Co-funded by the European Union

AgroDigiRise 2.0

Deliverable D 2.4
Training manual:
“Working with AI Robots on Farms”

Project acronym / title	AgroDigiRise 2.0
Grant Agreement No.	101256746
Call / topic	DIGITAL-2025-EDIH-EU-EEA-08 (Digital Europe Programme)
Deliverable	**Deliverable D 2.4 Training manual: “Working with AI Robots on Farms”**
Work Package	WP2 - Test before invest services, supporting digital transformation, with a focus on precision agriculture (TBI)
Lead beneficiary	7 - Initium eng
Type / Dissemination level	DEC —Websites, patent filings, videos, etc
Due date	Month 9
Language / format	EN / PDF
Granting authority	European Commission-EU

Prepared by

INITIUM ENGINEERING

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Document control

Version	Date	Author / editor	Summary of changes
1.0	[submission date]	Initium eng	First complete version: AGROMNI training content (Sections 1–6, Annexes A–D), figures from the operator interface and training videos.
—	planned M8	Initium eng	Scheduled date 24.11.2026 - Demonstration of AIbased robot AGROMNI and Pilots with Farmers (Year 1).

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Agro Hub

Co-funded by the European Union

Table of contents

About this manual **5**

1. Purpose and main tasks of the AGROMNI robot **6**

1.1 What AGROMNI is 6

1.2 Why autonomous robots on farms 6

1.3 Main tasks by type of farm 7

1.4 What AGROMNI does not do 8

1.5 The role of the operator 8

2. Technical overview **9**

2.1 System architecture 9

2.2 Chassis and running gear 9

2.3 Drive and propulsion 10

2.4 Sensors and cameras 11

2.5 Power supply 12

2.6 Operating conditions 13

3. Autonomous capabilities **14**

3.1 Localisation – where am I? 14

3.2 Mapping – building the map of the farm 15

3.3 Route planning 17

3.4 Obstacle detection and avoidance 18

4. Control and interface **20**

4.1 The operator station 20

4.2 Interface layout 20

4.3 Operating modes 21

4.4 Manual and remote control (Drive) 21

4.5 Navigation set-up (Navigate) 22

4.6 Tasks and missions 22

4.7 Monitoring during operation 23

5. Practical demonstration **24**

5.1 Organisation of the demonstration 24

5.2 Exercise 1 – Start-up and initial checks 24

5.3 Exercise 2 – Manual control 24

5.4 Exercise 3 – Localisation and autonomous go-to-point 25

5.5 Exercise 4 – Running a route (Waylist task) 25

5.6 Exercise 5 – Obstacle reaction and stopping 26

5.7 Exercise 6 – Shut-down 26

5.8 Assessment of trainees 26

6. Safety and operation **28**

6.1 Safety concept 28

6.2 Emergency stop 28

6.3 Pre-operation checks 29

6.4 Basic safety rules 29

6.5 What the sensors cannot see 30

6.6 Charging the battery 31

6.7 End of work and maintenance 31

6.8 In case of an incident 32

Annex A – Quick operator checklist **33**

Annex B – Troubleshooting **33**

Annex C – Glossary **33**

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Annex D – Training videos 34

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

About this manual

This training manual supports Deliverable D2.4 of the AgroDigiRise 2.0 project and the “test before invest” pilots with farmers. It introduces AGROMNI, the autonomous agricultural ground robot developed by Initium Engineering, and explains how to prepare, operate and supervise it safely in a farm environment.

The manual is written for farmers, farm workers, agronomists and technical staff who take part in the practical demonstrations of AGROMNI, including the demonstration and pilots with farmers scheduled for **24 November 2026**. No programming knowledge is required. The robot is operated through a graphical interface, and the manual follows the same order in which an operator works with it.

Table 1. Structure of the manual

Section	What you will learn
1. Purpose and main tasks	What AGROMNI is, which farm problems it addresses and which tasks it can and cannot take over.
2. Technical overview	Architecture, chassis and running gear, drive system, sensors and cameras, power supply and key figures.
3. Autonomous capabilities	How the robot localises itself, builds maps, plans routes and detects and avoids obstacles.
4. Control and interface	The operator station, the menus of the interface, operating modes, manual/remote control and monitoring.
5. Practical demonstration	Step-by-step exercises: start-up, manual driving, autonomous go-to-point and route execution, shut-down.
6. Safety and operation	Emergency stop, pre-operation checks, rules for everyone in the working area, charging and maintenance.
Annexes A–D	Quick operator checklist, troubleshooting table, glossary and the list of training videos.

Sources. The content is based on the AGROMNI Operator Manual (v1, November 2026), the AGROMNI technical presentation, the farmer presentation and one-page flyer (September 2026), and the five AGROMNI training videos recorded for this deliverable (Annex D). Interface screenshots come from the real AGROMNI interface.

> **Prototype and series specification**
> The robot used in the AgroDigiRise demonstrations is a pre-series prototype with a flat cargo platform. Some figures in Section 2 describe the design specification of the series machine (for example the tipping body, payload rating and certified safety functions). Where the demonstration unit differs, the configuration of the specific machine and the instructions of the Initium Engineering trainer prevail.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

1. Purpose and main tasks of the AGROMNI robot

1.1 What AGROMNI is

AGROMNI is an **unmanned ground vehicle (UGV)**: a self-propelled machine with no driver on board. More precisely, it belongs to the class of **autonomous mobile robots (AMR)**. Unlike an automated guided vehicle (AGV), which follows rails, magnetic tape or painted lines, an AMR moves on a digital map that it has built itself, plans its own route and recalculates it when an obstacle appears.

Four features summarise the concept:

- **No person on board.** There is no cab, seat or place for a passenger. The robot carries loads, never people.
- **It finds its own way.** It navigates on a map using LiDAR and satellite positioning (GNSS with RTK corrections) and drives around obstacles in real time.
- **It stops by itself in front of a person.** Laser scanners monitor a protective field around the machine and trigger a stop before contact, not after it.
- **It works by task, not by command.** The operator defines a task such as “collect at point A, unload at point B”; the robot repeats the cycle while battery charge allows.



Figure 1. *The AGROMNI demonstration prototype with its operator*



Figure 2. *AGROMNI in a vineyard application*

1.2 Why autonomous robots on farms

Agriculture faces labour shortages, rising production costs and pressure to use resources more efficiently. A large share of farm working time goes into repetitive internal transport: short trips between the field, the yard, the barn and the store. This work is expensive but often invisible in the accounts, because it is spread across people who are formally doing something else.

