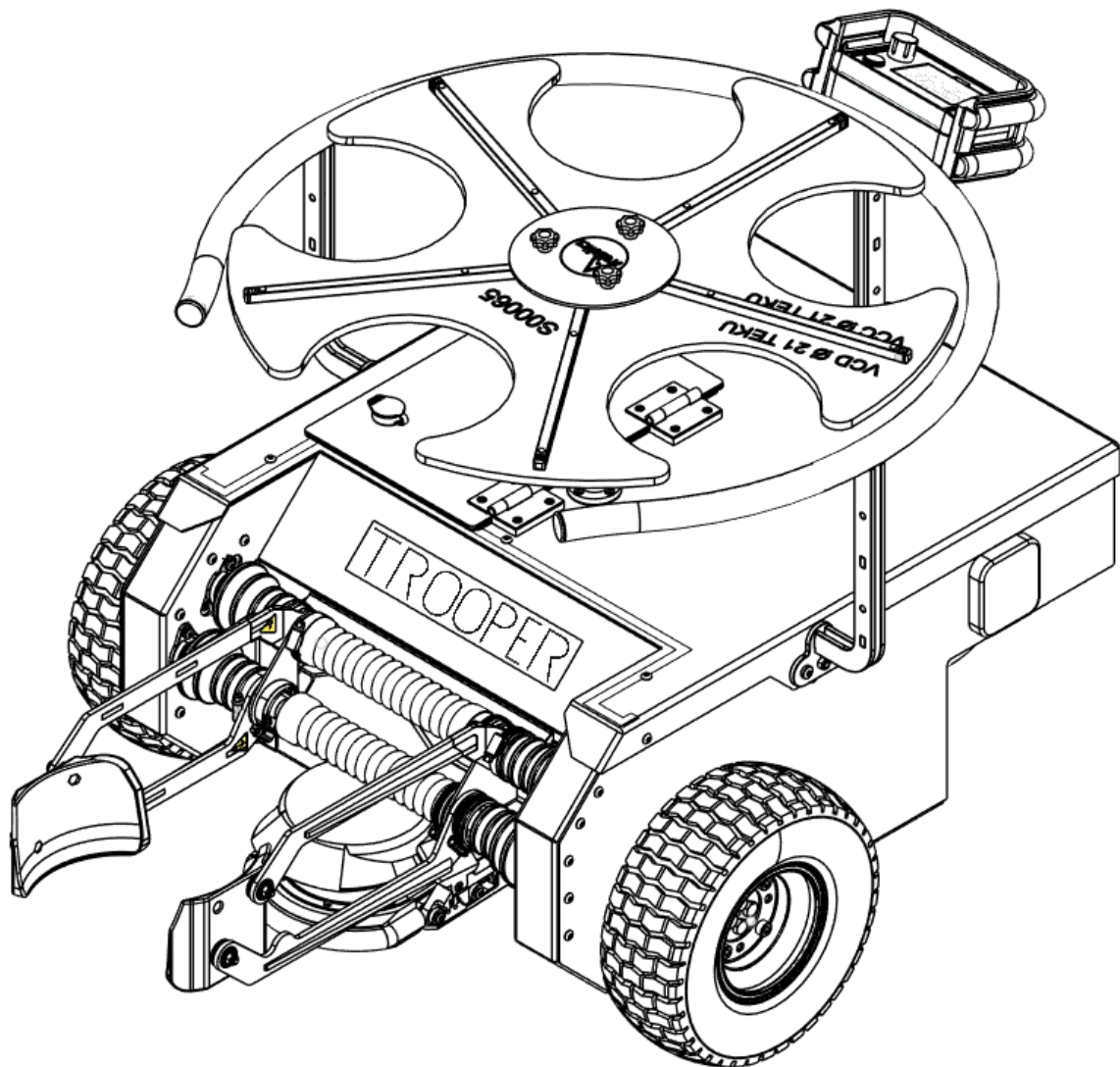


TROOPER

USER GUIDE Version 3.0





**IMPORTANT! READ THIS MANUAL
BEFORE USING THIS PRODUCT AND
KEEP IT FOR FUTURE REFERENCE**

- V3.0** V3.0 Reorganization of HMI display menus in software version V3.
- V2.11** Update of gripper hands for round pots and HMI display of gripping width.
- V2.1** Update of gripper hands for pots under 2 L and grippers for planters.
- V2.0** Initial release of software version V2 (07/01/2024).

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I. ABOUT THIS USER MANUAL

1. General Information

This user manual is an original manufacturer's document in accordance with the Machinery Directive 2006/42/EC.

The instructions and recommendations described herein cover the specific risks associated with the use of an automated machine, in compliance with standard NF EN ISO 18497:2019.

The TROOPER® product and its accessories may evolve over time through software updates, version changes, and technical improvements resulting from their development cycle.

As such, diagrams, images, graphical representations, and technical data contained in this manual are non-contractual.



An up-to-date version of this manual is available in digital format for download on our website:

instar-robotics.com, section "**Downloads**".

Ensure you regularly download the latest version of the manual, especially after a TROOPER robot software update.

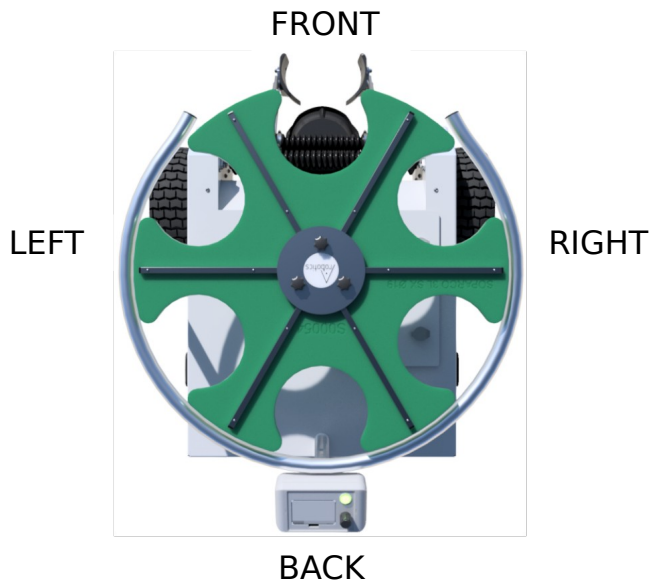
This manual describes the operation of the TROOPER robot for use in France.

Figures and recommendations refer to equipment fitted with European-standard connectors.

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2. Reading the Manual



The directional terms “front”, “rear”, “left”, and “right” used in this manual refer to the respective directions from the **robot’s point of view**.

Accordingly, the user stands behind the robot, facing the control unit, and looks toward the front.

Some paragraphs or notes may be accompanied by symbols indicating their level of importance for safety and proper product operation:



DANGER !

This pictogram warns of a significant risk of serious injury that may require medical intervention (cuts, crushing injuries, fractures).



WARNING !

This pictogram warns of a significant risk of serious injury that may require medical intervention (cuts, crushing injuries, fractures).



CAUTION

This pictogram warns of a significant risk of material damage, which can be avoided through adequate monitoring and compliance with recommendations.



NOTE

This pictogram provides a remark or tip to improve understanding and use of the machine.

II. PRODUCT DESCRIPTION

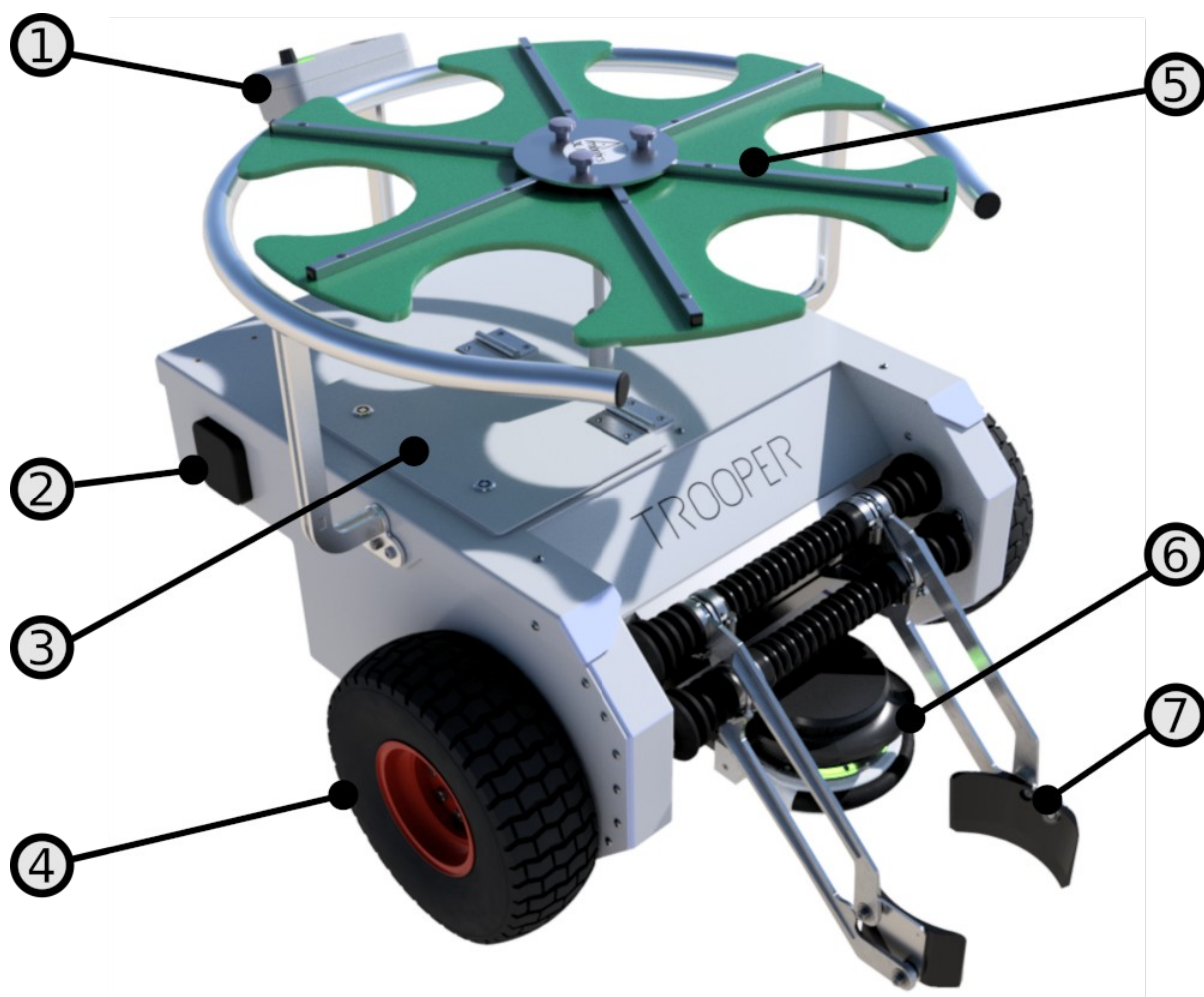
1 - General Overview

TROOPER is an autonomous plant spacing robot designed to assist nurserymen and horticulturists with repetitive and strenuous pot handling tasks.

It is a robust mobile platform suitable for indoor and outdoor use, IP54-rated waterproof, compact (70×60 cm), and lightweight (65 kg without battery).

The robot is fully electric, silent, environmentally friendly, and provides 10 hours of autonomy under normal operating conditions.

With the multi-battery pack, it can operate 20h/day, 7 days/week, day or night.



1 – HMI unit:

- User interface with display screen, rotary knob, and LED indicator.
- Allows intuitive task configuration and displays information to monitor the robot's status.

2 - 4G/Wi-Fi/Bluetooth Antennas

- Two antennas (one on each side) enable wireless communication
- Remote control via joystick,
- SMS notifications, subject to GSM coverage.

3 - Battery Hatch

- Provides access to the robot battery for replacement.
- Default delivery includes one battery. Additional batteries are optional.
- Autonomy: 10h under normal usage.

4 – Drive Wheel

- Enables robot movement.
- Default wheels: smooth “lawnmower” type to protect ground sheets.
- Optional all-terrain tractor wheels available.

5 – Rotary Storage Tray

- Stores and transports pots.
- Tray rotates to present the next slot to the gripper.
- Can hold 3-7 pots (up to 30 kg total), depending on pot diameter.
- Removable tray, selectable according to pot type.

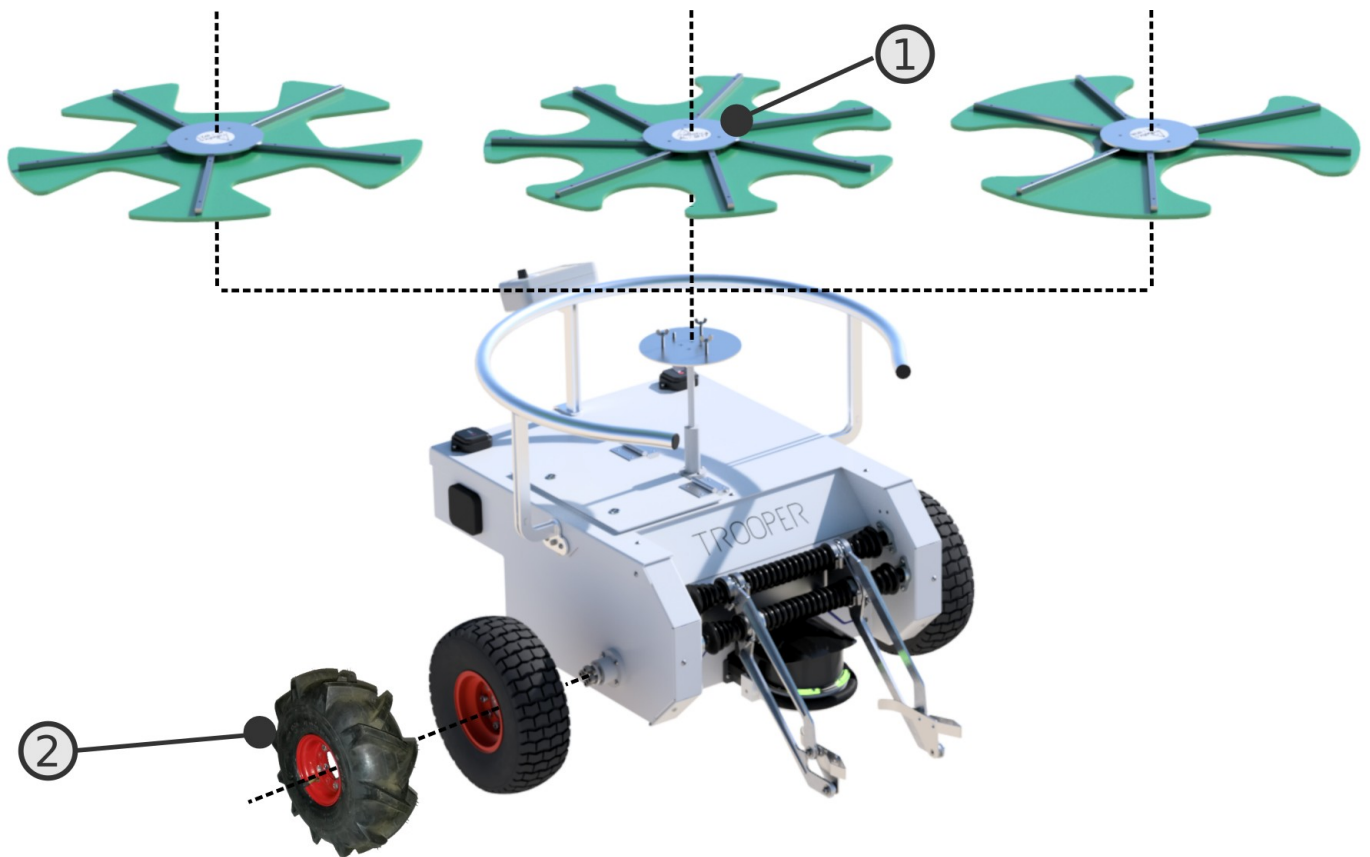
6 – LiDAR

- 4-layer multi-echo laser sensor to detect distances over 160°.
- Weatherproof and robust for outdoor use.
- Includes protective cap and shock-absorbing rubber bumper.
- Note: In case of frontal impact, plastic bumper support may break; replacement via 3D printing required.

