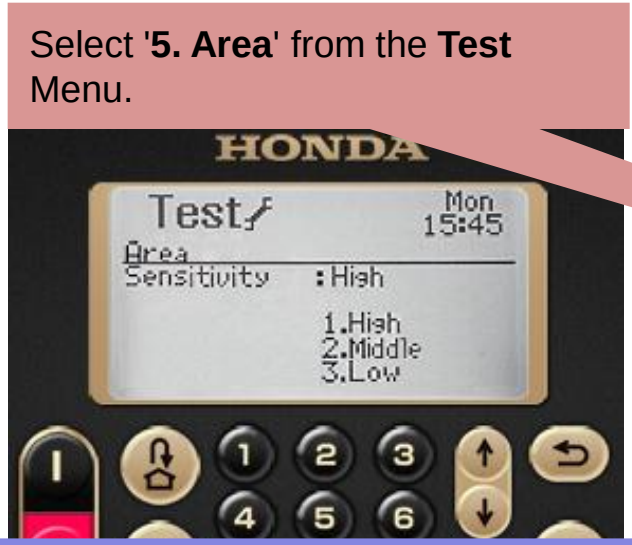
The **Test Mower** menu has several automated tests to allow the diagnosis of faults with the mower.

Dealer Mode

Area Sensitivity

Whilst in Dealer Mode the Area Sensitivity can be adjusted. This sets the mowers sensitivity to the homing signal from the docking station and the boundary wire.

Select '**5. Area**' from the **Test** Menu.



After selecting the **Area** Menu set the sensitivity as required to **High, Middle** or **Low**

- High strength signal:
  95 cm *(long boundary wire, 1 or 2 shortcut wires)*
- Middle strength signal:
  70 cm *(default value, ok for most cases inclusive with 1 shortcut wire)*
- Low strength signal:
  60 cm *(short boundary wire or if experiencing any signal perturbations)*

Mower Tests

Sensor Test

The sensors fitted to the mower can be tested for serviceability.

From the **Test Mower** menu select **'2. Sensors'.**

To carry out a lift sensor test select **'1. Lift Sensor'.**

Mower Tests

Sensor Test

Test the sensors by lifting the body of the mower.

The status of the sensors are shown on the display as the body is lifted.

Mower Tests

Sensor Calibration

The Calibration menu is used to recalibrate the mower's sensors.

From the **Test** menu in dealer mode select **'4. Calibrate Sensor'.**

Place the mower on a level solid surface and press the **'Enter'** key.

Mower Tests

Sensor Calibration

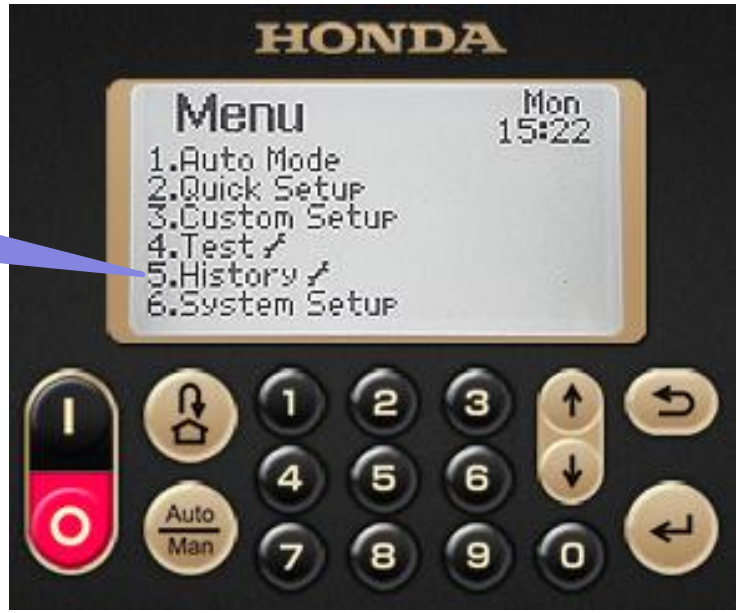
The sensor calibration continues automatically and the result is displayed after completion of the test.