Table 2. Typical farm challenges and the AGROMNI response

Challenge on the farm	How AGROMNI responds
Seasonal workers are harder to find and more expensive	Takes over the carrying and hauling, so people can do skilled work such as picking, pruning or animal care.
Skilled labour spent on simple trips (e.g. 300 m with a tractor)	Performs repetitive point-to-point transport without a driver.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Challenge on the farm	How AGROMNI responds
Logistics, not picking, sets the pace during harvest peaks	Can work a second shift and at night; LiDAR navigation does not depend on daylight.
Heavy machinery used for light loads, compacting the soil	Eight wheels and low ground pressure (≈150 kPa at full load in the series specification).
Monotonous and risky night trips, narrow rows, busy yards	Person detection with laser scanners, speed limits and keep-out zones.
No data on how many trips, tonnes and hours	Records time, distance and task status for every mission.

1.3 Main tasks by type of farm

AGROMNI is designed for **repetitive transport between fixed points** inside the farm. It does not replace the tractor; it takes over the short, repeated hauling that today consumes hours of people and machinery.

Table 3. Applications of AGROMNI by farm type

Farm type	Typical AGROMNI tasks
Orchards and vineyards	• Hauling crates of fruit from the row to the collection point and returning empty crates • Carrying posts, wire, fertilisers and plant-protection products into the plantation • Removing pruned wood and branches to the shredding area • Passing 1.7 m inter-rows at reduced speed; turning on the spot at the end of the row
Greenhouses and nurseries	• Moving produce from the compartments to the grading area • Delivering substrate, pots, trays and seedlings • Taking plant waste to the composting area • One route can start indoors and continue outdoors without operator intervention
Livestock farms	• Feed from the silage pit or store to the barn • Manure and bedding to the manure yard (automatic tipping in the series version) • Straw, sawdust and consumables between buildings
Arable farms, yards and stores	• Grain, seed and bagged fertiliser between the intake point, silos and store • Shuttle runs between store, workshop and offices • Palletised goods with the pallet-fork module

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.



Figure 3. *AGROMNI carrying crates of tomatoes in a greenhouse*

The same chassis, autonomy software and safety system can carry different work modules: tipping body, flat platform, roller conveyor, pallet forks, tank/sprayer and a carrier for a robotic arm. A new application therefore means a new module, not a new robot or new training. In the longer term the platform is intended to support monitoring and precision-farming tasks as well, and the data it collects make the robot a source of information about the farm, not only a performer of physical work.

1.4 What AGROMNI does not do

Knowing the limits is part of safe use. AGROMNI:

- does **not** carry people and has no place for an operator on board;
- is **not** approved for driving on public roads; all routes must stay within the farm;
- does **not** work in deep mud, loose sand deeper than 100 mm, on ice without studs, or in explosive (ATEX) atmospheres;
- does **not** reliably detect fully transparent glass or mirror-like surfaces; physical barriers are needed there;
- does **not** lift loads over people;
- pays off only where transport is regular: if internal transport is irregular, different every time and less than one to two hours per day, the robot has little to optimise.

1.5 The role of the operator

Autonomy does not remove human responsibility. The operator prepares the working area, checks the robot, loads the map and the route, starts the task and **supervises the execution**, ready to stop the robot at any time. At the beginning of every new deployment the robot works in **supervised autonomous mode**: it moves by itself, but a trained person watches it on site or through the interface. One trained operator can supervise several machines once the process is stable.

> **Key message for trainees**
> True autonomy does not simply mean a machine that moves on its own, but a system that carries out useful work with minimal human intervention while people stay in control.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

2. Technical overview

2.1 System architecture

AGROMNI combines a robust mechanical platform with electric propulsion, a multi-layer sensor system and an on-board computer running the control software (AGRO OS). The software turns the mechanical platform into an intelligent machine that can orient itself, plan its movements and carry out tasks. Hardware and software must work in perfect synchronisation to ensure stable, precise and safe behaviour in a changing agricultural environment.

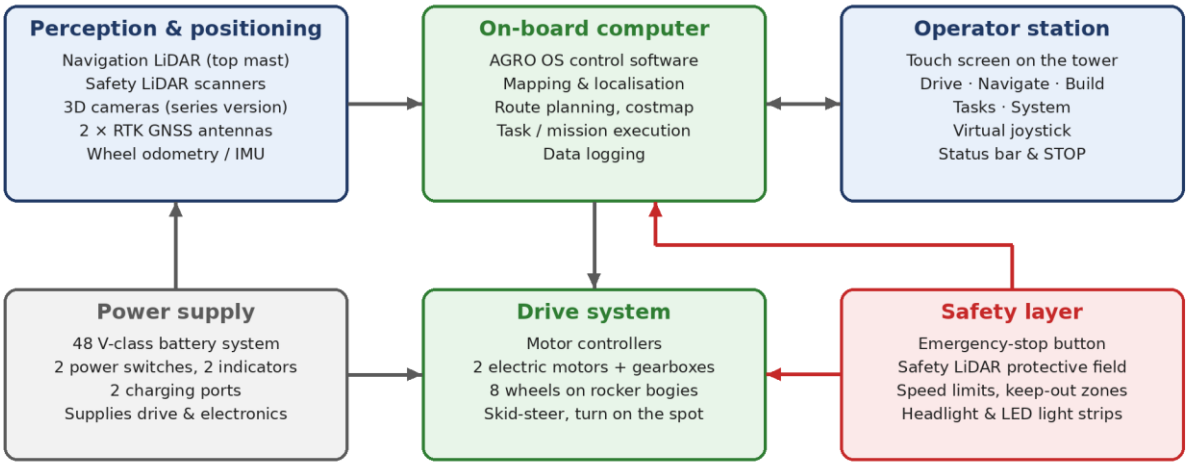


Figure 4. *Simplified functional architecture of AGROMNI*

Table 4. Main subsystems of AGROMNI

Subsystem	Function
Perception and positioning	LiDAR scanners, cameras, RTK GNSS antennas and wheel odometry collect information about the robot's position, the terrain and the objects around it.
On-board computer	Processes sensor data, builds and uses maps, localises the robot, plans routes, executes tasks and controls each subsystem. Open interfaces include ROS 2 and REST.
Operator station	Touch screen on the robot's tower with the graphical interface (Drive, Navigate, Build, Tasks, System).
Drive system	Motor controllers, electric motors and gearboxes driving eight wheels on rocking bogies.
Power supply	Battery system supplying the drive and the electronics; switches, charge indicators and charging ports.
Safety layer	Emergency-stop button, safety scanners with protective fields, speed limitation, keep-out zones and light signals.