7 – Gripper

- Arms and hands for picking and placing pots.
- Adapts automatically to pots from 12-26 cm diameter, up to 5 kg.
- Two degrees of freedom:
 - **Grip:** lateral hand movement to hold or release pots
 - **Lift:** arm rotation to lift pots to storage or place on the ground

Options:



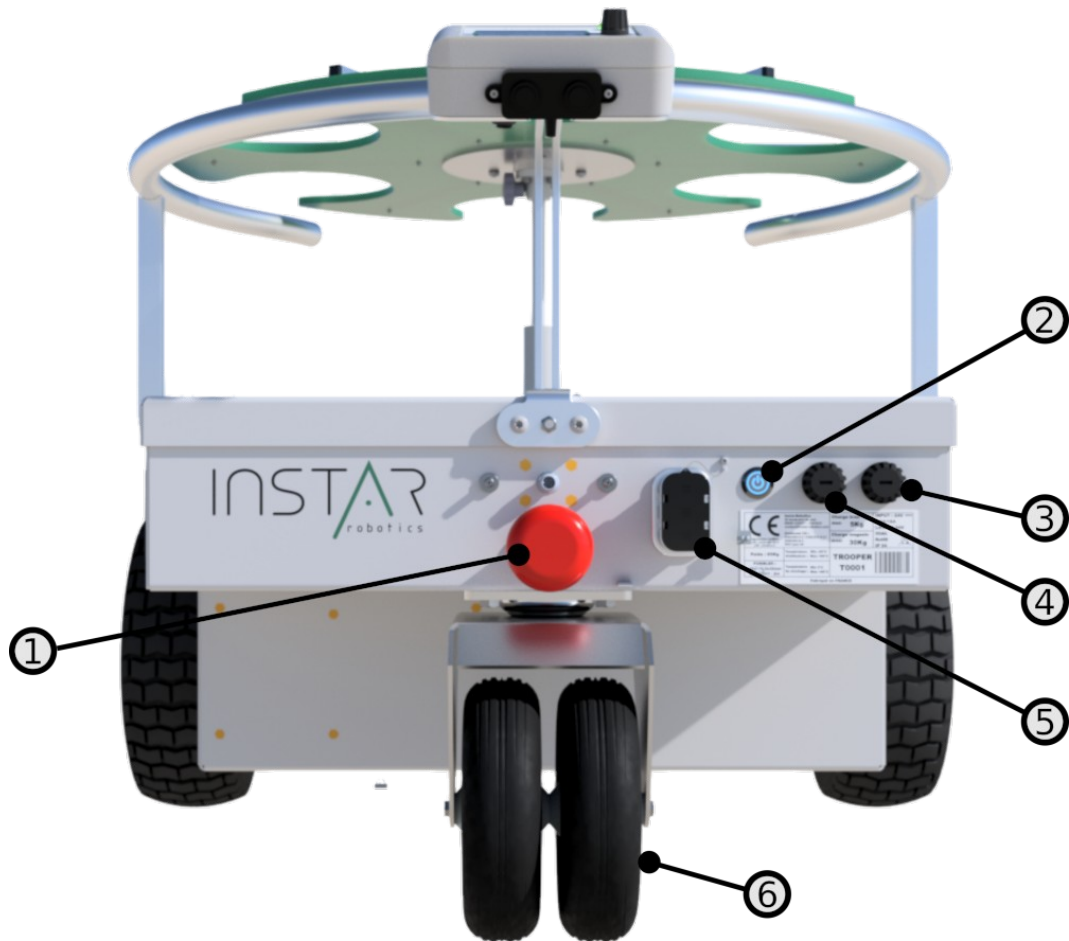
1- Magasin: A rotative platform with a number of slot to hold pots. Removable to adapt to pot types (2-5 L). Number of slots determines robot carrying capacity:

- 2L pots → 7 slots
- 3L → 6 slots
- 4L → 5 slots
- 5L → 4 slots

2- Drive Wheels: Trooper can be equipped with different types of wheel, depending on the floor type:

- Lawnmower wheels: smooth, for flat surfaces
- Tractor wheels: treaded, for uneven terrain

2 – Rear panel



1 – Motor Emergency Cut-off: disables robot effectors (wheels, gripper, rotary platform) without shutting down onboard PC.

2 – ON/OFF Switch: a button to power ON and OFF the robot.

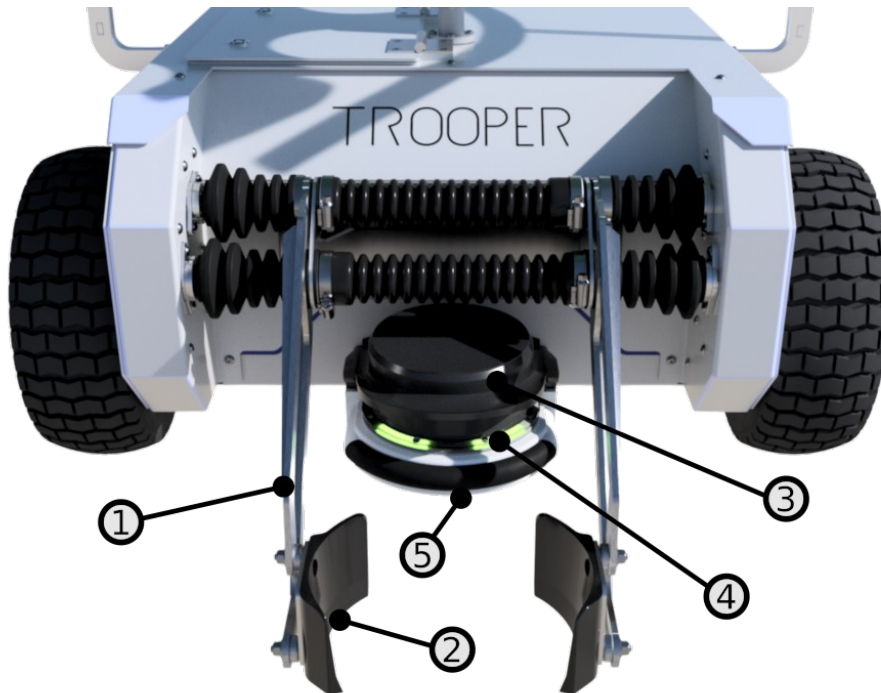
3 - Charger Fuse: protects against overvoltage or short circuit

4 – Motor Fuse: protects motors against overcurrent

5 – Charge Connector: for battery charging

6 – Free Wheel: supports robot rear weight and allows maneuvering

3 – Gripper Details



1 – Arm :

- Double-arm lifting for pot grab, storage and placement



Warning: The gripper arms operate at high speed and torque. Do not enter arm range when powered. Maintenance or hands removal need to be done once the emergency stop is pressed or when robot power is OFF.

2 – Hands

- Conical shape to grip pots without slipping or crushing.
- Standard hands: 2-3 L pots
- Optional: 3-5 L pots or custom shapes

3 – Rain Cap

- Removable cap to protect LiDAR sensor from rain, snow, sun, and dust

4 – LiDAR:

- 4-layer, multi-echo, detects objects over 160°
- Waterproof and suited for outdoors usage.
- A green LED confirm the lidar is ready to be used. If Led is orange or red, it generally indicate that the lidar is not ready yet.

5 – Shock Bumper:

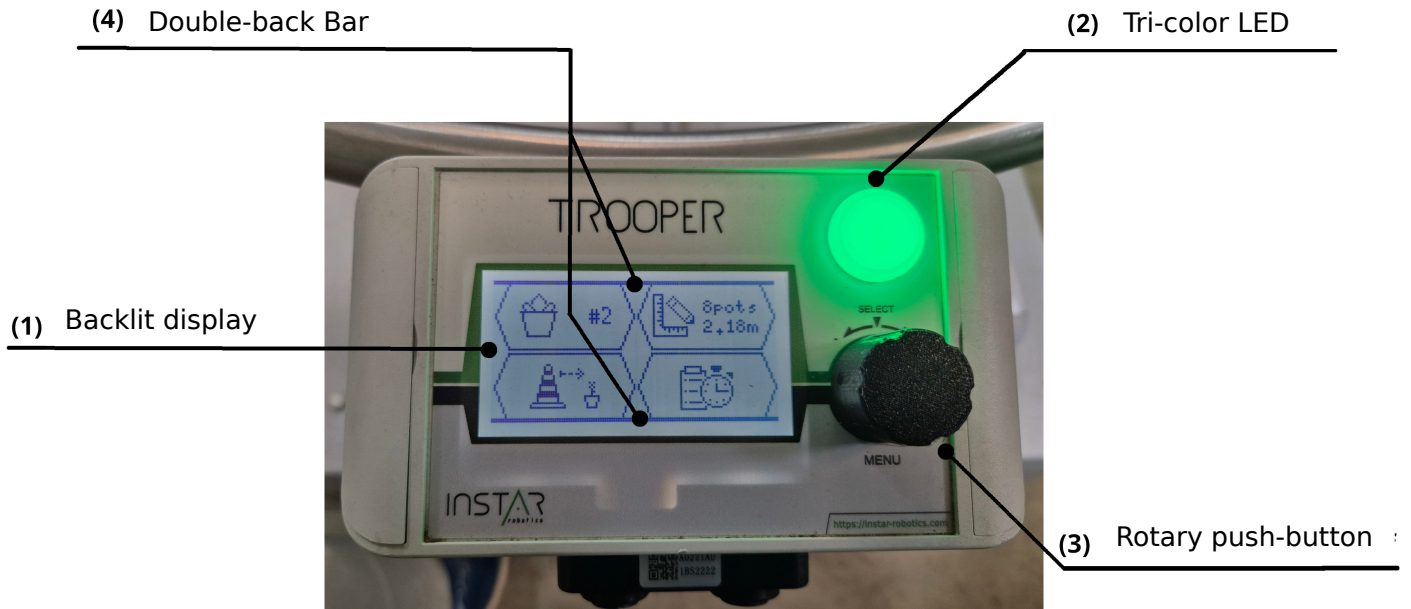
- protects LiDAR; replacement may be required after frontal impact



- **Note:** the shock bumper does not guarantee safety for people or property

4 – HMI unit Overview

The HMI unit is at the back of the robot. It allows to configure the task and to monitor robot state.



1- Backlit display

2- Tri-color LED: showing robot state.

- **Green** : indicate manual control mode (if green is permanent)
- **RED** blinking : the robot is on error state. Message and error ID are displayed on screen. The buzzer emit an alarm sound at 1Hz.
- **Amber** blinking : indicate autonomous mode. The buzzer emit alarm sound at 2Hz during 2 seconds before robot movements.

3- Rotary push button : allow to navigate menus.

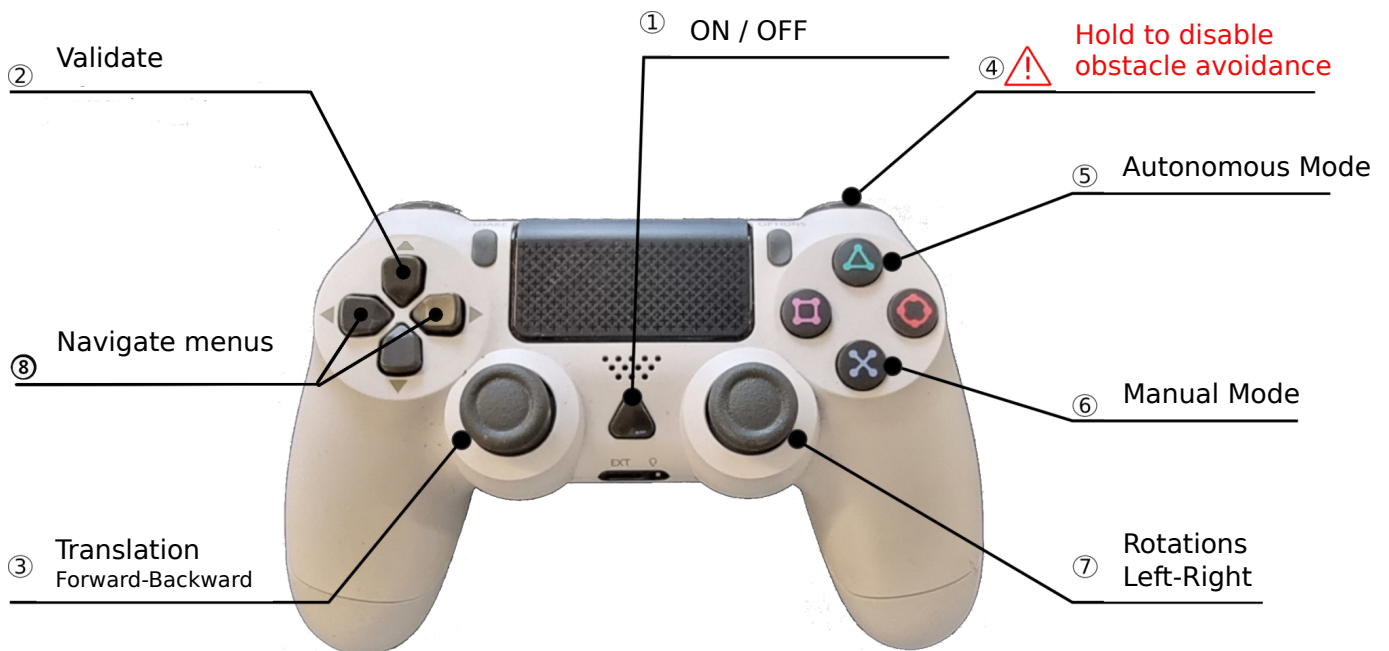
- Rotation left or right allows to switch from one element to the next.
- A push allows to activate the selected element.

4- Double-back bar : allows to return to previous menu.

- Rotate the button until the double horizontal bar is showing.
- Then push the button to return to the previous screen.

5 – Control Joystick

The robot come with a bluetooth remote joystick (wireless). Once powered on and synchronized, the joystick allows to control the robot manually.



1 – ON/OFF Switch: A short push launch the synchronized stage with the robot. The LED at the back of the joystick indicates its state:

- A slow blink indicates a search of bluetooth signal (in progress).
- Once synchronized, the LED stays fixed (no blink).
- A blink could also indicates a low battery for the joystick.
- Joystick needs to be charged by USB cable.

2 – Directional pad up: Pressing the up direction on the directional pad validates a selection in the robot interface.

3 – Translations: Joystick used to control linear speed. The vertical axis allows forward / backward movement. The horizontal axis is not used.

4 – Obstacle inhibition: The upper right trigger allows obstacle detection to be inhibited only while it is held down.

When obstacles are inhibited, the robot's speed is automatically reduced. When the trigger is released, obstacle detection is re-enabled.



Warning: use with caution.

This function allows the robot to safely pass through narrow areas (e.g. doors) or small obstructive obstacles that do not pose a risk to the robot (e.g. grass on the ground).

Improper use of this function may cause material damage or injury to nearby persons.

Therefore, while the upper right trigger is held down, the user is solely responsible for any damage caused to property or persons.

5 – Autonomous control:

Pressing this button switches the robot to autonomous mode.

Translation and rotation commands from the joystick are then ignored.

6 – Manual control:

Pressing this button switches the robot to manual mode.

7 – Rotations:

Joystick used to control angular speed.

The horizontal axis allows right / left rotation.

The vertical axis is not used.

8 – Directional pad right/left:

Has the same function as the rotary knob.

The directional pad allows navigation through the robot menus and modification of a parameter.

6 – Charger

The robot is supplied with a 24 V – 13 A wired charger.
The charger is connected to a standard 220 V power supply.
It has a protection rating of IP64.



7 – Boundary cones

A set of 20 signaling cones is supplied with the TROOPER robot.
To order additional cones, or a different model from the one supplied, please refer to the supplier or the manufacturer.
The cones are used to define the TROOPER robot's working area (see III. Configuration).



III. Start-up

1 – Usage precautions



Before switching on the robot, the following precautions must be taken:

a – No obstacle must interfere with the movement of the robot arm. The robot must be positioned at least 1 meter away from any obstacle in front of it.

b – The storage tray must be empty. Remove all pots from the slots.

No object must be placed on the tray or obstruct its rotation.

c – The robot charger must be disconnected from the rear charging connector.

d – The charging connector cover/cap must be properly put back in place.

2 – Power ON

A short press on the “ON/OFF Switch” starts the robot.

The LED of the “ON/OFF Switch” must start flashing blue (one pulse per second).

At this stage, the control unit is powered.

The tri-color LED on the control unit flashes green (one pulse per second) and the start-up screen is displayed.



Once the robot is ready for operation, the “ON/OFF Switch” LED turns solid blue.