History

Fault Codes and Operating History

Fault codes and the operating history of the mower are also available.

Fault codes and the operating history of the mower can be accessed from the **History** menu.

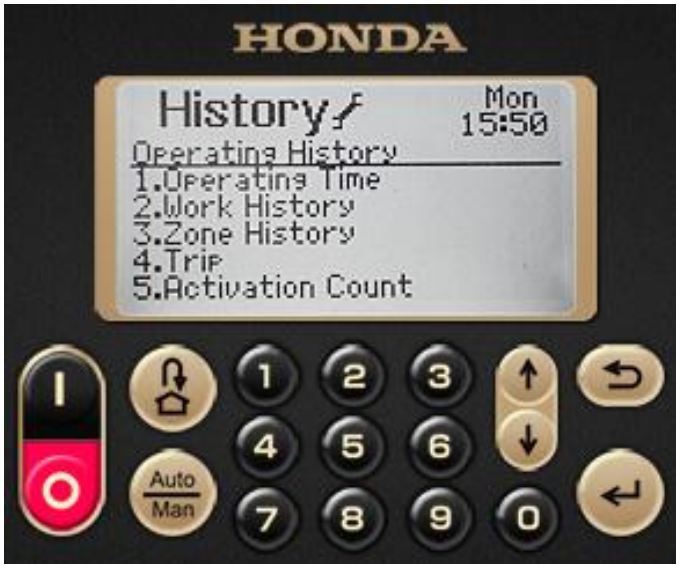


From the History menu select **'1. Operating History'.**

History

Fault Codes and Operating History

Several sub-menus can be selected from this screen.



Cutting time
- *Quick Mode*
- *Custom Mode*
- *Manual Mode*

The **Operating Time** menu displays:

Cutting time
- *Quick Mode*
- *Custom Mode*
- *Manual Mode*
- *Random Mode*
- *Directional Mode*
- *Mixed Mode*

Running Time
Return Time
Charging Time
Total Operating Time

History

Fault Codes and Operating History

Cutting time
- *Random Mode*
- *Directional Mode*
- *Mixed Mode*

Running Time
Return Time
Charging Time

Total Operational Time

History

Fault Codes and Operating History

A list of the last 20 faults can also be accessed from the **History** menu by selecting **'2. Fault History'.**

The date and time for each fault is displayed.