2.2 Chassis and running gear

The chassis is a welded steel frame with a low, flat cargo platform and a tower at the rear that carries the operator screen, the emergency-stop button, the navigation LiDAR and the GNSS antennas. The machine stands on **eight wheels mounted on rocking bogies** (±15° in the series design), so all wheels stay on the

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

ground on uneven terrain. This gives traction close to a tracked vehicle without ploughing the soil and with lower rolling resistance.

- **Steering:** skid-steer; the robot can turn on the spot (zero radius), so no headland or turning area is needed at the end of a row.
- **Ground pressure:** ≈150 kPa at full load (≈120 kPa with optional wide tyres), noticeably lower than a tractor with trailer.
- **Gradeability (series spec, loaded):** 15% (8.5°) continuous, 25% (14°) for up to 2 minutes; side slope up to 12°, monitored by an inclinometer.
- **Obstacles:** step up to 180 mm, ditch or gap up to 350 mm, wading depth 300 mm.
- **Surfaces:** asphalt, concrete, paving, compacted gravel, compacted soil, grass, light mud and snow up to 150 mm.

> **Traction on wet ground**
> On wet grass or loose gravel all gradeability values drop by about one third. This is the physics of grip, not a limit of the motor.

2.3 Drive and propulsion

AGROMNI is fully electric. On the demonstration prototype the drive consists of **two electric motors with two gearboxes**, one for each side, controlled by motor controllers that allow precise control of speed and torque. The electric drive offers low noise (≈70 dB(A) at 1 m in the series specification), high efficiency and no exhaust emissions, diesel or hydraulic oil.

Table 5. Key drive and dimension figures

Parameter	Value (series specification)
Driven wheels	8 of 8 (8×8)
Maximum speed, autonomous with load	4.5 km/h
Maximum speed, remote control	9 km/h (2.5 m/s)
Rotation on the spot	up to 45°/s with load (30°/s in shared zones)
Braking distance from full speed, loaded	0.6 m
Brakes	regenerative + spring-applied; hold the machine on a 20% slope
Positioning accuracy	±20 mm (±10 mm and ±0.5° at a docking station with markers)
Payload / own weight	1,500 kg / 600 kg
Dimensions (L × W × H with sensor mast)	2,000 × 1,400 × 1,450 mm
Turning circle on the spot	2,420 mm diameter
Corridor needed at full / reduced speed	2,300 mm / 1,700 mm
Design life	8,000 operating hours or 5 years

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

In Drive mode the interface also offers the service commands **Re-init motors** and **Calibrate wheels** (see Section 4). These are used only by authorised personnel when the procedure for the specific machine requires it.

2.4 Sensors and cameras

Several independent sensor layers overlap, so the failure of one sensor does not remove obstacle detection in the direction of travel. On the demonstration prototype the following sensors can be seen (see the robot walk-through video):

- **Navigation LiDAR on top of the tower** – used to map the area in which the robot will navigate and, afterwards, to localise the robot on that map.
- **Safety LiDAR scanners** at the level of the platform, including one at the front – they detect when an obstacle is too close, causing the robot to stop or switch to emergency mode, and are also used to detect obstacles and navigate around them.
- **Two RTK GNSS antennas** on the arms of the tower – used for GPS-based localisation and for determining heading.
- **Front headlight** – illuminates the terrain the robot is about to travel through.



Figure 5. *Navigation LiDAR on top of the tower*



Figure 6. *One of the two RTK GNSS antennas*

The series specification extends this set as follows:

Table 6. Sensor set of the series AGROMNI

Sensor	Qty	Purpose and key data
Safety laser scanners	2	360° coverage; protective field up to 5.5 m, warning field up to 40 m; certified PL d / SIL 2.
Navigation LiDAR	1	32 channels, 360° × 40°, range 120 m; builds and reads the map.
3D cameras	4	Front, rear and both sides; recognise people, pallets, the load and the unloading area; detect ditches and kerbs from 2.5 m.
Radar 77 GHz	2	Front and rear; works where optics fail – dust, fog, rain, snow.
Ultrasonic sensors	8	Ring around the machine, 0.2–3.0 m; low obstacles and reversing.
RTK GNSS antennas	2	GPS / GLONASS / Galileo / BeiDou; 1–2 cm accuracy with corrections; heading ±0.2°.
Inclinometer, wheel odometry	–	Longitudinal and lateral tilt monitoring; movement estimation between position fixes.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Sensor	Qty	Purpose and key data
Contact bumpers	2	Front and rear; immediate category-0 stop on contact.

2.5 Power supply

AGROMNI is powered by a rechargeable battery that supplies both the drive and all electronic systems. On the prototype, the power panel is under the platform at the rear. It contains:

- **two switches** used to switch the robot on and off;
- **two indicators** showing the battery voltage and remaining charge;
- **two charging ports** used to charge the robot.



Figure 7. *Power panel: switches and charge indicators*



Figure 8. *Platform edge with LED strip and power panel below*

Table 7. Battery and charging

Parameter	Value (series specification)
Battery chemistry	LiFePO4 (thermally more stable than ordinary Li-ion), placed low between the bogies
Voltage / capacity	51.2 V (48 V system), 200 Ah; 10.24 kWh installed, 9.2 kWh usable
Battery management	Built-in BMS: cell balancing; protection against over-current, overheating and short circuit
Working time	6–8 h in mixed operation, up to 10 h in light operation; ≈25 km on flat hard ground
Energy consumption	≈1.4 kWh per operating hour; ≈0.40 kWh per km at full load
Charging	On-board 3.0 kW charger, 230 V/16 A: 0–100% in ≈3.7 h; optional 6.6 kW fast charger ≈1.8 h; optional automatic docking station
Battery life	at least 3,500 cycles to 80% capacity; replacement on site in under 30 min
Cold climate	operation −20…+45 °C; below −10 °C and charging below 0 °C only with optional heater

The software reports the state of charge and refuses a mission if the predicted energy is not sufficient to return. The charging procedure and its safety rules are given in Section 6.6.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

2.6 Operating conditions

Table 8. Environmental operating limits

Condition	Limit (series specification)
Temperature	−20…+45 °C
Ingress protection	IP 54 chassis and electronics; IP 67 drive, motors and battery
Rain / snow	continuous operation in rain up to 10 mm/h; works during snowfall
Wind	up to 15 m/s in operation (unloading up to 10 m/s)
Light	full darkness – navigation is LiDAR-based
Humidity	5–95% relative humidity, non-condensing
Cleaning	low-pressure washing only: max. 40 bar from 0.5 m, 25° nozzle; no steam cleaning