The control unit displays the home screen and the tri-color LED on the control unit turns solid green.

The motors are activated.

The calibration procedure of the rotary platform is initiated.

3 – Power OFF

A short press on the “ON/OFF Switch” initiates the robot shutdown.

The LED of the “ON/OFF Switch” starts flashing blue rapidly until the robot is completely powered off.

4 – Battery charging



Charging must be performed only when the robot is switched off.

If the charger is connected while the robot is operating, the motor power supplies and the 24 V output are automatically shut down for safety reasons.

Procédure :

- First, connect the charger to a 220 V power outlet.
- The ABS LED must turn on.
- Remove the protective cover from the battery sensor on the rear connector panel.
- Remove the protective cover from the charger connector.
- Connect the charger to the charging connector on the rear panel of TROOPER.

At this point, the charger performs a voltage measurement on the robot output.

This procedure may take a few seconds.

The charger “test” LED is illuminated.

Then, the charger starts the charging process.

The “bulk” LED is illuminated.

Once the robot is fully charged, the charger automatically stops the charging process.



Note : Do not disconnect the charger from the charging connector while the robot is charging.

First disconnect the charger from the 220 V power outlet.

5 – Emergency stop

When the motor emergency cut-off button (emergency stop) is pressed:

- The motor power supply is cut off.
- The robot alarm is triggered; a buzzer sounds at a frequency of 1 Hz.
- The tri-color LED on the control unit flashes red at a frequency of 1 Hz.
- The screen displays the error message “Emergency stop activated”.



Before resetting the button, make sure that:

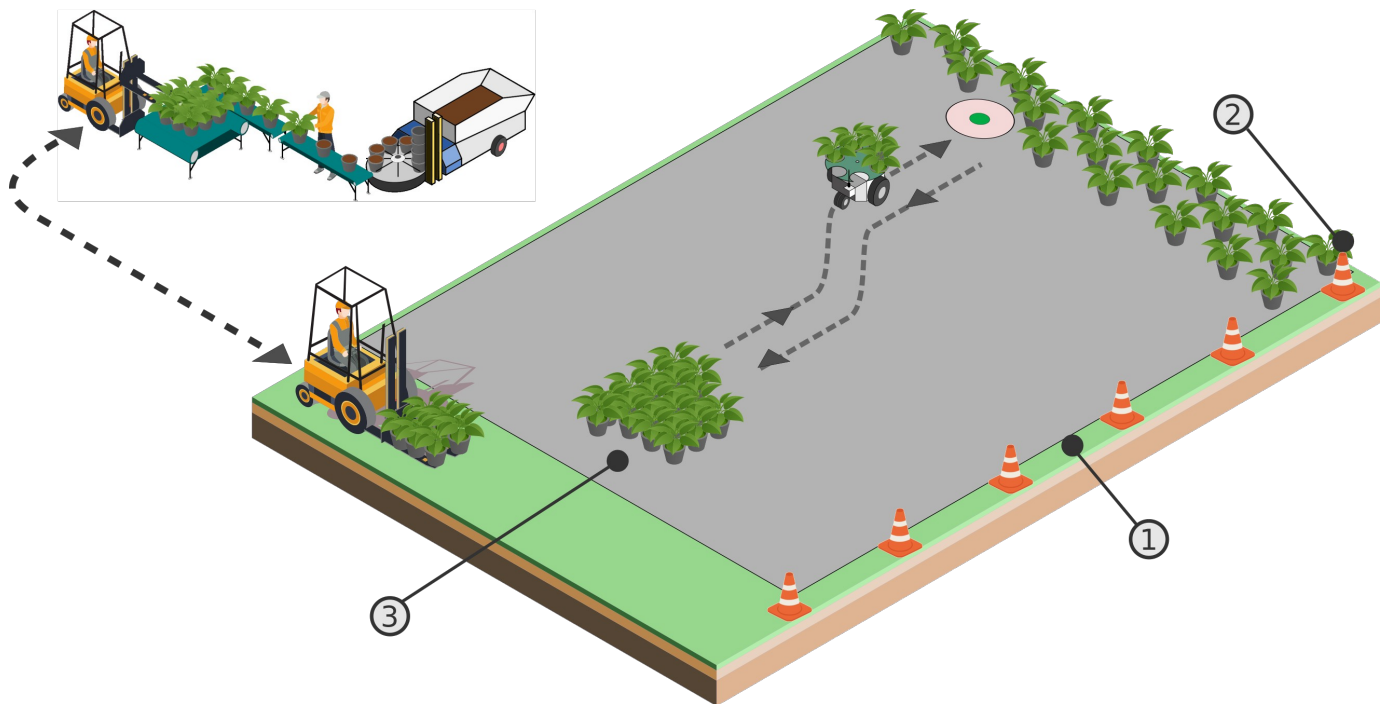
- No obstacle interferes with the movement of the robot arm.
- The robot must be positioned at least 1 meter away from any obstacles in front of it.
- The storage tray is empty. Remove all pots from the slots.
- No object must be placed on the tray or obstruct its rotation.
- The robot charger is disconnected from the rear charging connector.
- The charging connector cover is properly put back in place.

When the motor emergency cut-off button is reset (pulled out), the rotary platform calibration procedure is initiated.

Once calibration is completed, the motors become usable again.

The tri-color LED on the control unit turns solid green and the main screen is displayed.

IV. Spacing configuration



1 – Signaling cone line: Line of signaling cones defining the production bed.

2 – Drop-off point: Starting point for building the bed.

3 – Collection point: Location where pots are stacked on the ground.

1 – Preparation of the Environment

A. Preparation of the Production Bed

The first step is to place a line of traffic cones (1) along the entire length of one side of the production board.

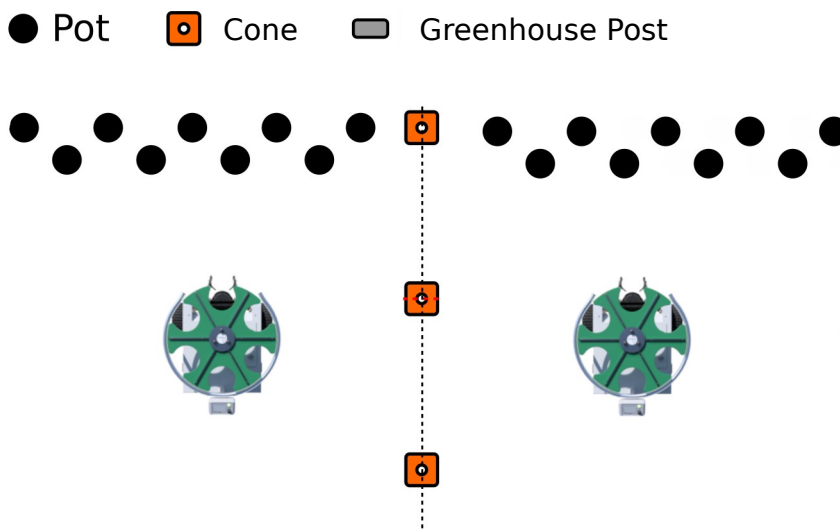
The spacing between two consecutive cones should be approximately 1.5 meters (minimum 1 meter, maximum 2 meters).

The most important thing is to maintain a consistent distance between each cone.

This line of cones serves to define the robot's working area and sets the orientation of the production board. The rows of pots placed by the robot will be perpendicular to the line of traffic cones. The robot must recognize the traffic cones and distinguish them from the pots to be transported.



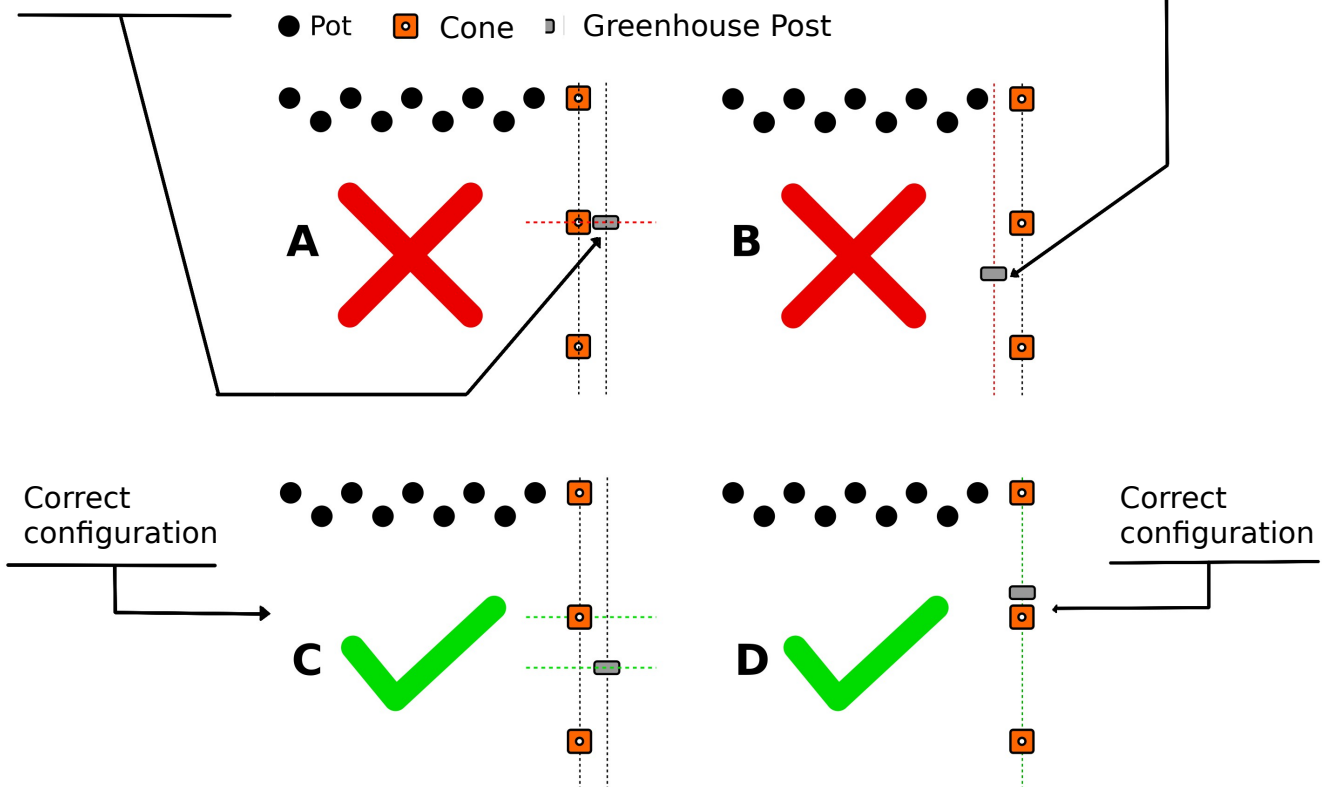
The same line of cones can be used to delimit two adjacent production boards. This way, one robot can space the pots to the right of the cones, while a second robot spaces them to the left of the cones. Both robots share the same traffic cones (see diagram below).



Example of Board Configurations for Spacing:

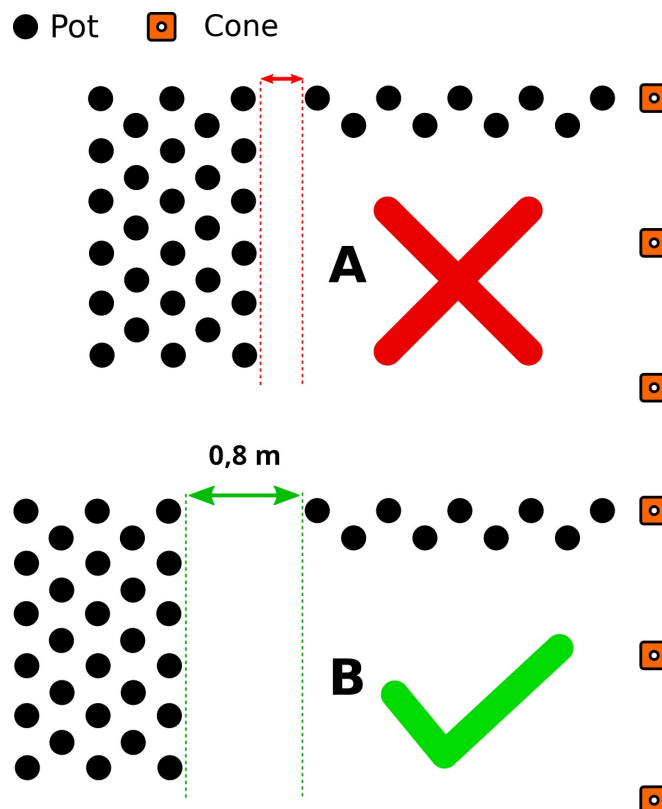
A post is behind a cone. It may confuse the robot

A post is on the way



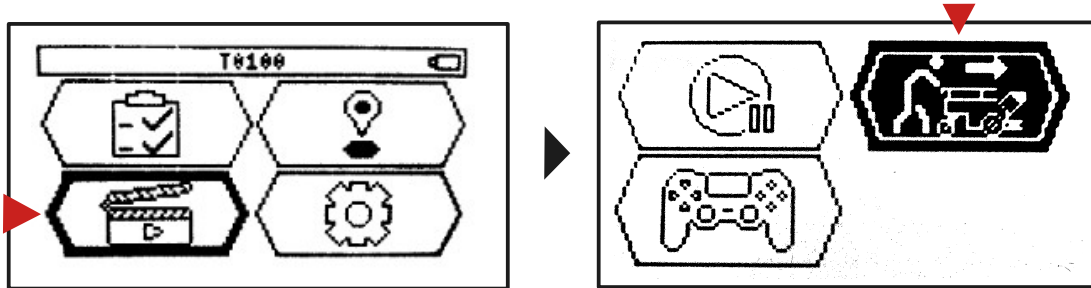
Recommended distance from an already spaced board:

0.8 m or more (see below):



B. Transport

The robot must be transported on the production board manually using the wireless control joystick or by using the motor disengagement function accessible from the interface box.



Warning: Do not push the robot when it is turned off or when the emergency stop is engaged. See the section “Danger and Safety Precautions → Prohibited Uses” for more details.



The robot must be sufficiently charged before starting its task.

C. Supplying Pots on the Floor

For optimal operation, the pots must be stacked on the floor following the spacing instructions provided by the TrooperUI application when creating the task.

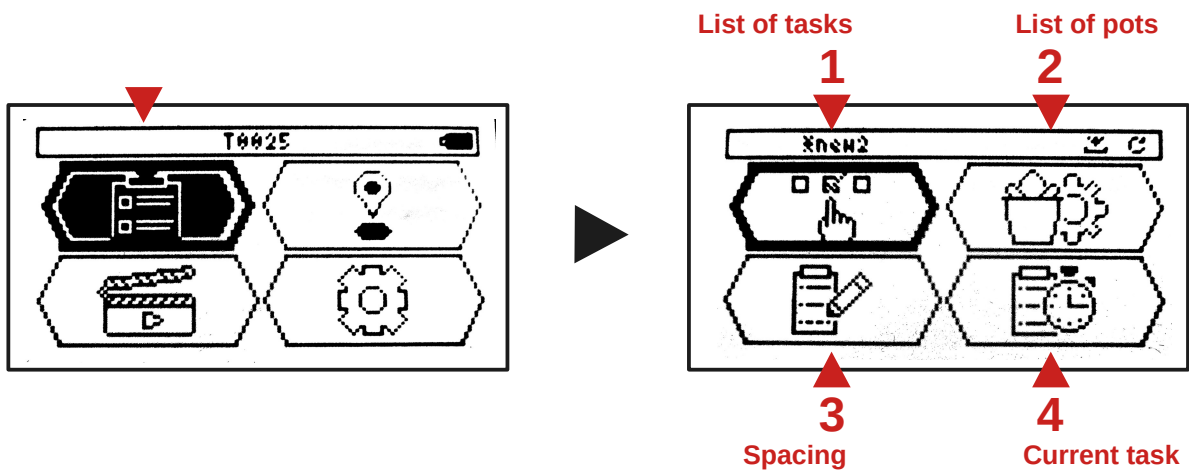
- The robot requires a minimum working space of 1.5 m or more between the stack of pots to be picked up and the row of pots to be spaced.
- The pots must be stacked at a distance of 1 meter from the line of traffic cones.
- The pots must be stacked within the bed and must not exceed the width of the spaced bed.

