HEXAGON

User Manual

Ti5 and Ti7 Displays

Machine Control Solution

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1. Introduction

This manual contains important information on how to install, configure, and use the display. To access the complete manual with other display features and products, download the document version available from the Hexagon Agriculture website support (https://hexagonagriculture.com/support).

Initials informations:

- Carefully read this user manual before turning the display on;
- To ensure your safety, observe the instructions contained in the **User Manual** and the **Safety Manual** issued by the manufacturer of the farming machinery;
- The images in this manual are purely illustrative. Screens and visual elements may differ from the actual items.

The symbols used in this manual have the following meanings:

 Danger	Indicates an imminently hazardous situation which, if unavoided, may result in serious injury or death.
 Warning	Indicates a potentially hazardous situation or misuse which, if unavoided, may result in minor to moderate injury, material loss, financial loss and/or environmental loss.
 Important	Important information that must be observed so that display is used in a technically correct and efficient manner.

2. Safety instructions

Allowed usage
Use risks
Electromagnetic compatibility

2.1 Allowed usage

The following instructions aim to inform users about the inherent risks to display operation as well as how to avoid them.

 Warning	Only use the display computer on vehicles with farming purposes such as tractors, sprayers, planters, fertilizer applicators, subsoilers, trucks, among others.

It is not allowed:

- Using outside the restrictions imposed in this manual;
- Opening the device with tools, except with technical support's written permission;
- Modifying or altering the product;
- Using the display with obvious damage or defects;
- Using the display with accessories from other manufacturers without approval.

 Warning	The display must not be used without the user being aware of the correct product usage. Its incorrect usage may result in personal injury, breakdown, and damage.
 Danger	Unauthorized modification of the vehicle for mounting or installing the display may alter the operation and safety of the agriculture machinery.
 Warning	Verify the integrity of the results of the display's measurements after a fall or misuse, transport, modification, or when stored for long periods of time.

2.2 Use risks

- Use of the display is not recommended during thunderstorms due to the risk of being struck by lighting;
- Keep a safe distance from electrical installations and components;
- In case the product will not be used for a long time, it is recommended to disconnect all components and cables;
- To clean the display's monitor, use a soft cloth moistened with 50% isopropyl alcohol.

Incorrect disposal of the display may cause the following problems:

- Release of poisonous gases in case of polymer burning;
- Improper product use, resulting in serious physical harm;
- Contamination of the environment.

 Warning	The display must not be mixed with household waste. It must be disposed of in accordance with regulations in force in the country of use.

2.3 Electromagnetic compatibility

Electromagnetic compatibility refers to the product's ability to function properly in an environment with electromagnetic radiation and electrostatic discharge, without causing electromagnetic disturbances to other devices.

 Warning	Electromagnetic radiation may cause disturbances in other devices. Although this product fully meets the strictest regulations and standards in force, Hexagon Agriculture cannot completely

	exclude the possibility of interference with other devices.

There is a risk that interference may occur in other devices if the instrument is used with accessories from other manufacturers such as computers, laptops, radios, non-standard cables, external batteries, etc.

Recommendations:

- **Only use devices and accessories recommended by Hexagon Agriculture.** When used with this instrument, such accessories meet the strictest requirements of the regulations and standards in force;
- **Consider the information on electromagnetic compatibility provided by computer and transceiver radios during their use;**
- Monitor measurement results when operating in areas with disturbances caused by electromagnetic radiation, as these may lead to incorrect results. **Although this product fully meets the strictest regulations and standards in force, Hexagon Agriculture cannot completely exclude the possibility of interference in the instrument caused by intense electromagnetic radiation emitted, for example, by radio transmitters, generators, electric cables, etc.**
- **Always connect both ends of the cables during use.** If the instrument is used with cables connected only to one end, the permissible level of electromagnetic radiation may be exceeded and the correct operation of the instrument may be affected;
- **Do not operate the product with radio devices or mobile phones near fuel stations, chemical facilities, areas with explosion hazards, medical devices, or aircraft.** The electromagnetic fields caused by using the product with radio devices or mobile phone may cause interference in other devices, facilities, aircraft, and medical instruments such as heart rate regulators or hearing aids. Electromagnetic radiation might even affect humans and animals. Although the product meets the regulations and standards in force, Hexagon Agriculture cannot completely exclude the possibility of other devices being disturbed or people and animals being affected.