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

3. Autonomous capabilities

To work autonomously, an agricultural robot must solve three key problems: **knowing where it is**, **perceiving its surroundings** and **planning its motion**. AGROMNI integrates these technologies into a single system. For the operator, the workflow always follows the same chain:

Table 9. The autonomous workflow

1. Map	2. Localisation	3. Route	4. Task
Create or load a map of the working area (Build → Maps)	The robot determines its position and orientation on the map (Navigate → Setup)	Define waypoints and lanes, or select a target point (Build → Waylist)	Start, monitor and stop the job (Tasks)

3.1 Localisation – where am I?

AGROMNI can determine its position in two ways, which can also be combined:

- **Mapping followed by localisation (LiDAR).** The robot first maps the area with its navigation LiDAR and then recognises its position by matching the current scan against the map (LiDAR SLAM). This works indoors, under dense canopy and in complete darkness.
- **Direct localisation using the antennas (RTK GNSS).** Satellite positioning with RTK corrections allows accuracy within a few centimetres under suitable conditions. Two antennas also give the heading of the robot.

In combined operation the localisation fuses **LiDAR SLAM, RTK GNSS and wheel odometry**. The robot can therefore leave a barn and continue onto an open field without interruption and without operator intervention.

The quality of satellite positioning is shown in **System → GNSS**: fix type (e.g. RTK FIX), number of satellites, HDOP, estimated accuracy, heading and corrections. In the example below the receiver reports an RTK fixed solution with 25 satellites and ±1.7 cm accuracy.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.



Figure 9. *System → GNSS panel with RTK fixed solution, power functions and Library*

Check the GNSS status before outdoor work
If the status is not RTK fixed, do not assume centimetre accuracy. Under dense foliage or next to tall buildings the GNSS signal weakens; localisation then relies on LiDAR, and without corrections GNSS accuracy falls to 1–2 m.

3.2 Mapping – building the map of the farm

The map is the foundation of autonomous work. The **Build → Maps** menu offers two ways to create it:

- **Mapping by driving.** Press **Start mapping**, drive the robot manually through the planned safe area (indoors and outdoors) and finish with **Stop mapping**. The software builds the map automatically (up to 500,000 m² in the series specification). Save it with a name.
- **Satellite map.** Create a **New satellite map**: enter a name and the size of the map in metres, choose the centre relative to the robot (Robot GNSS) or the satellite view, and press **Create**.

An existing map is opened with **Edit a saved map → Open editor**.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.



Figure 10. *Build → Maps: mapping and creating a satellite map*

Editing the map

The **Map editor** shows the satellite image with the map boundaries. With the **Brush** and **Picker** tools the operator marks areas as **Occupied**, **Free** or **Unknown**. A **Keep-out zone** adds an area the robot must never enter. The map can be rotated (**Rotation → Apply**) and saved under a new name (**Save as**).

1. Load the map into the editor.
2. Mark impassable objects and permanent obstacles as **Occupied**; use **Free** only for verified passable areas.
3. Add **Keep-out zones** for prohibited areas – for example irrigation hoses on the ground, areas with free-moving animals, glass walls.
4. If necessary, correct the orientation with **Rotation → Apply**.
5. Check the markings and save the edited version with **Save as**.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

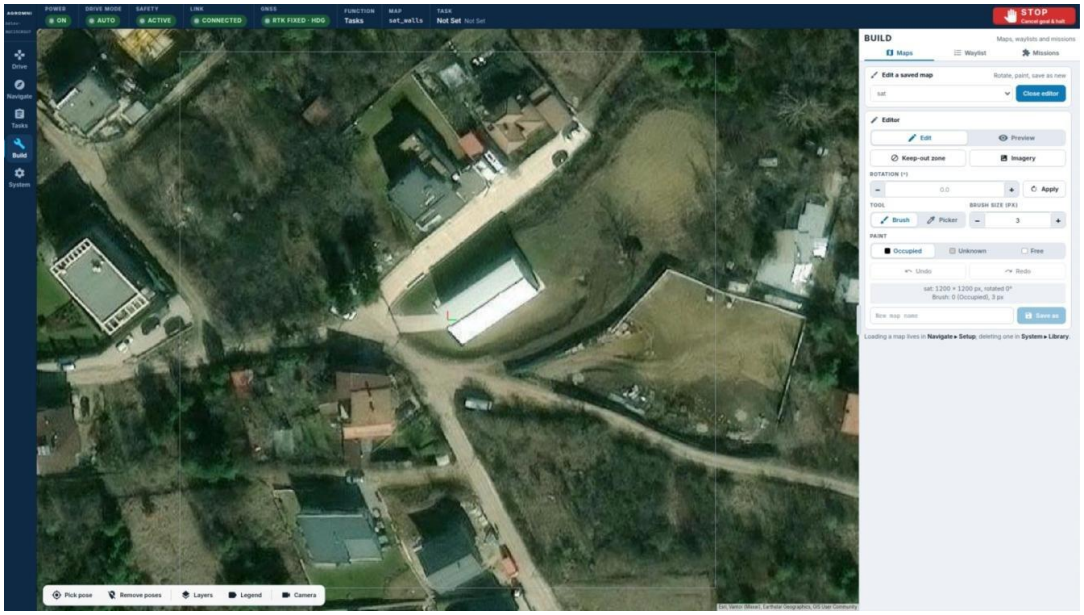


Figure 11. *Satellite map editor*

Walls and barriers drawn on the map are taken into account by the planner even when the sensors cannot see them. In the example below the map “sat_walls” has manually drawn walls (pink lines).



Figure 12. *Map “sat_walls” with manually drawn barriers*

3.3 Route planning

The software calculates a suitable path to the specified destination, taking into account the characteristics of the machine, the constraints of the map and any obstacles present. In the series specification the planner also considers slope, roughness and surface type, recalculates traversability 20 times per second and never plans a route through terrain outside the machine’s capabilities. Two ways of giving the robot a destination are available:

- **Go to a point.** In Navigate, select a point on the map and instruct the robot to go there. The robot calculates the route, moves fully autonomously, drives around obstacles and, on arrival, stops and notifies the operator that the position has been reached.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

- **Waylist (route).** A list of waypoints created in **Build → Waylist**, executed as a task. Used for repeated work such as hauling crates along the same path many times a day.

Creating a Waylist

The Waylist editor provides the tools **Select**, **Waypoint** and **Lane**, and the sections **Checks**, **Run order**, **Loops** and **Interval (s)**.