History

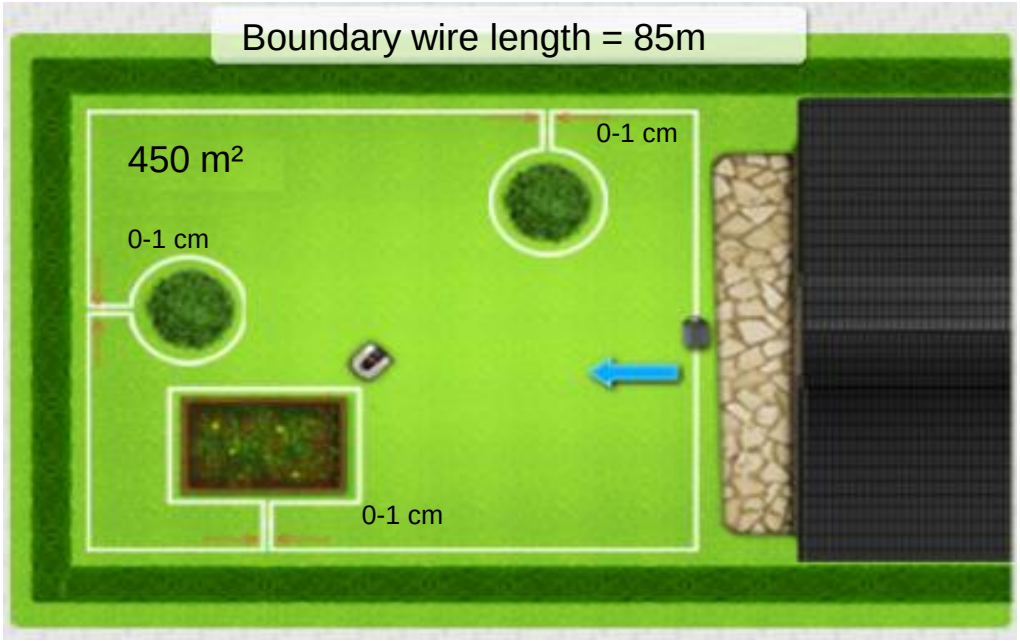
Fault Codes and Operating History

Selecting a specific fault gives you more information on that fault.

5. Installation Examples

Installation Examples

The installation example below shows a garden with 1 zone and 3 obstructions. It has a 20cm area wire offset. A mixed mowing pattern would be the most suitable to use for this garden type.



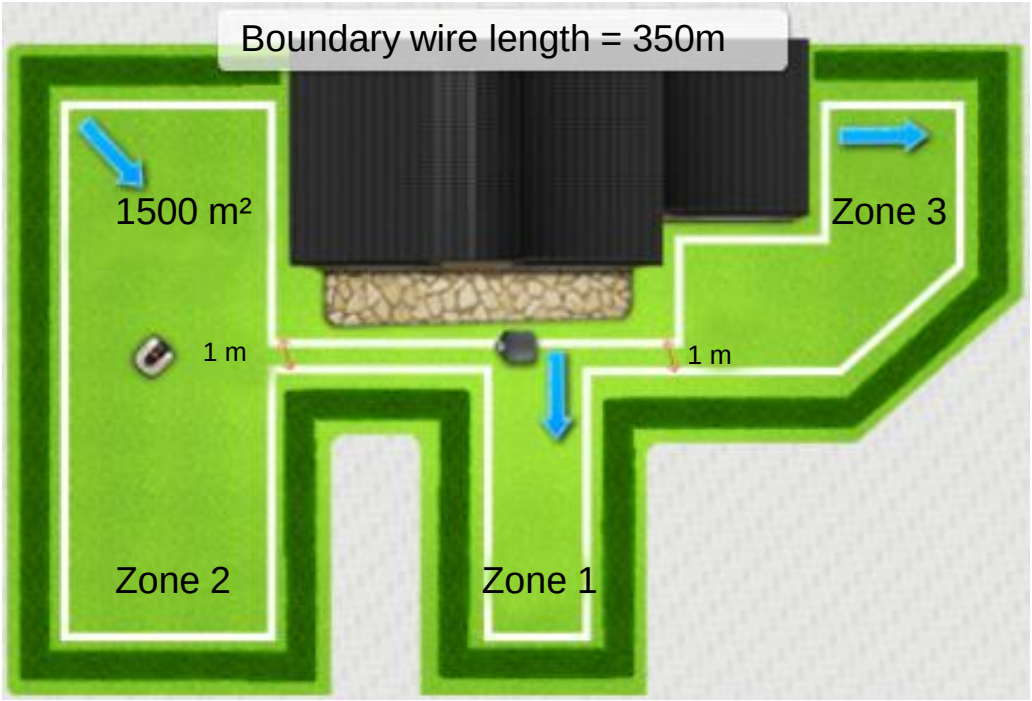
QUICK MODE	Zone 1	Zone 2
Passage Out Width (0 – 10)	N/A	N/A
Loop Direction (CW / ACW)	ACW	
Area Wire Offset (20 – 45 cm)	20	-
Mowing Pattern (Directional/Random/Mixture)	M	-
Quick set up Zone 2 (0-100%)	-	-
Wire Exit Location (0-250m) (CW/ACW)	0	-
Exit Angle Start – End (10-170°)	50-150°	
Passage Return Width.	4	
Timer	20h / Week	

Quick set up Zone 2 (0-100%)
Proportion of mowing time to spend in zone after each return to the docking station.