2 – Task Configuration

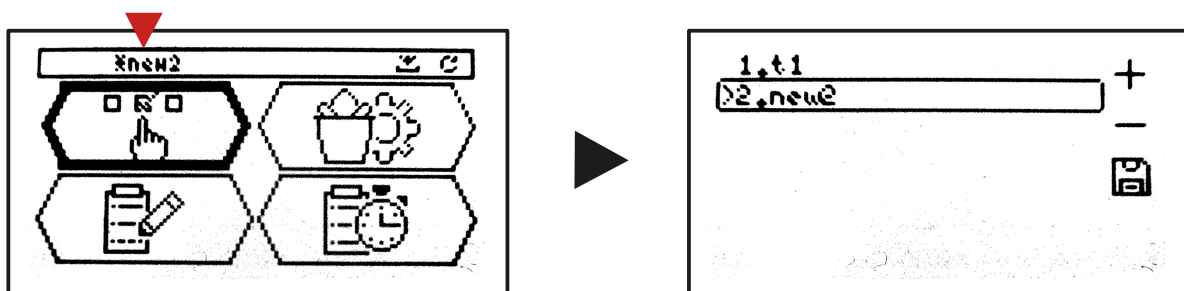
A. Task Setup

Task setup is performed from the first menu at the top right, in 4 steps:

- 1 - Select the task
- 2 - Select the pot model
- 3 - Configure the spacing
- 4 - Summary of the current task



1. Task Selection



Select a task from the list of stored tasks by clicking on it once.

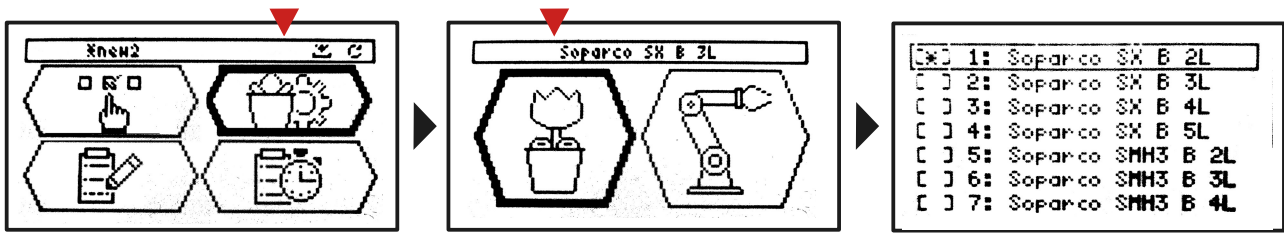
A second click allows you to edit the name of the selected task. Move the cursor from left to right to select the letter to modify. Click on the letter to scroll through characters until you find the desired one.

A task name can contain up to 19 alphanumeric characters:

- Letters from a to z
- Numbers from 1 to 9
- Or a space

The menu on the right allows you to add (+), delete (-), and save (floppy disk symbol) tasks.

2. Pot Model Selection



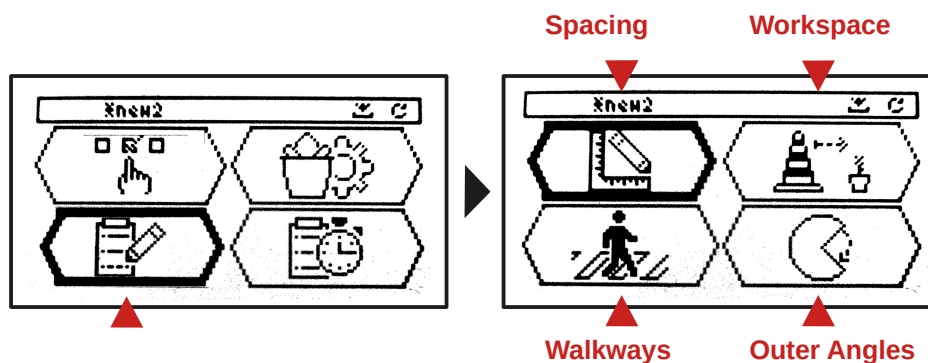
Select the desired pot model from the list of available pots.

Warning: Choosing a similar reference that does not match the actual pots may lead to reduced performance or recognition errors.

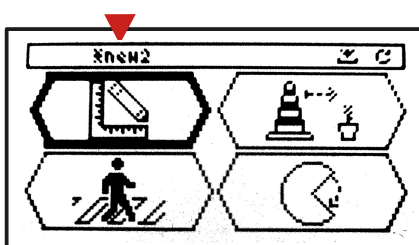
Note: The menu on the right (robotic arm) allows you to adjust all parameters related to pot handling (grip, spacing, arm speed, positioning, etc.)

→ see the section “Settings and Advanced Parameters”

3. Spacing configuration

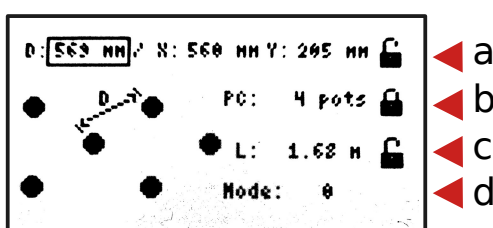


3.1. Spacing

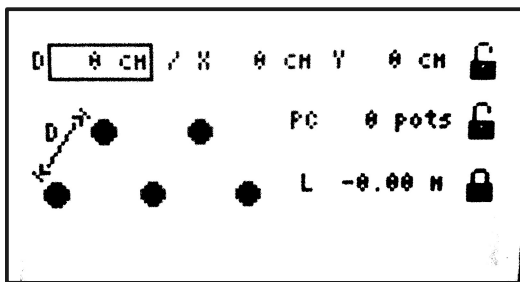


The spacing parameter screen is divided into 4 lines:

- a - Inter-pot distance
- b - Number of rows
- c - Line width
- d - Mode selection

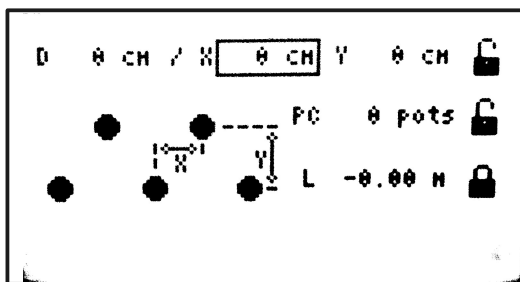


a. Inter-Pot Distance



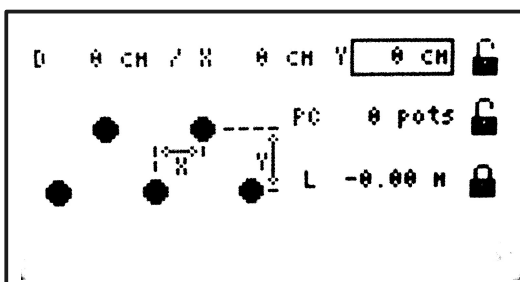
Adjust the inter-pot distance (D) in mm. The distance D is the "diagonal" center-to-center distance between two successive pots.

Warning: This distance must be greater than the diameter of a pot for spacing to work correctly.



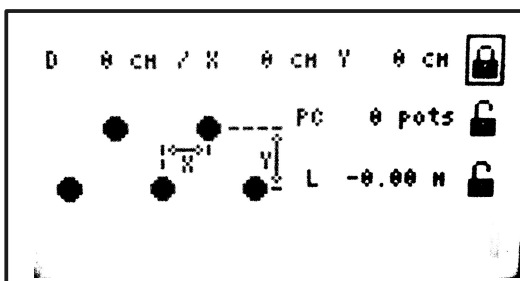
Adjusting X/Y Distances in mm

It is possible to separately adjust the distance between each column (X) and the distance between each row (Y). When adjusting X or Y, the distance D is automatically recalculated.



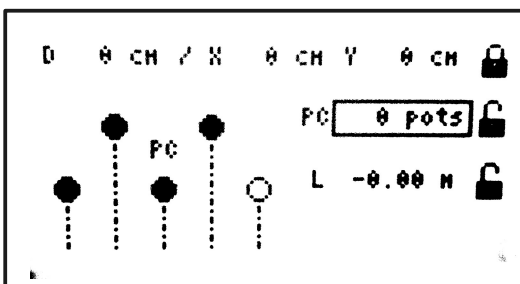
Warning: Just like with distance D, X/Y distances that are too small may not work.

Warning: If X/Y distances are used, spacing will no longer be optimal in terms of pots per hectare.



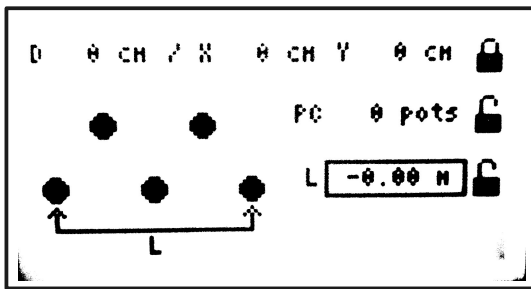
Once the settings (D or X/Y) are complete, click on the **lock icon** to save and lock these values.

b. Nombre de rangs



Next, select the number of columns/rows (across the width of the bed).

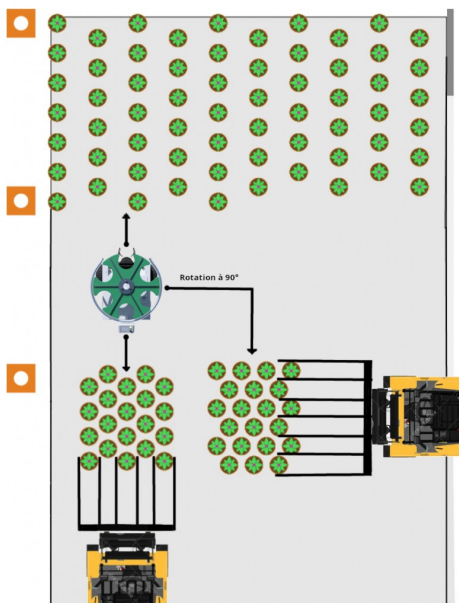
c. Line Width



The robot automatically calculates the center-to-center width of the line (from the first to the last pot) based on the number of pots and the inter-pot distance.

You can also choose to manually adjust/modify the line width. The robot will then automatically calculate the number of rows.

d. Other modes



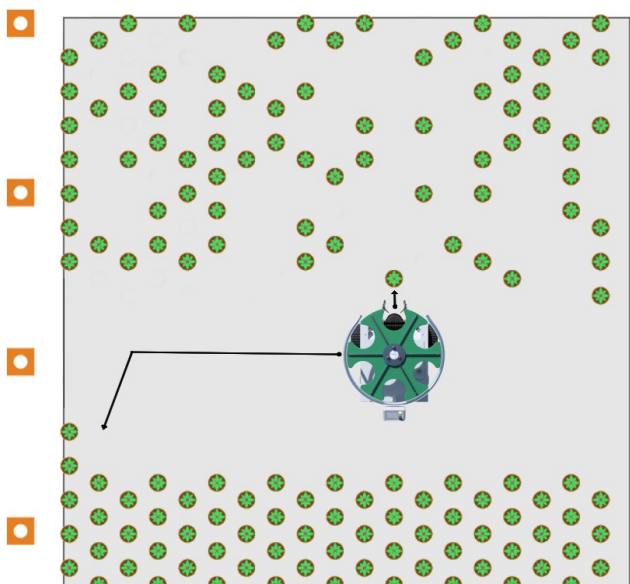
TIGHTENING

In addition to spacing, Trooper can also tighten pots, meaning it can pick up plants from an already spaced board and bring them closer together so they are touching.

This tightening remains staggered, and can be performed in 2 ways:

Mode 1: Straight tightening, allowing fork pickup along the length of the board.

Mode 2: 90° tightening, allowing fork pickup laterally.

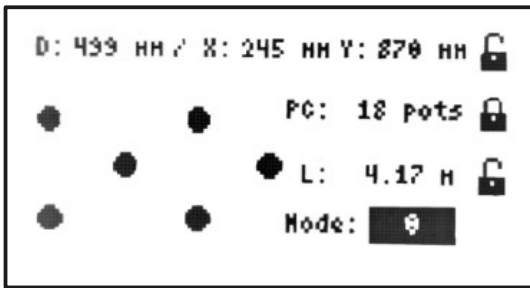


GROUPING

Trooper can also group pots, meaning it can collect plants spread randomly across the entire board and reposition them closer together to save space.

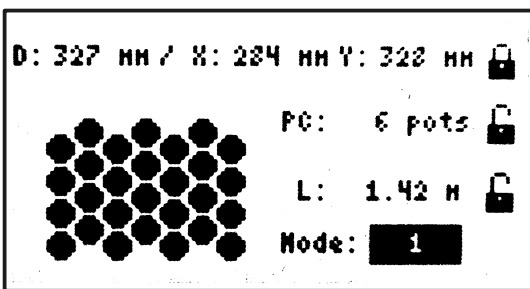
Similarly, a second, wider spacing can be performed to accommodate plant growth.

Mode 0: Spacing



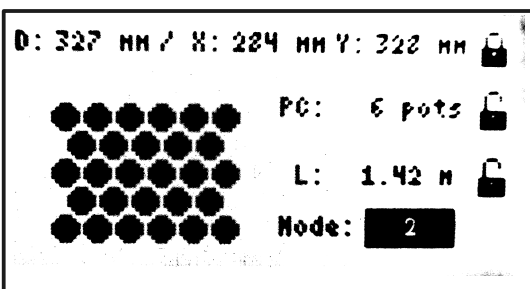
Mode 0 allows for standard spacing using the parameters described above.

Mode 1: Straight Tightening



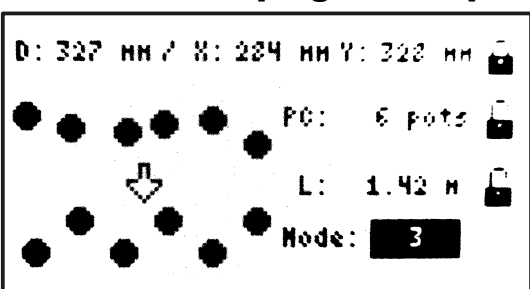
Mode 1 allows for straight tightening, enabling frontal fork pickup.

Mode 2: 90° Tightening



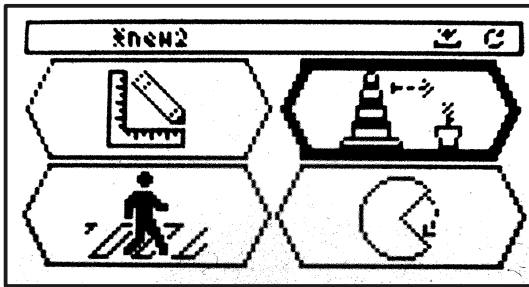
Mode 2 allows for 90° tightening, enabling lateral fork pickup.

Mode 3: Grouping or Re-Spacing



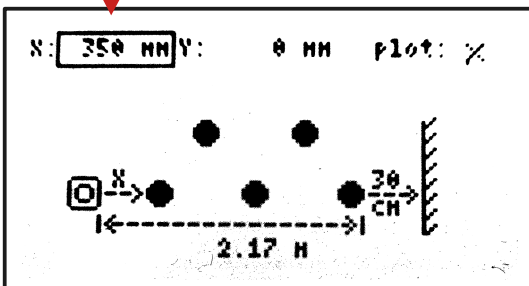
Mode 3 allows for grouping, meaning it picks up pots distributed randomly across the entire width of the board and re-spaces them to save space.

3.2. Workspace



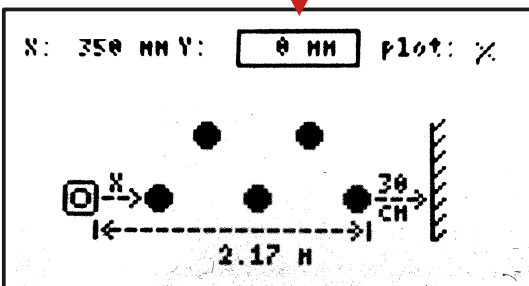
This menu allows you to configure the workspace:

- The X,Y position of the first pot relative to the first cone.
- The end-of-board cone option.
- The width of the collection area.



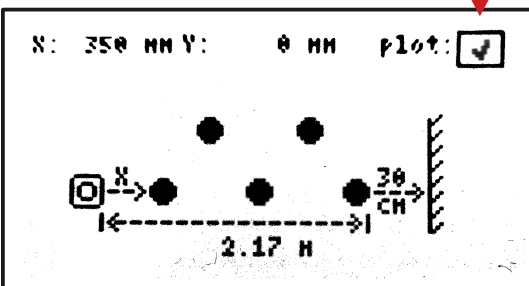
X (in mm) sets the lateral distance (widthwise) from the edge of the first pot to the edge of the first cone.