1. Open **Build → Waylist** and create a new list with **New**.
2. Select **Waypoint** and place the required points on the map; set their orientation.
3. If an exact path between points is required, connect them with **Lane**. Without lanes the robot moves in a straight line between points.
4. In **Select** you can move a point and correct its orientation; in **Run order** set the order and tick the points that take part.
5. Check **Checks** for any problem messages.
6. If required, set **Loops** (repetitions) and **Interval (s)** (waiting time), then press **Save**.



Figure 13. *Waylist "test2" – 11 waypoints connected by 10 lanes*

3.4 Obstacle detection and avoidance

Sensor measurements build a navigation picture of the environment. On the map, red points are the measurements of the LiDAR on top of the robot. The navigation **costmap** marks obstacles and the space around them: dark areas are treated as impassable, and the coloured halo shows an increased "cost" of passing close to an obstacle. The planner therefore keeps a safe distance from obstacles and re-plans when something new appears on the route.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.



Figure 14. *Costmap with safety buffers around obstacles*

Independently of navigation, the safety scanners monitor a protective field around the robot. If a person or object comes too close, the robot stops; it resumes only when the field has been clear for at least 2 seconds (series specification). The shape of the protective field changes dynamically with speed, turning direction and the terrain the robot is about to enter.

> **The costmap is not a safety function**
> Obstacles drawn on the map and the costmap are part of navigation planning. They do not by themselves prove compliance with functional-safety requirements and do not replace the safety system or physical barriers.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

4. Control and interface

4.1 The operator station

The robot is controlled through its software interface, displayed on the **touch screen in the tower** of the robot. The same interface shows the map, the robot's position, the sensor data and the status of all subsystems. Directly under the screen is the red **emergency-stop button**. In the series version the interface can also be opened on a tablet or computer, the fleet software can manage up to 50 robots, and a wireless remote-control pendant is available.



Figure 15. *Operator screen and emergency-stop button on the tower*



Figure 16. *Working with the map on the operator screen*

4.2 Interface layout

The main menu is on the left side of the screen; the panel of the selected menu opens on the right, and the map occupies the centre.

Table 10. Menus of the AGROMNI interface

Menu	Purpose
Drive	Manual control with a virtual joystick, drive status and motor functions (Re-init motors, Calibrate wheels); Auto returns control to autonomous navigation.
Navigate	Loading a map, localisation and starting/stopping autonomous navigation; sending the robot to a point.
Build → Maps	Mapping, creating and editing maps.
Build → Waylist	Defining waypoints, lanes and routes.
Tasks	Task mode, saved missions, running and stopping jobs, Custom task, Recovery.
System	Power on/off, password-protected service access and lock, GNSS diagnostics, Library (deleting maps, waylists and missions).

The **status bar** at the top permanently shows **POWER, DRIVE MODE, SAFETY, LINK, GNSS, FUNCTION, MAP** and **TASK**. The **STOP** button in the top right corner is an element of the software interface.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

The on-screen STOP is not an emergency stop
Do not assume that the STOP button on the screen, Stop the job or Stop navigation are equivalent to the physical emergency stop or to a certified safety function. In an emergency, press the red mushroom button on the robot.

4.3 Operating modes

In the series design a key switch on board selects **Autonomous / Manual / Service** mode; autonomous mode has three sub-modes. Together they give five ways of working:

Table 11. Operating modes

Mode	Description	When it is used
A – Fully autonomous	The robot executes planned missions without supervision; tasks are scheduled or sent to a point on the map.	Stable, validated routes after the commissioning period.
B – Supervised autonomous	The robot moves by itself; the operator watches on site or in the interface and can intervene.	Start of every deployment, training, changing traffic.
C – Remote control	A trained operator drives the robot with a wireless pendant: up to 300 m line of sight and 2.5 m/s (9 km/h).	Moving between areas, mapping, positioning.
D – Manual joystick	The robot is outside autonomous operation and is driven directly (on the prototype: virtual joystick in Drive).	Short positioning, loading, unloading from a trailer, set-up.
E – Service	The robot does not accept missions. Requires a password.	Maintenance, safety tests, diagnostics.

Loss of connection
If the connection to the remote-control pendant is lost, the robot performs a controlled stop within 0.5 s. Do not rely on tele-operation where a short stop could itself create a hazard.

4.4 Manual and remote control (Drive)

The **Drive** menu provides a virtual joystick. The panel shows the active mode and the speed limits.

1. Open **Drive** and check the active mode and the speed limits.
2. Use the virtual joystick only with good visibility and free space around the robot.
3. When finished, stop manual movement and select **Auto** if you want to return control to autonomous navigation.
4. Use **Re-init motors** and **Calibrate wheels** only if you are authorised and the procedure for the machine requires it.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

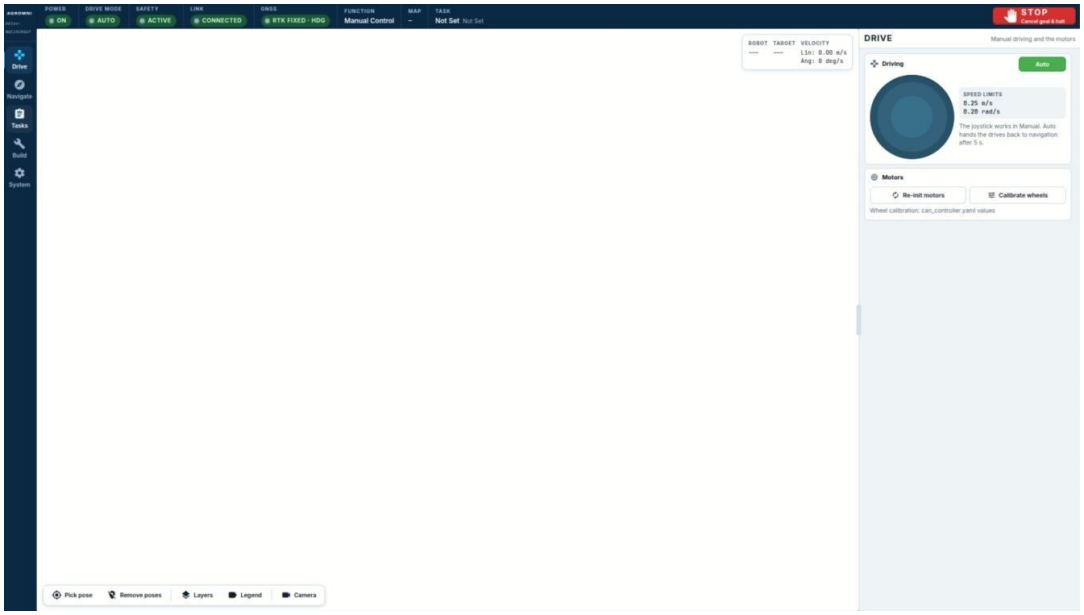


Figure 17. *Drive – virtual joystick and motor functions*

4.5 Navigation set-up (Navigate)

Preparation in **Navigate → Setup** has three steps: **(1) Map, (2) Initial pose, (3) Navigation**. The operator selects the **ENVIRONMENT** size (Large / Medium / Small), the **LOCALIZATION** mode (Outdoor) and the **MAX SPEED**.