Wire Exit Location (0-250m) (CW/ACW)
The distance to reach the zone and start mowing after leaving in a clockwise (CW) or anticlockwise (ACW) direction.

Installation Examples

The installation example below shows a garden with 3 zones, a narrow passage (1m) and no obstructions. It has a 20cm area wire offset, a 0m clockwise wire exit location in Zone 1, a 100m anti-clockwise wire exit location in Zone 2 and an 80m clockwise wire exit location in Zone 3. A random mowing pattern would be the most suitable to use for Zones 1 & 2, with a directional mowing pattern used in Zone 3.

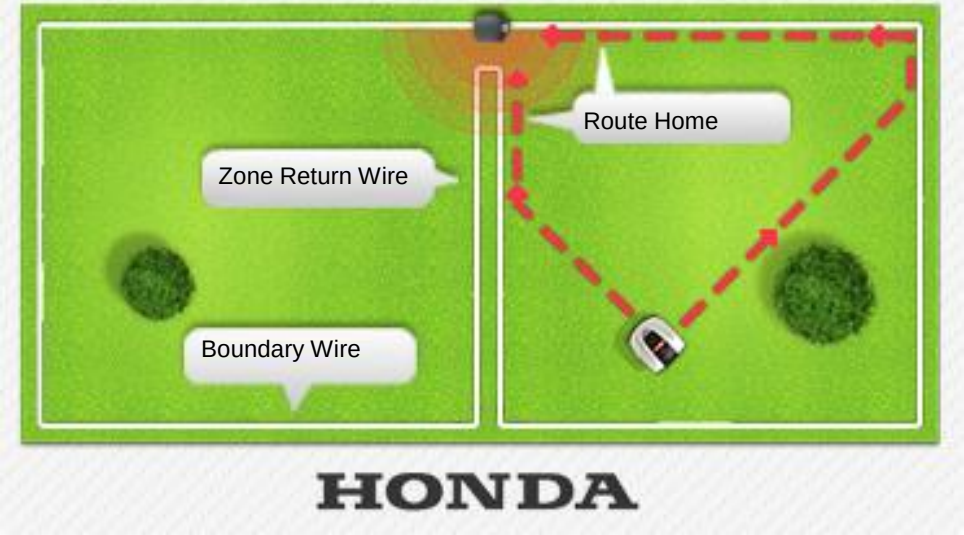


CUSTOM MODE	Zone 1	Zone 2	Zone 3
Passage Out Width (0 – 10)	4	4	4
Loop Direction (CW / ACW)	ACW		
Area Wire Offset (20 – 45 cm)	20	20	20
Mowing Pattern (Directional/Random/ Mixture)	R	R	D
Quick set up Zone 2 (0-100%)	-	-	
Wire Exit Location (0-250m) (CW/ACW)	0m CW	55m ACW	50m CW
Exit Angle Start – End (10-170°)	30-120°	80-160°	80-90°
Passage Return Width.	4		
Timer	45h / Week		

6. Sales

Autonomous Operation – Go Home / Auto Recharge

Competitors use a “guide wire” to return the device to the docking station.