Warning: This value cannot be less than 50 mm.



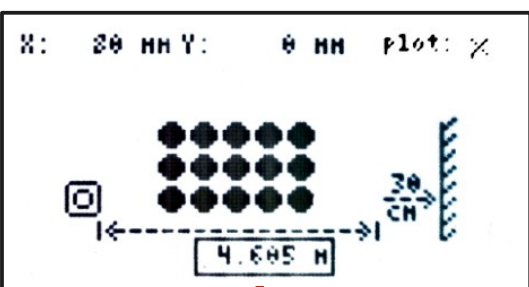
Y (in mm) allows shifting the first pot forward or backward (lengthwise) to start spacing before or after the cone.

By default, the value is 0 mm, centering the pot on the cone's axis.



End-of-Bed Cone Option:

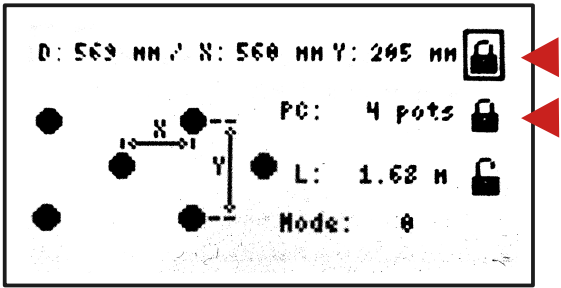
Once this option is activated, you can place cones at the end of the board to create a virtual wall and prevent the robot from picking pots beyond it.



You can also enlarge the pot collection area using this option.

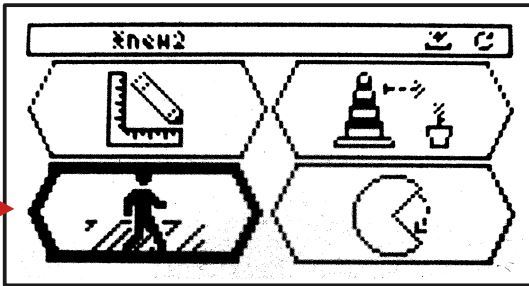
Warning: Ensure there are no obstacles in the robot's path when enlarging the collection area (e.g., posts, water pipes, ditches...).

3.3. Walkways



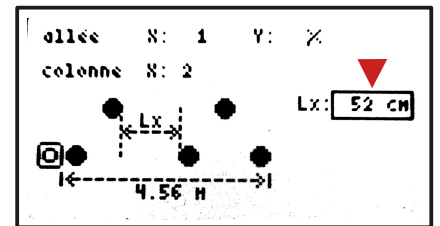
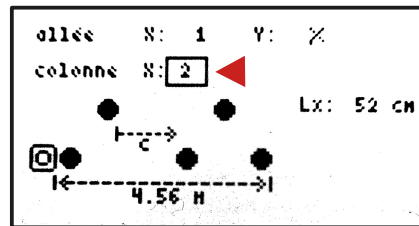
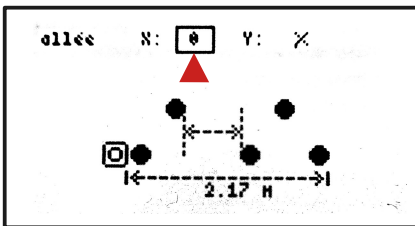
First, in the spacing menu, make sure that 2 locks are closed; otherwise, the walkways cannot be activated.

Then return to the previous screen.



This menu allows you to configure walkways:

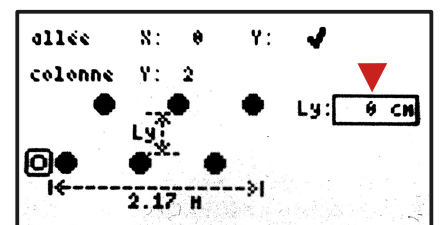
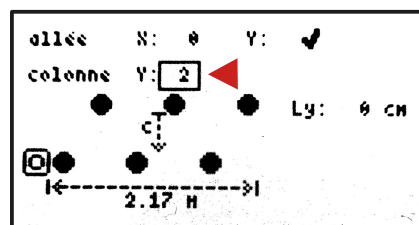
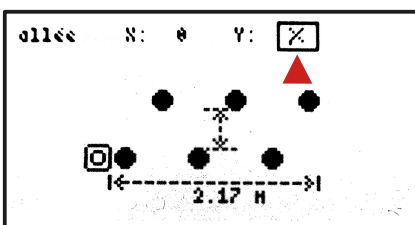
- Width (X)
- Length (Y)



Width:

- X aisle: number of walkways: 0, 1, or 2
- X column: row number of the 1st and 2nd walkways
- Lx: width of the walkway(s) (edge-to-edge)

In the example above, the user configured 1 walkway, 52 cm wide, between row 2 and row 3.

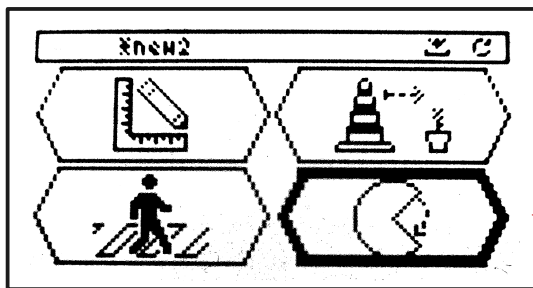


Length:

- Y aisle: option to activate or not
- Y column: periodicity (one walkway every Y rows)
- Ly: width of the walkways (edge-to-edge)

In the example above, the user configured 1 walkway every 2 rows

3.4. Outer Angles



This menu allows you to adjust the drop angles for the outermost rows.

Indeed, to avoid collisions with a cone or a post, the first and last rows often cannot be placed with a straight approach

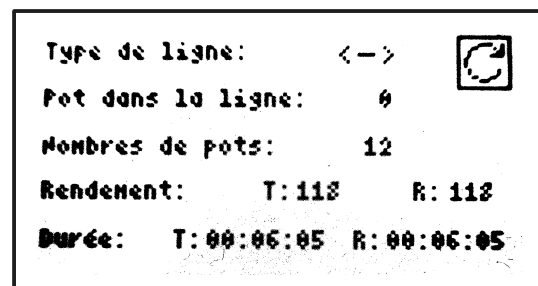
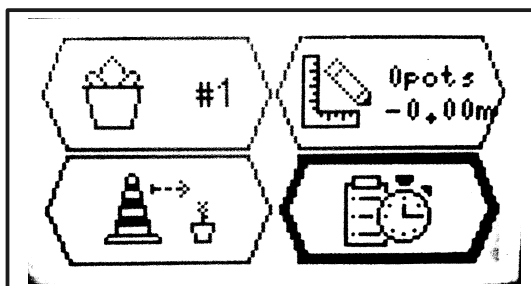
- **Left:** adjustment of the first row angle, cone side
- **Right:** adjustment of the last row angle, outer side



To allow the robot to place pots very close to obstacles or cones, an angle of 45-50° is recommended.

Note: For very tight spacing, an angle greater than 40° may prevent the robot from reaching the drop point.

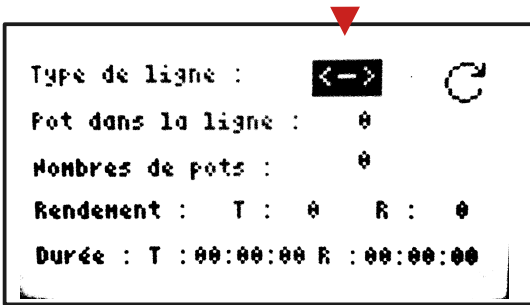
4. Current Task Summary



This menu allows you to review the current task.

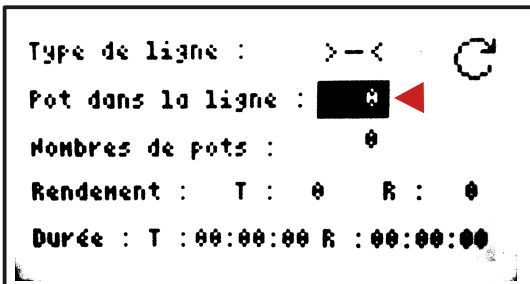
It displays:

- The type of row (see p.30)
- The number of pots in the current row
- The number of pots spaced since the start of the task
- Theoretical and actual output (excluding pauses) in pots/hour
- The task duration, theoretical and actual



The first parameter indicates the type of the current row:

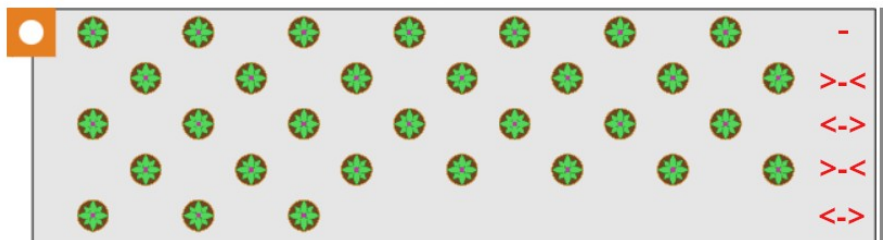
- -- (dash): first row of the task
- <--> (long line): row close to the cones
- >--< (short line): row set back from the cones



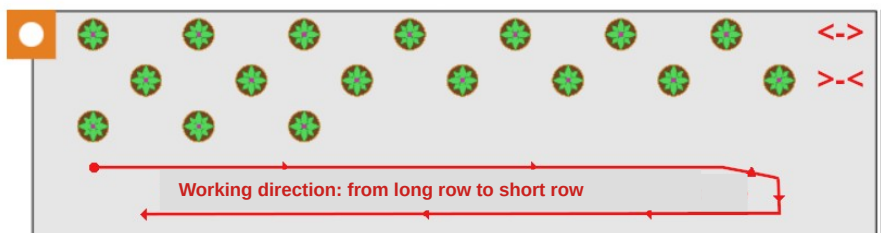
The second parameter indicates the number of pots in the current row.

Note: The row type and number of pots in the row can be modified if needed when resuming a previous task.

Example :

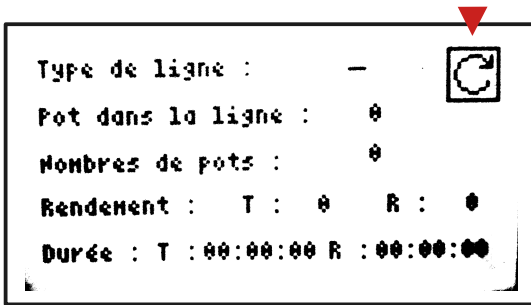


- The current row is a long row (<-->), close to the cones.
- The number of pots in the row is 3.



Note: The robot always spaces in a serpentine pattern:

- Moving away from the cones in a long row
- Moving toward the cones in a short row

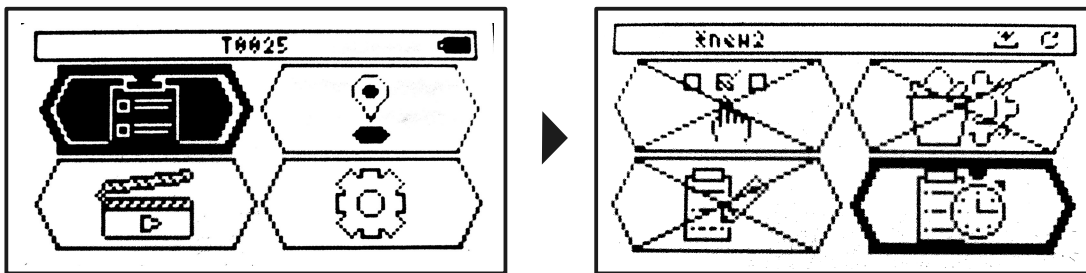


The rotating arrow allows you to **reset** the current task.

Once the task is cleared, all values return to zero and the row type becomes a dash (--) (first row of the task).

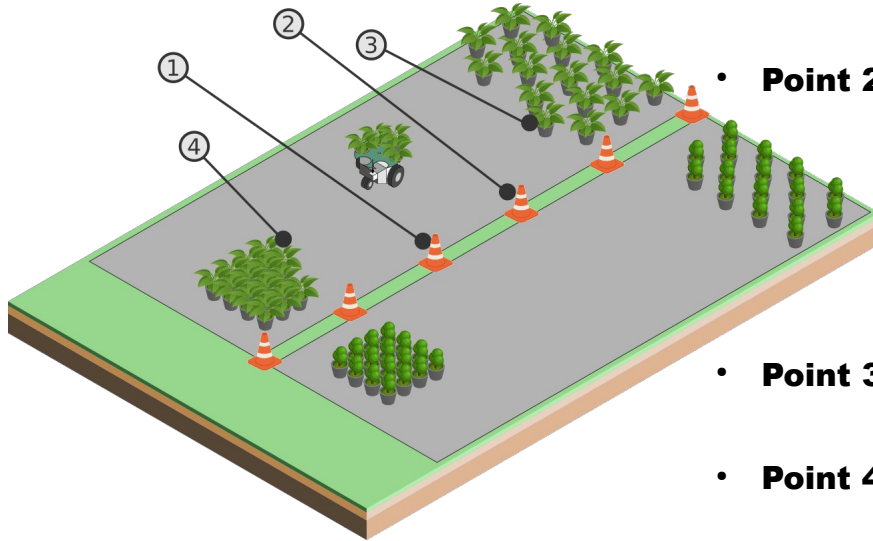
Note: When a task is in progress, the icon in the home menu appears in black. Similarly, the task sub-menus are grayed out.

However, it is possible to modify parameters during the task without resetting it. If the changes are minor, the robot can accommodate them and continue the task.



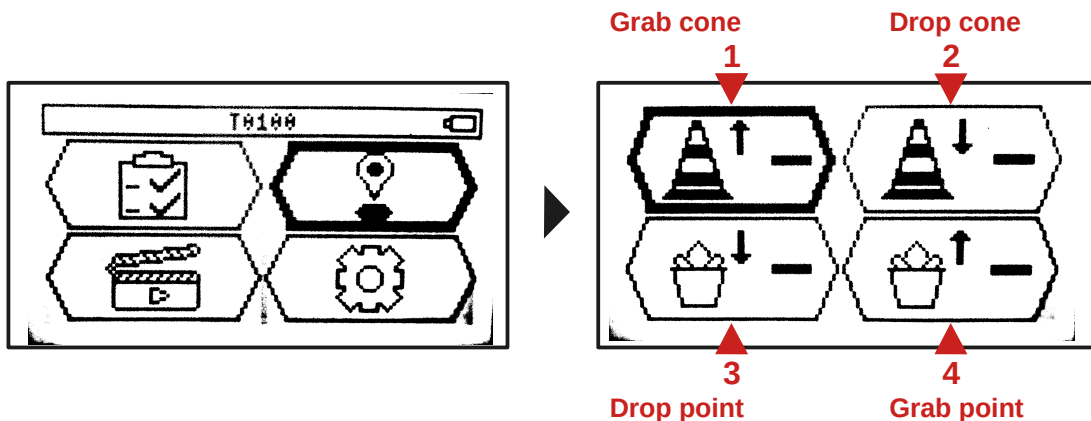
B. Memorization of Geographical Points

To navigate, the robot needs to memorize 4 points:



- **Point 1:** cone on the collection side
- **Point 2:** cone on the deposit side
- **Point 3:** deposit point
- **Point 4:** collection point

To enter the point memorization menu, select the map icon at the top right of the home screen. The screen then displays 4 icons representing the 4 points to be memorized.



Dash Symbol:

Before clicking, this symbol appears to the right of the icon, indicating that the corresponding point has not yet been memorized.



Checkmark Symbol:

After clicking, the checkmark symbol appears, indicating that the point has been successfully memorized.



Error Symbol:

After clicking, if the symbol is a cross, it means the point was not memorized correctly.

Check that the point (cone or pot) is clearly visible to the robot and that the robot is close enough to the cone.

To Memorize the Points:

- a - Move the robot in front of the point to be memorized
- b - Select the corresponding icon on the interface, then click
- c - The checkmark symbol should appear
-

If the error symbol appears, repeat the procedure while adjusting the robot's angle and distance to the point.

Once the point is successfully validated, move the robot to the next point and repeat the procedure.