Figure 18. *Navigate → Setup before loading a map*



Figure 19. *Loaded map, localised robot, active navigation*

4.6 Tasks and missions

The **Tasks** menu contains **Task mode**, **Missions**, **Run a job**, **Custom task** and **Stop the job**. Selecting a Waylist shows the route on the map in advance. A saved mission is started with **Run** in the Missions section. The **Recovery** button cancels the current mission and returns the robot to its starting position when a task is blocked. Because Recovery can initiate movement, ensure a safe corridor before using it.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.



Figure 20. *Tasks – Waylist "test2" selected and displayed on the map*

4.7 Monitoring during operation

During autonomous work the operator continuously watches:

- the **status bar** (POWER, SAFETY, LINK, GNSS, MAP, TASK) – any unexpected state is a reason to stop;
- the **robot's position on the map**, the planned route and the live LiDAR points;
- the **TASK and STATUS** fields in Tasks and the navigation state (RUNNING / STOPPED);
- the **GNSS quality** in System → GNSS when working outdoors;
- the **surroundings of the robot** – people, animals, vehicles and new obstacles.

For every mission the system records time, distance and task status (in the series version also tonnage and energy consumption), so the farm can see where the bottlenecks in its logistics are. Deleting in **System → Library** is permanent: check the name and make sure a backup exists before pressing Delete.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

5. Practical demonstration

This section is the script for the practical part of the training. Each exercise lists the steps, what the trainees should observe and the safety point to remember. The exercises follow the demonstration shown in training videos 4 and 5.

5.1 Organisation of the demonstration

Table 12. Demonstration set-up

Item	Requirement
Area	Cleared, mapped area with firm surface (concrete, compacted gravel or soil); marked boundaries; no public road crossing.
Roles	**Trainer / operator** at the screen; **safety observer** with direct access to the emergency stop; **trainees** behind the marked line.
Spectator distance	At least 5 m from the route and outside the unloading zone; never in front of a moving robot.
Equipment	Charged robot, prepared map and Waylist, a light obstacle (e.g. empty crate or traffic cone) for the obstacle exercise.
Briefing	All participants are briefed on the rules in Section 6.4 before the robot is switched on.

Never use a person as a test obstacle
Obstacle and stop behaviour is demonstrated with objects only. Trainees do not step into the path of the robot.

5.2 Exercise 1 – Start-up and initial checks

1. Walk around the robot: no visible damage, nothing caught in the wheels, cargo secured, sensors clean.
2. Check that the emergency-stop button is released and that nobody is close to the robot.
3. Switch the robot on with the **two switches** on the power panel under the rear of the platform.
4. Read the **two charge indicators**; do not start a demonstration with a low battery.
5. Wait for the interface to start on the tower screen. Check **POWER, SAFETY** and **LINK** in the status bar.
6. Outdoors: open **System → GNSS** and check for an RTK fixed solution.

Trainees observe: the location of the switches, indicators and charging ports; the status bar; the GNSS panel.

5.3 Exercise 2 – Manual control

1. Open **Drive**; check the active mode and the speed limit.
2. Using the virtual joystick, drive the robot slowly forward and backward a few metres.
3. Turn the robot on the spot to show that no turning area is needed.
4. Stop, release the joystick and confirm that the robot is stationary.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Safety point: manual driving only with clear visibility and free space; the safety observer keeps a hand near the emergency stop.

5.4 Exercise 3 – Localisation and autonomous go-to-point

1. Open **Navigate → Setup**.
2. Select the map and press **Load map**.
3. Select the localisation mode – for the outdoor demonstration, localisation with the GNSS antennas – and press **Localise**.
4. Check that the robot appears in the correct position on the map. If the Initial pose is not set, enter it in the permitted way (X, Y, θ or positioning on the map).
5. Set a low **MAX SPEED** for the demonstration and press **Start** in the Navigation section; check that the status is **RUNNING**.
6. Show the trainees the objects around the robot as they appear on the map (LiDAR points and costmap).
7. Select a target point on the map and instruct the robot to go there.
8. Observe: the robot calculates the route, moves fully autonomously using its LiDARs and drives around obstacles.
9. On arrival the robot stops and notifies the operator that the target position has been reached.



Figure 21. *AGROMNI driving autonomously to a selected point during the demonstration*

5.5 Exercise 4 – Running a route (Waylist task)

1. Confirm that Navigate is ready, the map is correct and the robot is localised.
2. Open **Tasks** and switch on Task mode with **Start task mode**.
3. Select the prepared Waylist from the drop-down list.
4. Check the displayed points and lanes for errors, keep-out zones and impossible passages.
5. Press **Custom task** to start the selected route (or **Run** next to a saved mission).
6. Follow the TASK and STATUS fields, the robot's position and the surroundings throughout the run.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

7. End the run with **Stop the job** and confirm that the robot is stationary.

5.6 Exercise 5 – Obstacle reaction and stopping

1. With the robot moving slowly on a straight segment, the trainer places a light object (crate or cone) on the route well ahead of the robot.
2. Observe that the obstacle appears on the map and the robot either re-plans around it or stops when it is too close.
3. Remove the object; observe that the robot continues.
4. Demonstrate the **physical emergency stop**: the observer presses the red button; the robot stops immediately. Explain the reset procedure (Section 6.2).

5.7 Exercise 6 – Shut-down

1. Stop the current task with **Stop the job** and check that there is no movement.
2. Stop autonomous navigation in **Navigate → Setup → Stop**.
3. Switch off Task mode.
4. Drive the robot to its parking place and secure the area.
5. Shut down through **System → Turn off**, then switch off the power switches according to the machine instructions.