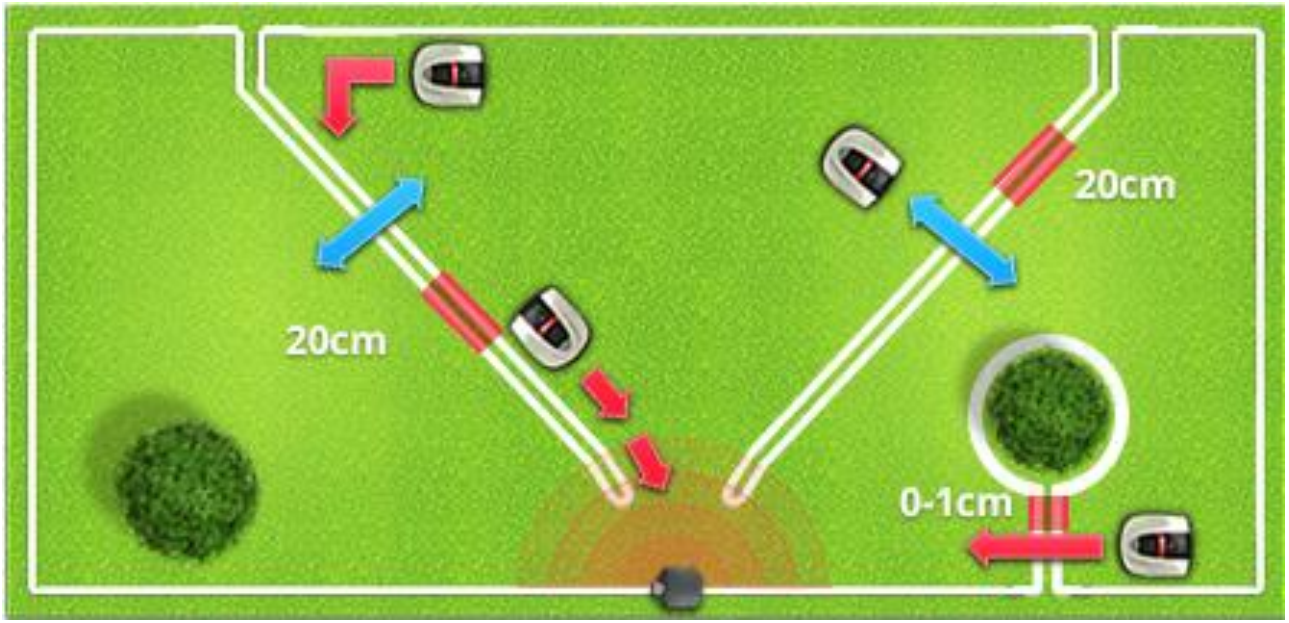


Honda uses a “zone return wire” which provides greater flexibility.

Autonomous Operation – Go Home / Auto Recharge

Miimo sees the Boundary wire differently, depending on the operation mode:

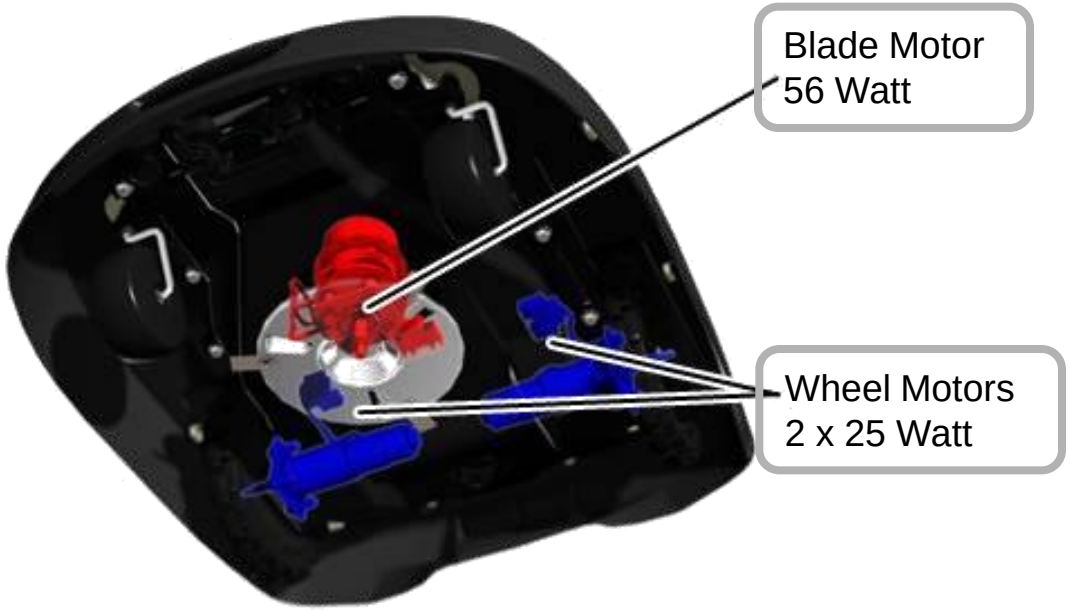
- **Mowing mode:** The mower passes parallel wires separated by less than 20cm.
- **Searching & returning home mode:** The mower can trace parallel wires separated by less than 20cm – shortcut wire.