Note on Cones:

- Cones must be aligned and placed at regular intervals
- The interval can be chosen between 1 m and 2 m, depending on the spacing
- Cones selected as points to memorize must be adjacent. There should be no cones between the two memorized cones

Note on Points:

- To memorize the collection point, the robot must see pots in the collection area
- To memorize the deposit point:
 - For a new task, the deposit point is a cone
 - When resuming an ongoing task, the deposit point can be any pot already spaced on the deposit side

3 – Starting the Task

A. Switching to Autonomous Mode

Once the task is configured and the geographical points are memorized, you can switch the robot to autonomous mode to start the task.

For this, the robot must be at least 1 meter away from any surrounding obstacles to allow safe maneuvering.

Switching to autonomous mode can be done in two ways:

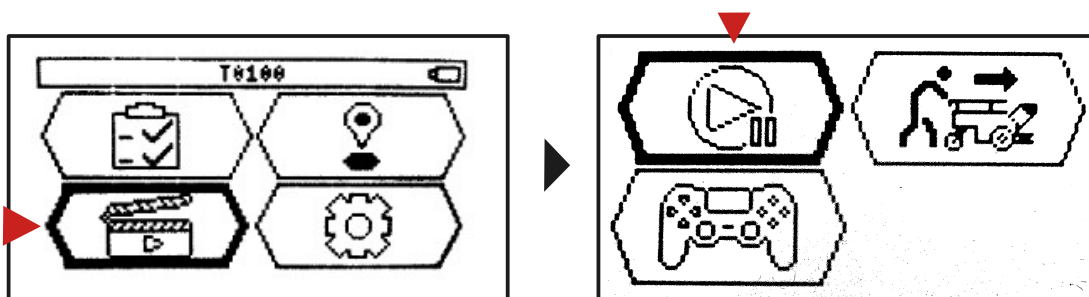
a – Via the wireless joystick:

Press the autonomous control button 5 (triangle), as shown below.



b – Via the interface:

Click on the menu at the bottom left, then select the RUN icon on the left. This will start the robot in autonomous mode if it is currently in manual mode.



The tricolor LED on the control box will flash amber at a frequency of 1 Hz, and the alarm will sound at the same frequency.

The robot then checks that no nearby obstacles prevent it from switching to autonomous mode. After 2 seconds, the robot begins its task. The alarm stops, and the LED lights up amber permanently.

If an obstacle is too close during this phase, the robot goes into error mode (flashing red LED and alarm). To resolve the error, the operator must:

- a** - Switch to manual control using the joystick or the interface
- b** - Move the robot at least 1 meter away from any obstacle
- c** - Reactivate autonomous mode, starting again from the previous step

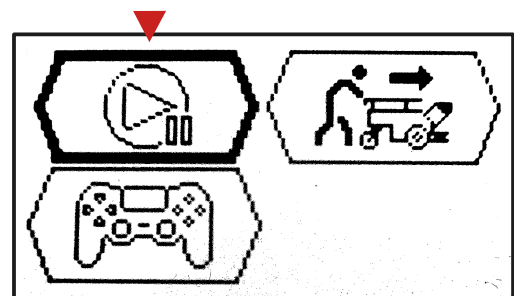
B. Switching to Manual Mode

At any time, it is possible to stop the robot during its task (pause) and take manual control:

- Via the wireless joystick: Press the manual control button 6 (X), as shown below, then move the robot using the pads (joysticks)
- Via the interface: Click on the RUN icon, which will pause the robot when it is in autonomous mode



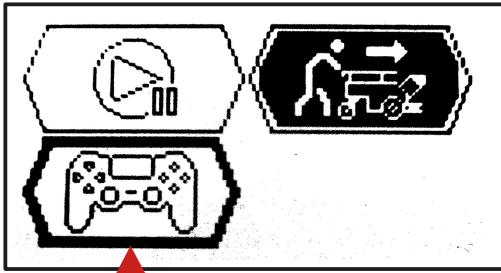
OR



Warning: It is strongly discouraged to pause the robot via the interface.

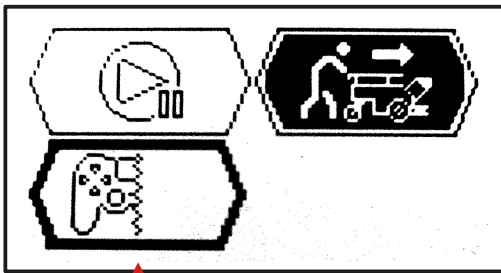
Indeed, doing so requires clicking the button on the interface while the robot is moving. The robot may make sudden movements, and the button is **not designed to withstand strong pressure** from an uncontrolled user input.

“Free Hand” Option

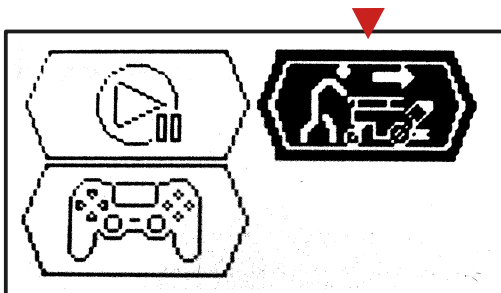


The icon at the bottom left allows you to switch between two joystick control modes:

- **Full joystick mode:** allows control of the robot using both joysticks
- **Partial joystick mode:** allows control of the robot using only the left joystick (forward-backward + rotations)



C. Disengagement Mode



The icon at the top right allows you to disengage the robot so it can be pushed manually. This mode is useful for moving the robot without using the joystick. The interface LED then flashes slowly in green.



Warning: Do not push the robot when it is turned off or when the emergency stop is engaged. See the section “Danger and Safety Precautions → Prohibited Uses” for more details.

D. Task Execution and Completion

Once returned to the collection point, the robot searches for pots to pick up. Make sure pots are stacked at the collection point before starting the robot in autonomous mode.

The robot will make back-and-forth movements and space the pots as long as it finds new pots at the collection point.

The collection point and deposit point gradually shift according to the progress of the task.

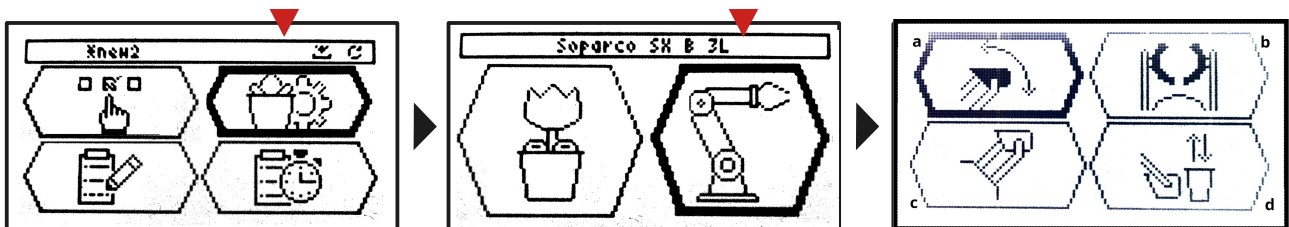
As soon as the robot no longer finds any pots, it stops at the location of the last pot it spaced.

To restart the task, simply stack more pots and switch the robot back to autonomous mode via the wireless joystick.

4 – Advanced Settings and Parameters

A. Pot Handling Settings

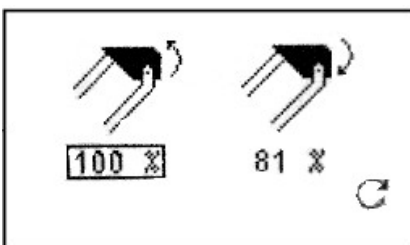
From the task screen, select the pots menu, then the robotic arm icon on the right to access the various arm settings for pot handling.



Sub-menus:

- a: Arm speed
- b: Grip and spread
- c: Arm position
- d: Pick-up and deposit distance

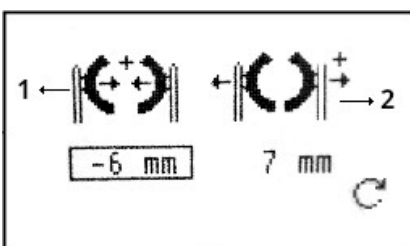
a. Arm Speed



Allows adjustment of the lifting speed and pot placement speed (settings in %).

- If the pots are heavy (>4 kg), it is advisable not to exceed 60-70% of maximum speed to preserve the arms and prevent slipping.
- If the pots are covered with mulch, reducing the arm speed may help limit the scattering of chips during handling.

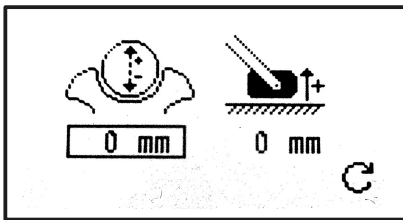
b. Grip and Spread



Allows adjustment of the grip strength on the pots during pick-up, as well as the spread of the grippers when inserting into tightly spaced pots.

- **1** - Grip (right): The higher the value, the tighter the pot is held by the grippers
- **2** - Spread (left): The higher the value, the wider the grippers open

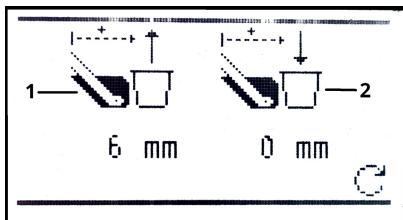
c. Arm Position



Allows adjustment of the arm position during storage placement and at ground level.

- **Storage placement (left):** A negative value moves the pot further back into the slot.
- **Ground position (right):** The higher the value, the higher the arm is relative to the ground.

d. Pick-up and Deposit Distance

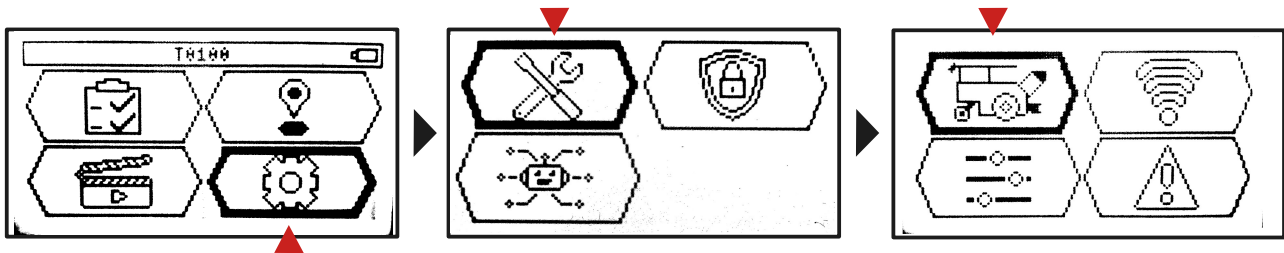


Allows adjustment of the pick-up and deposit distances.

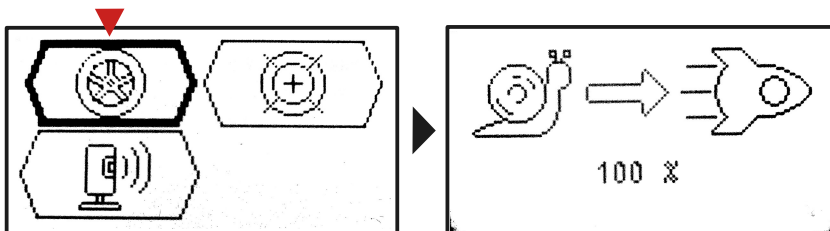
- **Pick-up distance (left):** The higher the value, the further forward the gripper moves before picking up the pot.
- **Deposit distance (right):** The higher the value, the further ahead the pot is placed in front of the robot.

B. Advanced Parameters

From the home screen, select the advanced settings menu (gear icon at the bottom right), then the tool icon.



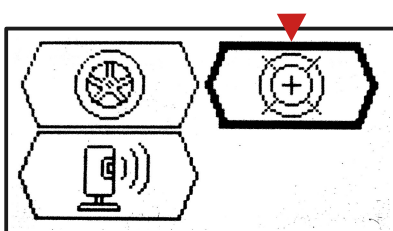
a. Robot Speed



The wheel menu allows adjustment of the robot's speed and acceleration (in %).

- By default, the speed is set to maximum (100%).
- Reducing the percentage slows the robot and helps prevent slipping on smooth surfaces.

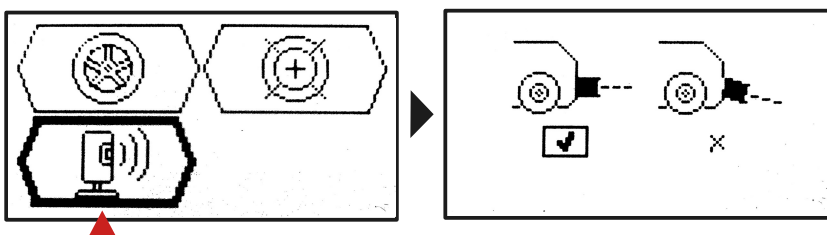
b. Robot Calibration



The second menu (target icon) allows angular and linear calibration of the robot.

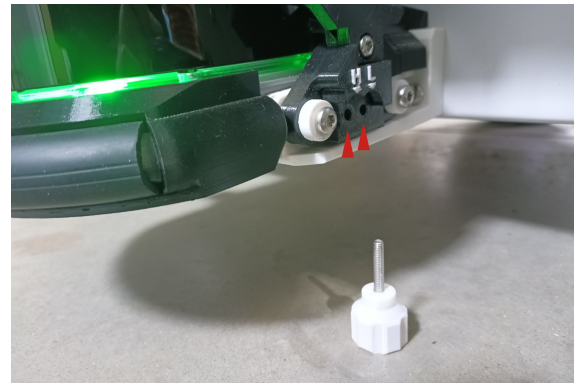
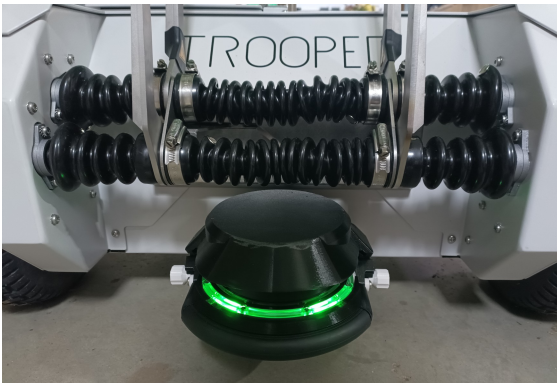
This menu is disabled for the user.

c. Lidar Sensor Positioning



The sensor menu indicates to the robot the position of its lidar sensor (the laser at the front):

- High position: recommended for containers larger than 2 L
- Low position: required for containers smaller than 1 L

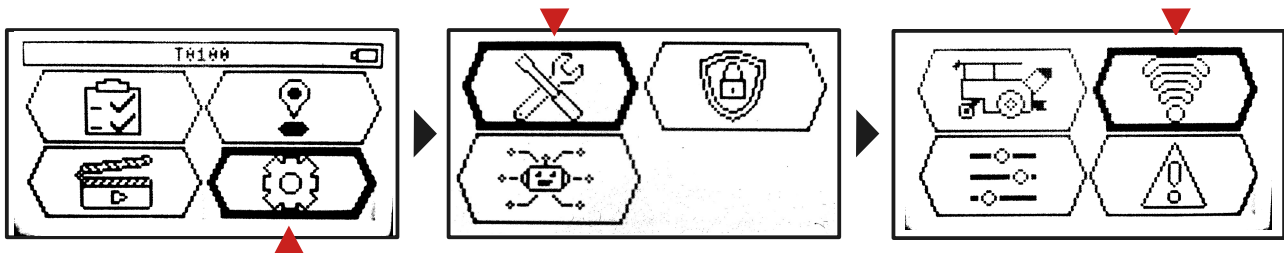


The position set in the interface must correspond to the **actual position** of the lidar. To do this, the lidar is equipped with 2 white knobs and 2 positioning holes:

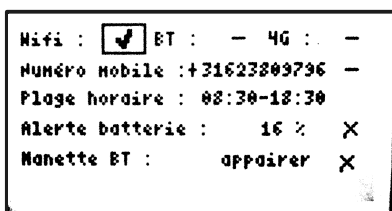
- Front hole (H: High): high position
- Rear hole (L: Low): low position
- To change the position:
 - 1) Fully unscrew the knobs
 - 2) Tilt the lidar to the desired position
 - 3) Screw the knobs into the hole corresponding to the selected position