5.8 Assessment of trainees

After the practical part each trainee who will operate the robot should be able to demonstrate the following:

Table 13. Trainee competence checklist

#	Competence	Done
1	Explains the purpose of AGROMNI and at least three tasks relevant to their own farm.	☐
2	Names the main sensors and shows them on the robot.	☐
3	Locates and uses the physical emergency stop; knows the on-screen STOP is not equivalent.	☐
4	Performs the pre-operation checks and reads the status bar.	☐
5	Switches the robot on and off and reads the charge indicators.	☐
6	Drives the robot manually in Drive mode.	☐
7	Loads a map, localises the robot and starts navigation.	☐
8	Sends the robot to a point and starts a Waylist task.	☐
9	Stops a task and shuts the robot down correctly.	☐
10	States the basic safety rules for people in the working area.	☐

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

6. Safety and operation

6.1 Safety concept

Safety outdoors is harder than in a closed warehouse: the floor is not flat and the ground “moves” under the scanner. AGROMNI therefore uses several layers of protection:

- **Protective field:** two laser scanners cover 360°; protective field up to 5.5 m, warning field up to 40 m. When a person enters, the robot makes a protective stop and restarts only after the field has been clear for at least 2 s.
- **Dynamic fields:** the shape of the field is selected according to speed, turning direction and the terrain ahead.
- **Contact bumpers:** front and rear; on contact an immediate category-0 stop independent of the scanners.
- **Tilt protection:** a two-axis inclinometer; safe stop above 12° side slope.
- **Emergency stop:** physical mushroom buttons that immediately cut power to moving parts.
- **Organisational measures:** map keep-out zones, marked routes, signs, briefing and a site-specific risk assessment.

Table 14. Safety functions of the series design (target PL d, Category 3)

Function	Behaviour
Emergency stop	Category-0 stop with brakes applied (two buttons on the machine plus one on the pendant).
Speed limitation	Speed limited according to zone, size of the protective field and load state.
Person detection and distance monitoring	Slows down, then stops when a person approaches; resumes only after the field is clear.
Safe standstill monitoring	Detects unintended movement and applies the holding brakes.
Protection against self-movement	Spring brakes apply on loss of power, fault or emergency stop.
Tilt and roll-over protection	Safe stop when measured tilt exceeds the configured limit.
Raised-body interlock / tipping release	No autonomous travel with raised body; tipping only when stationary, braked, tilt < 8° and zone clear.
Loss of pendant connection	Controlled stop within 0.5 s.

The series design is developed in line with Regulation (EU) 2023/1230 on machinery, EN ISO 12100, EN ISO 13849-1 (PL d, Cat. 3), EN ISO 13850, EN ISO 3691-4, ISO 17757 and, optionally, ISO 18497. The machine is supplied as partly completed machinery; CE marking is completed by the integrator. For the demonstration prototype, the measures in this section and the site risk assessment apply.

6.2 Emergency stop

The red mushroom-head **emergency-stop button** is located on the tower directly below the operator screen. Pressing it puts the robot into an emergency state and stops movement immediately.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

- **Use it** whenever a person, animal or object is in danger, when the robot behaves unexpectedly or when you are unsure.
- **Do not use it** as a normal way of stopping work; for normal stops use Stop the job and Stop navigation.
- **Reset:** first remove the cause and make sure the area is clear; then release the button (turn/pull) and restore operation according to the procedure for the machine. Re-localise the robot and check the status bar before restarting a task.
- **Test:** all emergency-stop buttons are tested every three months (see 6.7).

Software stop ≠ emergency stop
The on-screen STOP, Stop the job and Stop navigation must not be treated as a replacement for the physical emergency stop or a verified safety stopping circuit.

6.3 Pre-operation checks

Table 15. Pre-operation checklist

#	Check	OK
1	No people, animals or obstacles in the immediate movement area of the robot.	☐
2	Visible mechanical condition: frame, wheels and tyres, bogies; nothing wound around wheels; load secured.	☐
3	Sensors clean and undamaged: LiDARs, cameras, antennas; headlight and light strips work.	☐
4	Emergency-stop button released and functional; protective devices in working order.	☐
5	Battery charge sufficient for the planned work (charge indicators / POWER).	☐
6	Status bar: POWER, SAFETY and LINK show the expected state. If not – do not start a mission.	☐
7	Outdoors: GNSS status checked; RTK fixed available if high-precision navigation is needed.	☐
8	Correct map loaded; keep-out zones and zone limits checked.	☐
9	Route (Waylist) checked; first run on a cleared area under observation.	☐
10	Weather and ground within limits (no deep mud, ice, heavy rain > 10 mm/h, wind > 15 m/s).	☐

Do not start autonomous movement if…
localisation is unreliable, the map is unknown, a protective function is in doubt, or a person is in the trajectory.

6.4 Basic safety rules

Everyone who enters the working area – including visitors and seasonal workers – must be briefed on these points.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Table 16. Rules for people in the working area

Everyone must know	It is forbidden to
• The robot moves by itself along the map and drives around obstacles. • If a person enters the protective field, the robot stops; when the area is clear, it starts again by itself. • Before moving off after a stop longer than 10 s the robot flashes its lights and sounds a signal (series version). • Where the robot works, where the unloading zones are and where access is prohibited. • What to do in an incident according to the site action plan.	• Stand in the unloading zone while the load is being tipped. • Approach a moving robot or touch the wheels and bogies. • Ride on the robot or use it to carry people. • Change the configuration of the laser scanners. • Use the emergency stop for normal stopping. • Let untrained persons operate the robot or the pendant. • Operate outside the mapped and commissioned zones.

The farm prepares: marking of unloading zones and routes as hazardous areas; signs and briefing for all staff; safety footwear in the working area (the protective field is at scanner height and may not detect feet); an ABC fire extinguisher; and a **site-specific risk assessment**, which is mandatory before putting the robot into service.

6.5 What the sensors cannot see

Sensors have physical limits that software cannot compensate. They are compensated by the organisation of the site.

Table 17. Sensor limitations and countermeasures

Limitation	Why	What you do
Fully transparent glass	Laser and cameras pass through it	Physical barrier or marking; do not rely only on a keep-out zone.
Mirror-like surfaces	They reflect the beam elsewhere	Matt them, fence them or exclude the area from the route.
Matt black, < 5% reflectance	Too little signal returns	Avoid such materials along the route.
People's feet	The protective field is at scanner height	Safety footwear for everyone in the area.
Thin objects (rope, wire, hoses)	Not reliably detected	Keep them off the route; mark hoses as keep-out zones.
Ditches and edges below the scanner	The scanner looks forward, not down	Physical barriers at dangerous edges.
Strong low sunlight	Can create phantom obstacles	Consider route orientation relative to the low sun.
Weak GNSS signal	Dense foliage, tall buildings	Rely on LiDAR localisation; expect 1–2 m without corrections.
Animals	Behaviour towards animals is not certified	Plan routes outside areas with free-moving animals or use barriers.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

6.6 Charging the battery

Preparation

1. End all active tasks and make sure the robot is completely stationary.
2. Switch the robot off according to the standard shut-down procedure.
3. Check the charging connector and cables for visible damage, dirt or signs of overheating.
4. Make sure the charger is compatible with the robot's battery.