Customer benefit- No interaction needed. Miimo is operating less, garden remains free, improved longevity of the machine due to less distance travelled. Reduced grass tracks next to the station.

Dealer benefit – Flexible installation tool, No need for additional connectors in the wire.

Evenly and Uniformly Cut Lawn



Even Cut Provided with Miimo

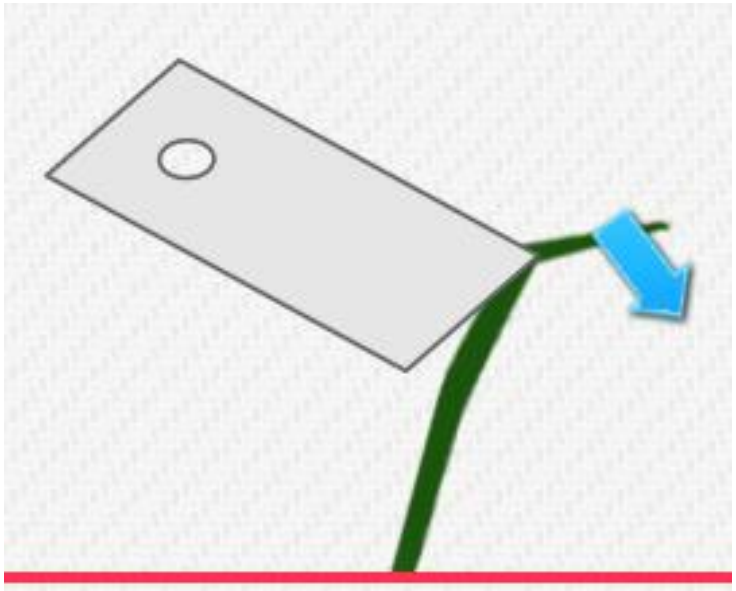
Uneven cut with competitor RPM drop

Customer benefit - Neat, evenly and cleanly cut lawn with a uniformly thick finish.
Dealer benefit - Sales based on spec figures for high power, performance and reliability.

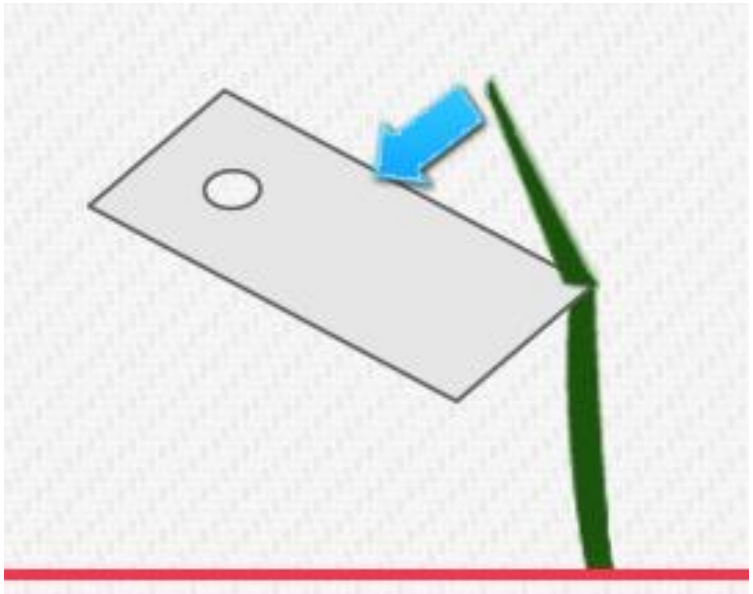
Cutting Finish

Miimo has a blade fan, this provides advantages over other robotic mowers:
The grass is lifted straight with the airflow generated by the fan before being cut.