Only the hole matching the lidar's position can be used for screwing

d. Connectivity

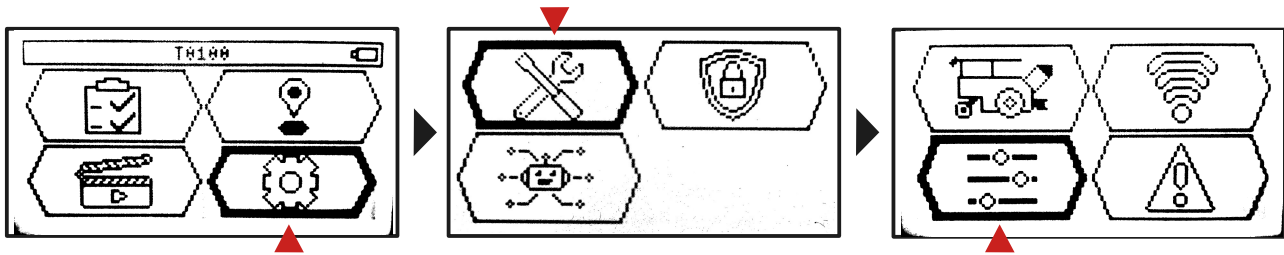


The Connectivity menu allows access to the robot's communication and alert settings:

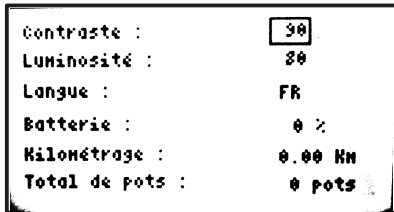


- Enable/Disable Wifi / Bluetooth (BT) / 4G communication
- Add a phone number and enable SMS alert notifications to that number
- Set a time window for sending SMS alerts
- Set a critical battery alert threshold (default 16%)
- Pair a new wireless joystick

e. General Settings

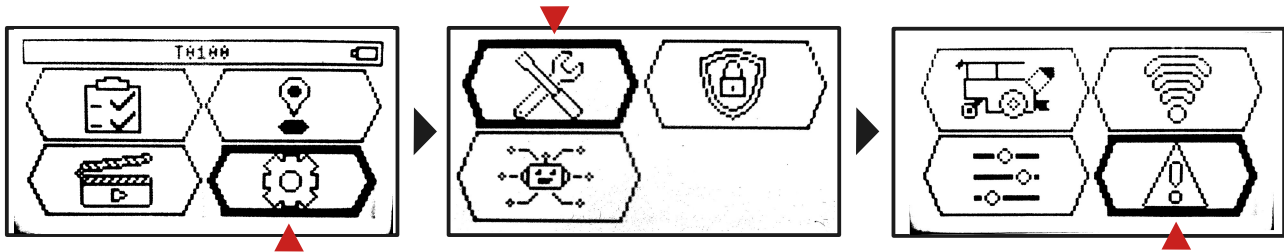


This menu provides access to more general settings and information:

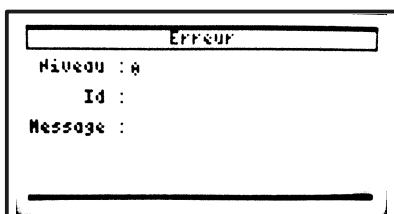


- Adjust the screen contrast
- Adjust the screen brightness
- Set the interface language
- Obtain an estimate of the remaining battery level
- Total distance traveled by the robot during its lifetime
- Total number of pots spaced by the robot during its lifetime

f. Alerts Summary



The Alerts sub-menu simply provides access to the robot's most recent alert.

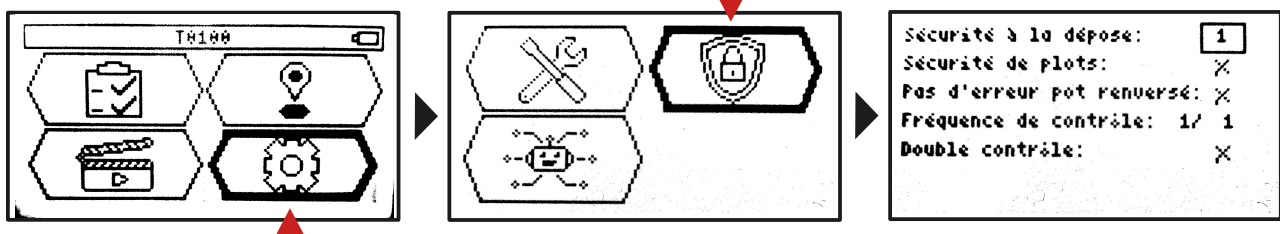


- This screen is useful when the robot no longer displays an alert due to manual control being activated.

If you have subscribed to the 12-month 4G plan (highly recommended) with the robot, you can both receive and send SMS messages to the robot. This function allows you to intervene remotely in certain situations.

- SMS: "**HELP**" - returns the list of possible SMS keywords (see list below)
- SMS: "**AUTO**" - restarts the robot after an autonomous stop
- SMS: "**OFF**" - turns off the robot (preserves battery)
- SMS: "**REBOOT**" - restarts the robot
- SMS: "**STATUS**" - the robot sends back an SMS with the following data:
 - Active mode (auto or manual)
 - Remaining battery level (%)
 - Selected pot reference
 - Number of pots spaced
- SMS: "**4G ON**" - activates the 4G connection
- SMS: "**4G OFF**" - deactivates the 4G connection

g. Safety Settings



The Lock menu provides access to the robot's safety modes.

Deposit Safety: This setting instructs the robot to move in reverse for the outermost rows. The value indicates the number of rows affected. We recommend keeping this setting at 1.

In very slippery or uneven working areas at the edges, you can increase the value to 2, 3, or more. This increases the traction of the drive wheels.

Cone Safety: You can activate this safety feature in certain situations, especially if the pots to be collected are placed very close to cones: less than 1.2 m.

No Upset Pot Error:

When this parameter is enabled, if the robot detects that it has overturned a pot, it will send an alert SMS but will continue working.

This can be useful in cases of frequent false detections (e.g., handling window boxes) so that the robot does not stop production.

The SMS received should still alert you to check whether a pot has actually been overturned or not.

Control Frequency:

This parameter allows you to optimize your workflow, especially when the robot spaces pots without using the storage, one container at a time (window box, tray, small container).

By default, the robot is set to 1/1. At each pick-up and deposit cycle, the robot periodically checks its position relative to the cones.

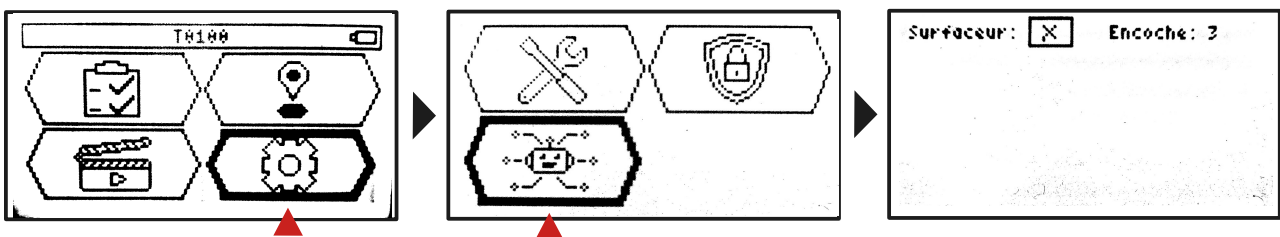
If the floor is clean and non-slippery, the pot stacks are positioned according to the TROOPER UI software, and there are very few surrounding obstacles, you can select 1/2 or even 1/3. The robot will perform cone checks once every 2 or 3 cycles.

Double Check:

Conversely, this parameter allows the robot to check the cones both on the outbound trip (from collection to deposit) and on the return trip (from deposit to collection).

This can be useful to make the robot more vigilant in difficult cases, particularly when the floor is very slippery or the working width is very large (e.g., 10-12 m).

h. Extension Modules:



The Extensions menu allows you to activate and configure various modules that can be added to the robot.

Example: The FertiBot fertilizer surfacing module can be activated or deactivated.

When active, you must specify which slot should be surfaced (depending on the number of slots in the storage).

V – ERROR MANAGEMENT

1. Error Display

When the robot detects an error, the robot's alarm is triggered: a buzzer sounds at 1 Hz and the tricolor LED on the control box flashes red at 1 Hz. The screen displays the error message and the associated error code.



Pressing the rotary button stops the buzzer, and the control box returns to the main screen. However, the robot remains in error.

To view the error message again, select the Settings menu at the bottom right of the screen, then select the Error menu at the bottom right of the screen.

2 – Error Categories

A. Hardware Errors

Hardware errors are related to the failure of a physical component of the robot. They often require stopping the machine and a technician intervention.

- **BI:** Errors related to the HMI (Human-Machine Interface)
- **BM:** Errors related to the motors
- **BO:** Errors related to power supply (fuses/battery)
- **BR:** Generic hardware errors (applicable to multiple components)
- **LI:** Errors related to the Lidar
- **PH:** Mechanical failures of effectors (arms, storages, and gripper)

B. Software Errors

Software errors are related to the robot's behavior. They do not require technician intervention.

- **SD**: Errors related to pot placement
- **SG**: Errors related to pot pick-up
- **SC**: Errors related to cone detection and heading management
- **WD**: Generic software errors



Restarting the robot may require a robot calibration. It is important to follow the procedure below to ensure proper calibration:

Procedure:

- 1) Engage the emergency stop.
- 2) Move the robot at least 1 meter away from any obstacle; nothing should obstruct the robot arm's movement.
- 3) The storage must be empty. Remove all pots from the storage so nothing obstructs its rotation.
- 4) Release (pull) the emergency stop button; the robot calibration starts:
 - Slow movements of the arms
 - Gripper movement
 - Slow rotation of the platform
- 5) Calibration is complete.

3 – Liste des erreurs et actions correctives associées

Error code	HMI message	Description	Corrective Action
HMI Errors (Interface)			
BI001	Buzzer failure	The buzzer is continuously sounding.	Call after-sales service (SAV). Maintenance may be required.
BI002	Pot selected not found	The pot selected in the current task does not exist or is no longer in the list of proposed pots.	Select another pot from the available list or configure correctly.
Megamotor Board			
BM001	Odometry communication error	Communication failure with the motor control board.	Restart the robot. If the fault persists, maintenance may be required.
BM002	Odometry wire inverse	Mounting error of the optical sensor.	Maintenance may be required.
BM003	Joint error	Communication failure with the odometry sensor.	Restart the robot. If the fault persists, maintenance may be required.
BM004	Calibration error	Calibration material fault.	Repeat the calibration procedure. If the fault persists, maintenance may be required.
BM005	Optical sensor error	Fault in the optical switch of the actuator.	Maintenance may be required.
BM006	Over current	The motor is overloaded. The motor may be blocked or a material fault occurred.	Check that nothing obstructs the actuator. Repeat the calibration procedure. If the fault persists, maintenance may be required.
BM008	Over temperature	The motor is overheated. The motor may be blocked or a material fault occurred.	Check that nothing obstructs the actuator. Repeat the calibration procedure. If the fault persists, maintenance may be required.
BM009	Joint blocked	The motor is blocked. It stopped for safety reasons.	Check that nothing obstructs the actuator. Restart the calibration procedure.
BM0010	Current Sensor default	The current probe gives a wrong value.	Restart the calibration procedure. If the fault persists, maintenance may be required.
BM0011	faulty odometry	No correspondence between movement and motor command.	Repeat the calibration procedure. If the fault persists, maintenance may be required.
BM0012	Temperature Sensor default	The temperature probe gives an incorrect value.	Call after-sales service (SAV). A remote check (4G) may be necessary. Maintenance intervention may be required.

Error code	HMI Message	Description	Corrective Action
Octopus Board			
BO001	Motors Fuse are damaged	The motor fuse is damaged.	Replace the fuse.
BO002	Emergency stop pressed	The emergency stop button is pressed. For safety reasons, motor power is completely cut.	Check that the robot is safe. Restart the calibration procedure.
BO003	Over current detected	Current consumption exceeded the acceptable limit. The robot has stopped for safety reasons.	Restart the robot. If the fault persists, maintenance is required.
FertiBot Fertilizer			
BF001	Applicator's gate jamming	The FertiBot spreader outlet is blocked.	Clean the applicator carefully, then restart.
BF002	The tank is empty	The FertiBot hopper is empty.	Refill the hopper.
BF003	Applicator's trigger failed	The FertiBot spreader does not respond when the robot requests pot spreading.	Unplug and reconnect the spreader, then restart. If the fault persists, contact after-sales service (SAV).
BF004	Applicator disconnected/ discharged	The robot no longer detects the FertiBot spreader.	Unplug and reconnect the spreader, then restart. If the fault persists, contact after-sales service (SAV).
Arduino Controller			
BR001	Starting communication failed	An electronic component no longer responds.	Restart the robot. If the fault persists, maintenance is required.

Error Code	HMI Message	Description	Corrective Action
GRAB Strategy			
SG001	I am lost	The robot cannot find the pots to be collected or cannot see the pots to pick up.	Check that the pots to be collected are correctly placed according to the production layout and that the distance from the cone line is respected. Ensure that no object obstructs access to the collection point. Place the robot in front of the pots to be collected and activate autonomous mode. If the problem persists, teach a new heading and the collection point before activating autonomous mode again.
SG002	I am locked	The robot cannot access the pots to be collected.	Check that no object obstructs access to the collection point. Place the robot in front of the pots to be collected and activate autonomous mode. If the problem persists, teach a new heading and the collection point before activating autonomous mode again.
SG003	Gripping blocked	The robot cannot pick up a pot.	Check that no object or overturned pot obstructs access to the pots to be collected. Place the robot in front of the pots to be collected and activate autonomous mode. If the problem persists, teach a new heading and the collection point before activating autonomous mode again.
SG004	Gripping impossible	The robot cannot pick up a pot.	Check that no object or overturned pot obstructs access to the pots to be collected. Place the robot in front of the pots to be collected and activate autonomous mode. If the problem persists, teach a new heading and the collection point before activating autonomous mode again.

Error Code	HMI Message	Description	Corrective Action
DELIVER Strategy			
SD001	I am lost	The robot cannot find the drop-off point.	Check that no object or overturned pot obstructs access to the drop-off point. Place the robot in front of the drop-off point and activate autonomous mode. If the problem persists, teach a new heading and the drop-off point before activating autonomous mode again.
SD002	No visible plot	The robot does not perceive the row of pots to be spaced.	Check that the pots are correctly positioned along the production layout and are clearly visible to the robot. Place the robot in front of the drop-off point and activate autonomous mode. If the problem persists, teach a new heading and the drop-off point.
SD003	Drop location not found	The robot cannot perceive the drop-off point or becomes blocked during drop-off.	Check the quality of spacing (respect of spacing between pots, correct alignment of rows). Check the pot layout: ensure that the number of pots in the row and the row type (straight/curved) selected in the interface matches the actual layout. Adjust spacing values if necessary. Place the robot in front of the drop-off point and activate autonomous mode. If the problem persists, teach a new heading and the drop-off point.
SD004	Drop location unreachable	The robot correctly perceives the drop-off point but cannot reach it or becomes blocked during drop-off.	Check that the drop-off location is accessible and that no obstacle (objects, remember points, etc.) prevents the robot from reaching the point. If necessary, empty the robot magazine, remove any pots blocking the robot's path, then start the calibration procedure. Check the pot layout: ensure that the number of pots in the row and the row type (straight/curved) selected in the interface matches the actual layout. Adjust spacing values if necessary. Place the robot in front of the drop-off point and activate autonomous mode. If the problem persists, teach a new heading and the drop-off point.

SD005	Cap error	The robot detects an inconsistency in the orientation of the cone signaling line.	Check that the cone line is correctly positioned along the production bed. Check the quality of the layout (respect of spacing between pots, correct row orientation). Teach a new heading before reactivating autonomous mode.
SD006	Overtured pot	A pot detected during drop-off is empty. The most likely cause is an overturned pot on the row.	Check that no overturned pot is present on the production bed. Activate autonomous mode again.
CAP FOLLOW Strategy			
SC001	I am lost	The robot can no longer identify the cone line.	Check that no object or overturned pot obstructs access to the cone line. Place the robot in front of the cone line and activate autonomous mode. If the problem persists, teach a new heading and the drop-off point before reactivating autonomous mode.
SC003	Learning failure	The robot does not perceive the cone signaling line.	Check that the cones are correctly positioned along the production bed. Ensure that no object obstructs access to the nearest cone. Place the robot in front of the cone line and activate autonomous mode. If the problem persists, teach a new heading before reactivating autonomous mode.
SC004	Heading calculation error	The robot detects an inconsistency in the orientation of the cone signaling line.	Check that the cone line is correctly positioned along the production bed. Check the quality of the layout (respect of distances, row orientation). Teach a new heading before reactivating autonomous mode.