Charging procedure

1. Make sure the charger is disconnected from the mains, unless its manufacturer prescribes a different sequence.
2. Connect the charging connectors to the corresponding ports of the robot.
3. Connect the charger to the mains and start charging according to the manufacturer's instructions.
4. Check the charger indicators to confirm that charging has started normally.
5. When charging is complete, switch off the charger according to the manufacturer's instructions.
6. Disconnect the charging connector from the robot and store it in its place.

Safety rules for charging

- Use only a charger approved for the type and characteristics of the battery.
- Do not charge a battery with visible damage, deformation, leaks, unusual smell or signs of overheating.
- Do not use damaged cables, connectors or sockets; do not let water or other liquids enter the connectors.
- Do not charge near flammable materials; ensure good ventilation; charge in a dry place.
- Do not operate the robot or start movement while charging, unless explicitly permitted by the manufacturer.
- Respect the permitted charging temperature range; do not charge below 0 °C without the heater option.
- For storage: 25–80% charge, battery switched off, recharge at least every 3 months.
- Do not carry out repairs or modifications on the battery, charger or electrical connections.

6.7 End of work and maintenance

At the end of each work session follow the shut-down steps of Exercise 6 (Section 5.7), clean the sensors if needed and put the robot on charge. Most maintenance tasks are simple checks that take minutes.

Table 18. Maintenance schedule

Interval	Who	What
Weekly	All users	Wipe body and platform; check lights and headlight; clean scanner optics and sensor windows; check cameras, LiDAR and antennas; tyre condition and pressure.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Interval	Who	What
Monthly	Operator	Clean bogies and wheels, check for entanglement and wear; covers and panels; review warnings in the interface; charging contacts and battery connector.
Quarterly	Operator	Test all emergency-stop buttons; test bumpers; check behaviour on loss of pendant connection; check reset button.
Half-yearly	Operator	Tyre depth and condition; brake test at full weight on a representative slope; bogie bearings.
Yearly	Operator / Initium Engineering	Warning labels and type plate; annual inspection of the safety system and firmware review; corrosion check, especially after winter.
Every 500 h or 6 months	Technical staff	Planned service (≤ 2 h, one technician): tyres, chain kits, wear liner, brake discs, sensor windows, air filters.

Warranty: 24 months or 4,000 operating hours, whichever comes first; spare parts available for 7 years. Cleaning only with low pressure (≤ 40 bar); no steam cleaning. In livestock buildings plan more frequent cleaning of optics and corrosion checks because of ammonia and frequent washing.

6.8 In case of an incident

1. Press the emergency-stop button and keep people away from the robot.
2. Help injured persons and call emergency services if needed (112).
3. Do not move the robot until the situation is understood, unless it is necessary to prevent further harm.
4. Record what happened: time, location, task, screenshots of the interface.
5. Inform the person responsible on the farm and Initium Engineering support.
6. Restart only after the cause is removed and the robot has been checked.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Annex A – Quick operator checklist

Phase	Actions
Before work	• Robot inspected, area secured • POWER / SAFETY / LINK / GNSS checked
Navigate → Setup	• Load map → localise → set suitable MAX SPEED → Start (status RUNNING)
Build → Waylist	• Points, lanes, Run order, Checks, Save (for a new route)
Tasks	• Start task mode → select Waylist → review → Custom task
During work	• Continuous supervision; ready to stop safely
After work	• Stop the job → stop navigation → Task mode off → park → System → Turn off → charge

Annex B – Troubleshooting

Symptom	Operator action
Map: NOT LOADED	Load a saved map via Navigate → Setup → Load map.
Initial pose: NOT SET	Confirm localisation or set the initial position in the permitted way.
Navigation: STOPPED	Check map, localisation and safe state, then press Start.
GNSS not RTK fixed	Check reception conditions and corrections; do not assume centimetre accuracy.
"Task mode must be on"	Start Task mode before a task or mission.
Waylist does not pass checks	Check the included points, the lanes and their order.
Task blocked	Secure the area and stop the task; use Recovery only after assessing the return route.
Robot stopped, emergency state	Find the cause (person/obstacle in field, E-stop pressed); clear it, reset, re-localise.
Mission refused – low energy	Charge the battery; the robot refuses missions it cannot complete and return from.

Annex C – Glossary

Term	Meaning
AMR / AGV	Autonomous Mobile Robot – plans its own route on a map / Automated Guided Vehicle – follows fixed tracks.
UGV	Unmanned Ground Vehicle – a self-propelled machine without a driver on board.
LiDAR	Laser scanner that measures distances to surrounding objects; used for mapping, localisation and safety.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.

Term	Meaning
SLAM	Simultaneous Localisation and Mapping – building a map while determining the position in it.
GNSS / RTK	Satellite positioning (GPS, Galileo, GLONASS, BeiDou) / Real-Time Kinematic corrections for cm-level accuracy.
HDOP	Horizontal dilution of precision – indicator of satellite geometry quality; lower is better.
Costmap	Navigation layer marking obstacles and a cost buffer around them.
Keep-out zone	Area on the map that the robot must never enter.
Waylist / Waypoint / Lane	Route made of points the robot must reach / a single point with orientation / a defined path between points.
Mission / Task	Saved job for the robot / execution of a job in Task mode.
E-stop	Emergency stop – physical button that stops the robot immediately.
PL d, Category 3	Performance level and architecture category of safety functions according to EN ISO 13849-1.
Odometry	Estimation of movement from wheel rotation.

Annex D – Training videos

The following videos (English subtitles) accompany this manual and are used in the training sessions:

#	Topic	Duration	Related section
1	Autonomous robots in agriculture and the aims of AGROMNI	1:39	1
2	Software: localisation, perception, motion planning, data collection	1:37	3
3	Hardware: mechanical platform, electric drive, sensors, on-board computer, safety	1:52	2, 6
4	Walk-through of the robot: switches, indicators, charging ports, LiDARs, emergency stop, screen, RTK antennas, motors, headlight	1:53	2, 6
5	Software demonstration: Navigate, localisation with antennas, go-to-point autonomous navigation	2:14	4, 5

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.