Without Fan (Competitor) – Grass is pushed and tops are **damaged / frayed**.

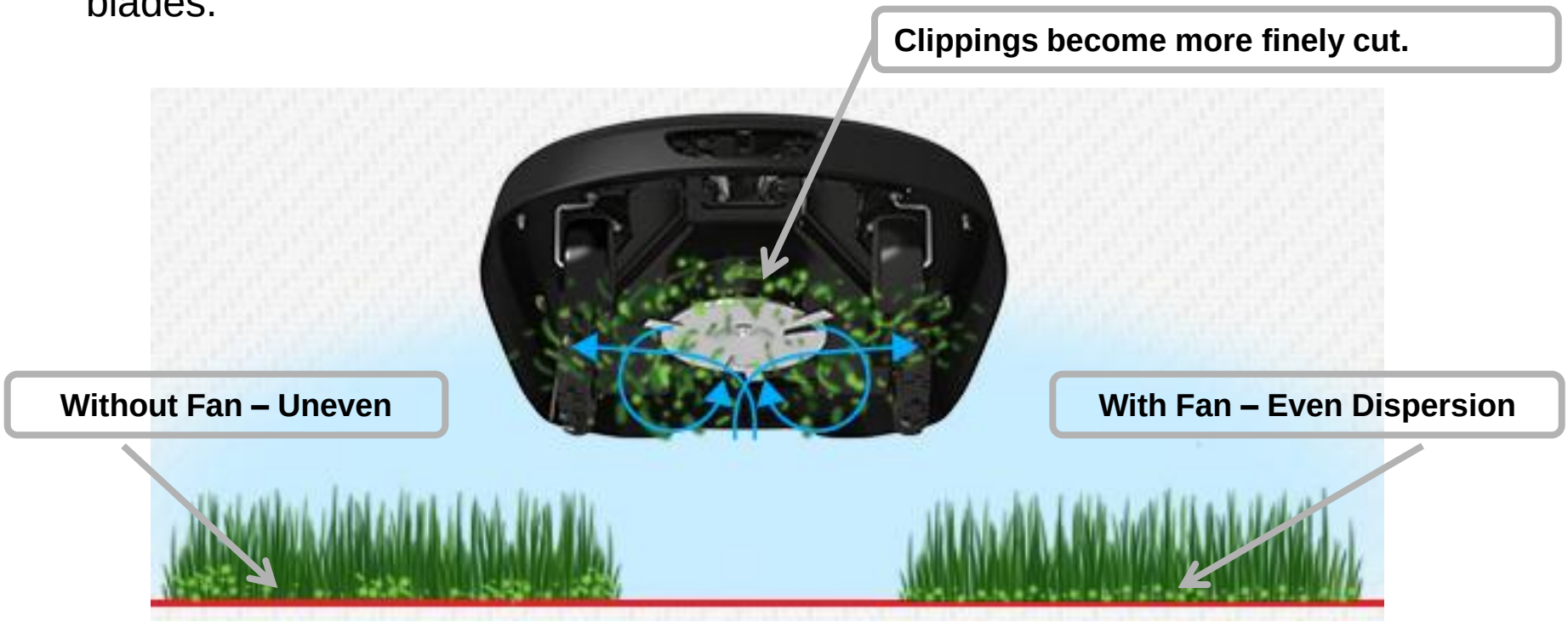


With Fan (Honda) – Grass is pulled straight and **cut cleanly**.



Cutting Finish

The grass is mulched by circulating the clippings around and down between the blades.