Error Code	HMI Message	Description	Corrective Action
SECURITY STATE MACHINE			
SM001	Security perimeter	An obstacle is in perimeter near the robot	Move the robot backward until no obstacle are in its private perimeter before launching again the autonomous mode.
SM002	LIDAR sensor blocked	An object (grass, root, clod) is obstructing the lidar sensor.	Check and clean the lidar. Launch autonomous mode again and check if the robot is able to go forward.
SM003	maximum backward movement	The robot has gone backward to much. It can be due to something obstructing the lidar	Check and clean the lidar. Launch autonomous mode again and check if the robot is able to go forward.
POTS HANDLE Strategy			
PH001	Arm shaft is twisted	A bent of the arm is detected.	Reboot the robot. If the error remain, a maintenance may be mandatory.
PH002	Calibration error	A problem with the calibration of the motors has been detected	Push the emergency stop. Empty the magasin. Pull the emergency stop. The robot should retry a new calibration.
WATCHDOG			
WD001	XXX not responding	Software component XXX is not responding anymore.	Reboot the robot
WD002	Oscillation error detected	A software element is in failure or indetermined state	Reboot the robot
SCAN LIDAR			
LI001	LIDAR on error	The Lidar is not responding	Reboot the robot. If the error remain, a maintenance may be mandatory.
OK STATE			
OK000	No error	No error	You can use the robot
OK001	Low Battery, please charge now	The charge of the battery is low.	The robot can work for 15-20min before shutdown. Charge the robot.
OK002	Task completed	The robot has finished its task	Put more pots on the floor and switch to autonomous mode again. Or put the robot on an other bed / task.

VI – SAFETY INSTRUCTIONS

1. General Information



It is essential to strictly adhere to the regulations for the prevention of workplace accidents when using the machine.

Carefully read the entire user manual before the first use of the device. Keep this manual safe for future reference.

The safety measures outlined below are necessary to ensure your safety, though this list is not exhaustive. Use the machine and its accessories only under normal conditions and for the specific purposes described in this manual.

INSTAR Robotics cannot be held responsible for accidents affecting people or property when the machine is used outside of its normal operating parameters or if the safety instructions listed below are not followed.

The term "user" refers to:

- The operator responsible for deploying, using, and monitoring the robot during its task,
- The person in charge of the machine's maintenance or servicing,
- People working with and/or near the machine,
- The person using the TrooperUI application or any other software available for the preparation, implementation, maintenance, or monitoring of the machine or its task,
- and, more broadly, anyone involved in any way with the machine or its accessories (hands, magazines, charger, battery, keys, posts, storage area, etc.).

Only operators who have been trained in the use of the machine and are aware of the risks and safety instructions are authorized to use it, in accordance with their technical expertise.

Do not use the robot if you are tired, unwell, experiencing physical or mental issues, or under the influence of substances with risk factors (medication, alcohol, drugs).

Even when the machine is used correctly, residual risks may still be present.

The use of the robot is strictly limited to transporting horticultural containers.

The robot may only pick up and transport pots associated with the hand/magazine pair and authorized by INSTAR Robotics at the time of the robot's order. **ANY OTHER CONTAINER IS PROHIBITED.**

2. Dangers and Precautions for Use

a. Gripper



Crushing Risk:

The robot's arms are made of multiple mobile and articulated parts, which can pose a risk of crushing, pinching, or twisting a limb (finger, hand) if there is close contact during their movement.

Never handle the gripper components when the robot is in operation.

Always perform tool changes (hands), maintenance, or servicing when the robot is turned off or the emergency stop button is engaged.



Yellow ISO 7010 labels are placed at the base of the arms to indicate a particularly high hand-crushing hazard in that area.

Never place a limb in the area near these labels when the machine is powered on and the emergency stop is not activated.



Impact Risk:

The robot's arms are mobile and relatively fast in their movements. They can cause impact injuries to a limb (foot, shin) if there is close contact. An impact with the arm may result in mild injuries (bruises).



Negligence in Assembly:

Parts mounted on the gripper, especially the hands attached to the robot's arms, are mobile and subjected to forces when handling pots. If the hands are not properly assembled or if there is negligence during maintenance, the assembly may loosen or develop excessive play, which could impair or prevent the proper functioning of the robot.

b. Mobile Base



Crushing Risk, Impact Risk:

The Trooper robot, when in motion, may collide with material objects or people, posing a risk of crushing or impact, particularly when reversing or rotating in place. This risk is especially significant if the object or person is within a blind spot of the perception system. **The machine should not be approached within one meter when operating autonomously, i.e., when the LED on the interface box is flashing amber.**



Negligence in Cleaning the LIDAR Sensor:

The visor of the LIDAR sensor may become covered with dust, dirt falling from pots, or mud. If the condition of the visor is not checked and maintained clean enough, perceptual issues may prevent the robot from moving forward or force it to reverse in order to perform a bypass maneuver. Always check the cleanliness of the LIDAR sensor visor before starting the machine. Perform weekly maintenance on it.



Negligence in Assembly:

The motors of the wheels and the motor driving the rotary magazine are mounted on brackets. These parts drive mobile components, all subjected to high torque during acceleration and deceleration of the mobile base.

If there is negligence during maintenance, the coupler assembly or the motor fixing screws may loosen or not be tightened properly, leading to a malfunction of the machine.



Antenna Maintenance:

The machine is equipped with WiFi/Bluetooth/4G antennas on each of its sides. If these antennas are damaged due to negligence or an impact, communication with the control unit may no longer function correctly. Regularly check the condition of the antennas



Wheel Maintenance:

The condition of the tires on the drive wheels and the freewheel must be checked regularly and before each startup of the machine. In the case of a puncture, or if the wear is significant, the tire must be replaced. The pressure of each tire should be maintained according to the value specified on it. Special attention should be paid to underinflation. If there is dried mud or accumulated dead leaves on the tire, it should be cleaned with a water jet.



Risk of Electric Shock or Fire:

Due to user negligence, bringing a metallic object (screwdriver, wrench, clamp, etc.) close to the battery terminals can cause a short circuit. The battery is equipped with an anti-short circuit module, but this may malfunction or fail to activate quickly enough. **When handling a battery, remain particularly cautious, and do not bring conductive items near the terminals. Also, always charge the robot after powering it off to prevent battery damage from deep discharge.**



Fuse Replacement:

The robot is supplied with two fuse holders, each containing fuses designed to protect the robot from voltage surges or short circuits at the input, as well as from potential overcurrent caused by the effectors. During maintenance, the user may need to replace a fuse. An inappropriate fuse may not provide adequate protection, leading to internal component damage or even a fire. **Always replace a damaged fuse with a new 24V-20A fuse supplied by the manufacturer.**



Incorrect Use of the Charger:

The robot comes with an external charger that connects to a charging port located at the rear of the chassis. The charging port is designed for a 24V power supply. An incompatible charger could damage the machine.

Never connect a power source other than the charger provided by the manufacturer with the machine.



Electrical Wiring Maintenance:

During maintenance, particular care must be taken with the internal electrical wiring. Wiring inversion, exposed wires, or improper crimping or securing of terminal blocks can cause malfunctioning of the machine.



Electromagnetic Interference:

In the case of strong electromagnetic interference, the robot's electrical system may malfunction, leading to erratic or dangerous control of the effectors. Never bring the robot near an electromagnetic emission source (high-voltage power line, transmission antenna, high-power machine, etc.).

c. Magasin



Pinching of a Limb During Magazine Rotation:

If not cautious, it is possible to pinch a finger, hand, or arm between the magazine and the guard, which could result in a mild pinch or bruise during rotation. Similarly, a pot may fall from the height of the magazine onto a limb on the ground (feet). **Never approach the magazine when the robot is operating autonomously, i.e., when the LED on the interface box is flashing amber. Move away your hands during calibration.**

**Payload:**

The magazine plate is made of HDPE500 plastic, a heat-resistant but relatively flexible material. The magazine is reinforced with a stainless steel tube structure, crimped onto the plate, to enhance its bending resistance. A weight exceeding the specifications (pot weighing more than 8kg) can cause the magazine to break or undergo permanent deformation. Never overload the robot with a weight exceeding 8kg per slot of the magazine, nor with a total load exceeding 30kg.

**Inappropriate Magasin:**

Due to negligence, the user may mount a magazine that is not suited for the type of pots programmed for the current task. The diameter and number of slots may not match the pot the robot is supposed to pick up. Slots that are too wide may cause pots to fall. Slots that are too narrow and/or an unsuitable number of slots may cause a blockage during lifting, triggering an error state in the robot. Always ensure that the magazine plate corresponds to the selected pot reference when configuring the task.

d. Cover**Battery Hatch Locking:**

If the battery hatch is not properly closed due to negligence, it will no longer ensure a complete seal.

Always check that the two locking latches of the battery hatch are properly secured after opening.

**Opening of the Cover or Interface Box:**

If there is moisture in the air during the assembly of the interface box, or if the seals of the IHM (Human-Machine Interface) box have aged, moisture may accumulate inside the chassis or fog may appear on the interface screen. The presence of moisture can promote mold growth or abnormal electrical or mechanical wear. **During maintenance, always open the cover or interface box in a dry environment and protected from water droplets. Check the condition of the sealing gaskets before closing the device.**

**GNSS Antenna Maintenance:**

The machine may have Dual GNSS antennas located at the rear, on top of the cover. If these antennas are damaged due to negligence or impact, satellite communication may no longer function properly, degrading the robot's orientation capabilities and accuracy.

Regularly check the condition of these antennas, if the machine is equipped with them.

e. Accessories



Charger Maintenance:

The robot is supplied with an external charger. The output connector of this charger is equipped with a protective cap that the user must always replace after each battery charge.

Forgetting to replace the cap can lead to contamination of the connector, which is exposed to the surrounding environment. Over time, this can prevent the connector from properly transferring energy.



Joystick Maintenance:

The robot is supplied with a control unit, which is a low-voltage electrical device that is **not waterproof**. The control unit must be stored in a suitable, dry place to prevent damage. Additionally, it should be charged after each use to ensure it has enough charge for future operation.



Remote Control of the Robot:

The user can manually control the robot using the control unit.

When controlling the robot manually, it is the user's responsibility to drive the robot safely, taking care with maneuvers and being vigilant and aware of both static and moving obstacles in the robot's immediate environment.



Maintenance of the Signal Cones:

The robot is supplied with a set of signal cones to delineate its working area. Unused cones must be stored properly to avoid damage, and their condition should be checked before installation.

f. Forbidden Uses

It is prohibited for anyone to mount the robot or load it with anything other than an authorized horticultural container or a load exceeding 30kg.



- **It is forbidden to tow the robot in any way.**
- **It is forbidden to push the robot when the software disengage has not been activated in the interface menu (see switching to manual mode).**

When the robot is on and in “disengaged” mode, energy generated by the dynamo effect of the motors when the robot is pushed is redirected to the battery to recharge it.

When the robot is turned off, or in emergency stop mode, the motors are no longer connected to the battery, and thus the energy generated cannot be properly dissipated.

Important risk of damaging the motor control board.

g. General Operating Conditions

- The production board must be clean before use, minimally damaged, and free of obstacles that could obstruct the robot (e.g., irrigation systems, tunnel legs).
- The holes present should not exceed a depth of 3cm and a diameter of 5cm.
- If there is a ditch or fragile equipment at the end of the board, it must be protected by placing a cone along the width of the board and **activating the "end cones" stop option (p30)**.
- The ground must be flat and not have a slope greater than 5°.
- **Do not turn off the robot or let it discharge while on a slope:** when the robot is turned off, the motors are no longer powered, and it will then be in freewheel mode.
- If the robot must work on a slope:
 - **Configure SMS alerts for battery level (at least 10%) and stop the robot when the alert is triggered.**
 - Never leave the robot unattended.

VII – MAINTENANCE

A. Robot

- The robot can be cleaned with a low-pressure water jet (<12.5 L/min).
- The LIDAR sensor must be kept clean regularly. It can be cleaned with water and should be wiped with a non-abrasive cloth.
- To ensure the robot's waterproofing and proper functioning, the protective cap of the charging connector must be replaced after each charge and before each use.

B. Charger

- To ensure the charger's waterproofing and proper functioning, the protective cap of the charging connector must be replaced after each use.

C. Joystick

- We recommend to charge the wireless controller every evening using a standard micro-USB charger.
- **The wireless controller is not waterproof.**

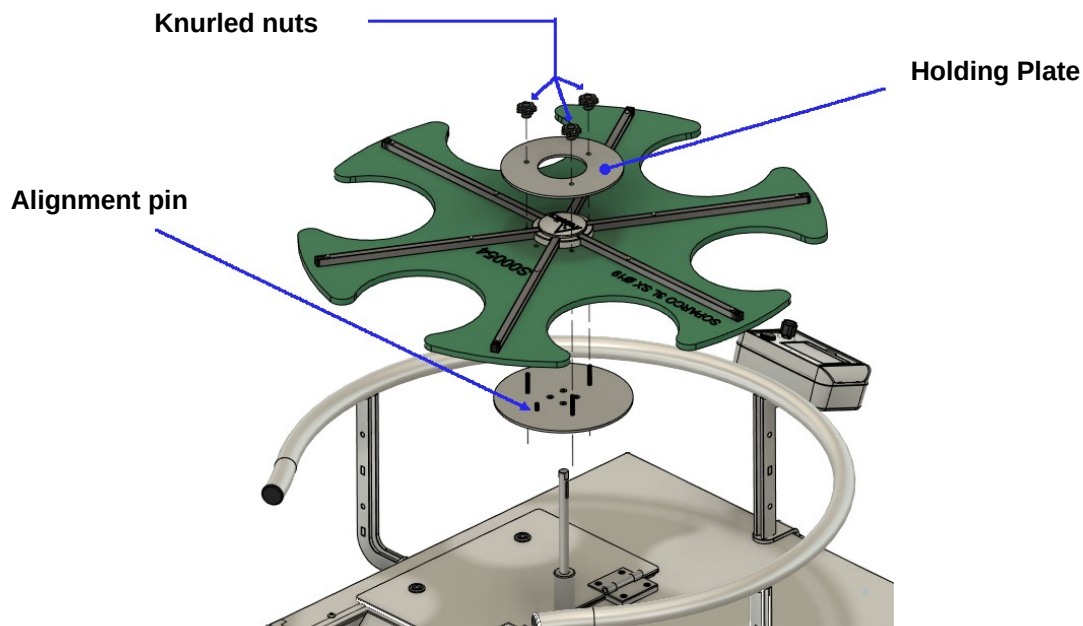
D. Hands

- **Do not tighten the hand fasteners too much.**
- Always use the provided tools to handle the nuts.
- Be careful, the hands have a specific mounting orientation:
 - Always mount the hands inside the arms / Never on the outside.
 - The "thumbs" (the part of the hand that curves the most inward) must always face the back.

E. Magazines

Magazine Change Procedure:

- 1) Unscrew the 3 knurled nuts.
- 2) Remove the retaining plate.
- 3) Remove the magazine.
- 4) Place the new magazine, ensuring that the positioning dowel is properly aligned (see diagram below). If not properly aligned, the magazine will be too high and poorly secured.
- 5) Reattach the retaining plate.
- 6) Screw the 3 knurled nuts back in.



VIII – TRANSPORT

- Always ensure that the robot is securely fastened using appropriate straps during transport.
- Open the battery hatch and remove the battery from the robot during transport.

IX – STORAGE

A. Daily Maintenance

Store the robot in a covered shelter, protected from the weather, and away from machinery or construction equipment that could collide with it.

B. Long-Term Storage

When the robot is not in use for an extended period (more than 1 month), it is strongly recommended to disconnect the robot's battery.

To do so:

- Open the battery hatch using the provided square key.
- Disconnect the battery connector from the robot's connector.
- Properly close the battery hatch to ensure its seal.

Store the robot in a covered shelter, protected from the weather, and away from machinery or construction equipment that could collide with it.

After-sales service :

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Informations, photos et videos :

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