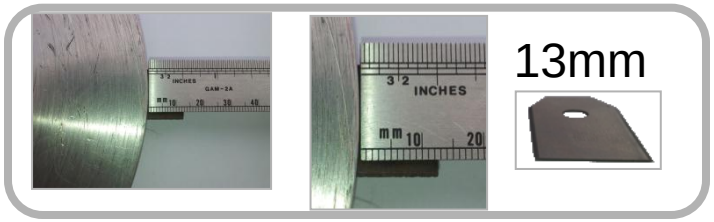
The clippings are dispersed evenly in the airflow arriving at root system to decompose.

Customer benefit - Beautiful, organically fertilized lawn with no clippings to walk into the house.

Dealer benefit - Miimo unique feature, sales argument.

Cutting Finish

Longer Blade - No grass is missed, the longer blade cuts more.



Competitor

Miimo

Heavier Blade - Denser grass can be cut as blade swings back less and RPM drop is reduced due to more inertia.

Competitor

Miimo

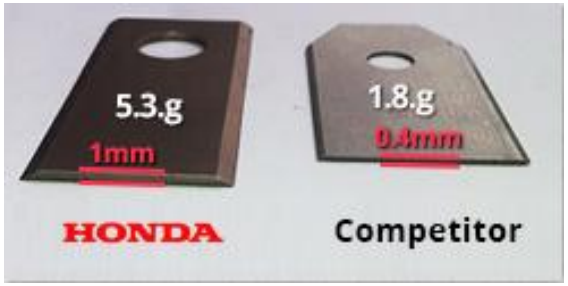
Blade modulation - When operating on normal grass conditions speed = 0.55m/s and blade rotation speed 2200rpm. When operating in long/thick grass speed reduces 0.55 - 0m/s to keep blade at a constant 2200rpm avoiding uneven cutting.

Customer benefit - Neat, smooth & evenly cut lawn, no long patches or partly cut grass.

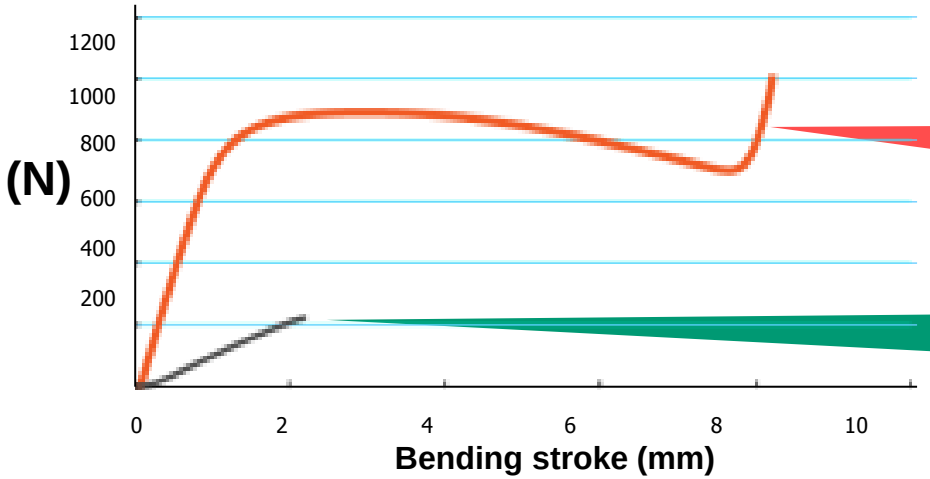
Dealer benefit - Bigger blade, clear sales argument.

Safety and Reliability - Blades

The Miimo Blade is thicker and tougher than the competitor blade. Honda Blade is made from high quality SK5 ductile spring steel. If the blade hits an obstacle it will bend rather than break, unlike competitor.



In 90°bending test: Honda Blade is 450% tougher than competitor.



Miimo blade
Deformation at:
900N – 90 Kg
No Breakage

Competitor Blade
Failure at:
200 N – 20 Kg
Breakage

Customer benefit - Miimo blades are safe, no broken blade pieces spread in lawn, Children and animals can play safely. Less down time, better lawn, less cost.

Dealer benefit - Big safety argument, can easily be demonstrated in showroom, less complaints from customer resulting in DLR call outs to search for broken blades.