3. Displays overview

3.1 Overview of the display HxGN AgrOn Ti5

The **HxGN AgrOn Ti5** is a complete precision farming guidance system with the following functions:

Figure - General application

3.1.1 System components

1. Display's monitor
2. GNSS antenna
3. Antenna suport
4. Antenna cable
5. Power cable
6. Arm - mounting bracket
7. Clamp - mounting bracket
8. Pendrive
9. Documentation

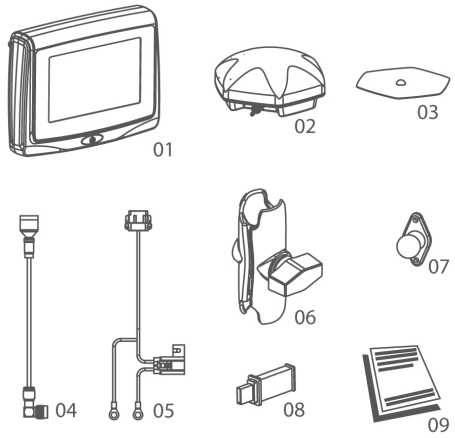


Figure - System components

3.1.2 Views

Warning	The display was designed to be used with the touch of your fingers on the screen. Do not operate with sharp objects such as pens or screwdrivers as this may damage and affect the warranty of your product.

1. 5-inch color touchscreen
2. Power button
3. CAN communication port
4. USB interface
5. Fixing bracket
6. GNSS antenna connection

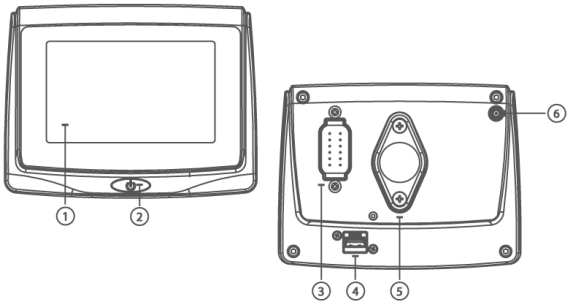


Figure - Connector identification

3.1.3 Product identification

The product type (model) and serial number are indicated on a label on the back of the display. Record the type and serial

number in your manual and inform them when contacting technical support.

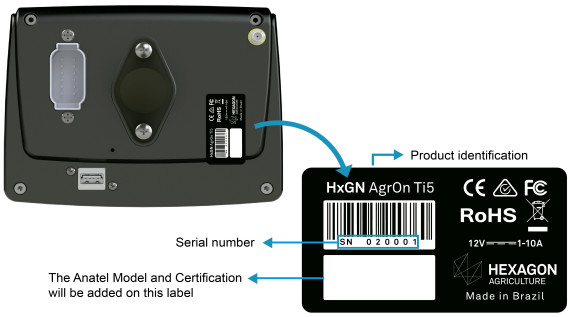


Figure - Product identificaon

Important	You can also check your device's serial number accessing the **Configuration menu – System settings – About.**

3.1.4 CAN connector pinout

1. Voltage output Vcc
2. CAN High
3. Buzzer output
4. Voltage output Vcc
5. Battery + (Main supply)
6. Serial RS232 TX
7. Battery - (Main supply)
8. Serial RS232 RX
9. Sensor input
10. GND
11. GND
12. CAN Low

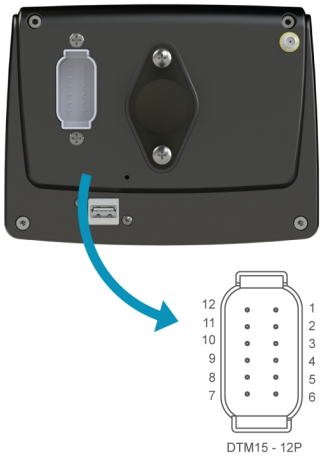


Figure - CAN connector output

3.2 Overview of the HxGN AgrOn Ti7

The display is a complete precision farming guidance system with the following functions:

Figure - General application

3.2.1 System components

1. Display's monitor
2. GNSS antenna
3. Antenna suport
4. Antenna cable
5. Power cable
6. Arm - mounting bracket
7. Clamp - mounting bracket
8. Pendrive
9. Documentation

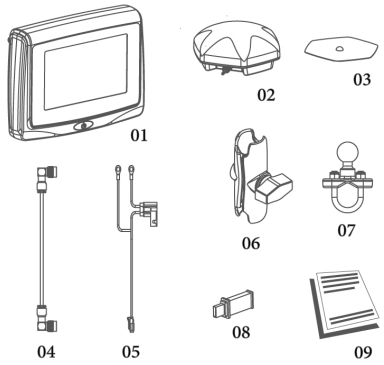


Figure - System components

3.2.2 Views

Warning	The display was designed to be used with the touch of your fingers on the screen. Do not operate with sharp objects such as pens or screwdrivers as this may damage and affect the warranty of your product.

1. 7-inch color touchscreen
2. Power button
3. SIM card slot
4. GPRS connection
5. Fixing bracket
6. Wi-Fi antenna connection
7. GNSS antenna connection
8. USB interface
9. CAN communication port
10. Power connection (12V)
11. Input and output connection

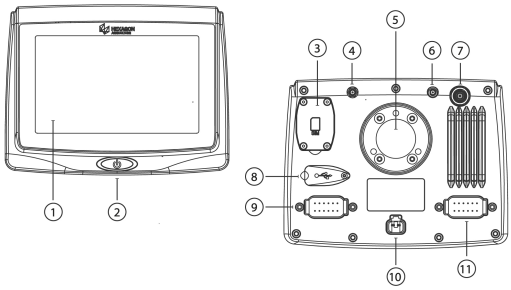


Figure - Connector identification

3.2.3 Product identification

The product type (model) and serial number are indicated on a label on the back of the display. Record the type and serial number in your manual and inform them when contacting technical support.

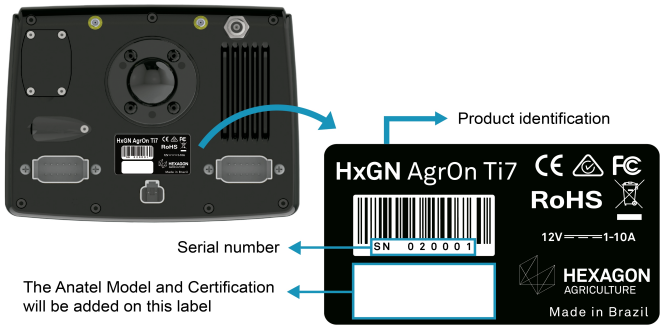


Figure - Product identification

Important	You can also check your device's serial number accessing the **Configuration menu – System settings – About.**

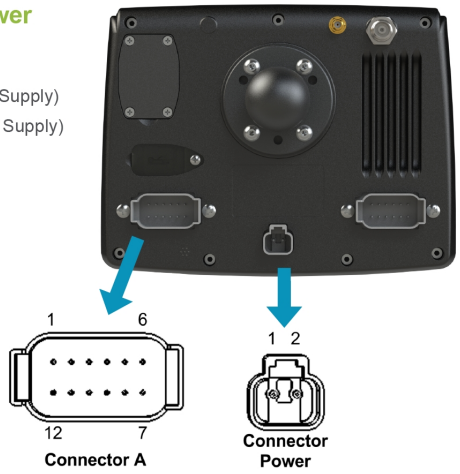
3.2.4 CAN connector pinout

Connector A

1. Power Output
2. CAN 1 High
3. Power Output
4. CAN 2 High
5. Power Output
6. Serial 1 RS232 TX
7. GND
8. Serial 1 RS232 RX
9. GND
10. CAN 2 Low
11. GND
12. CAN 1 Low

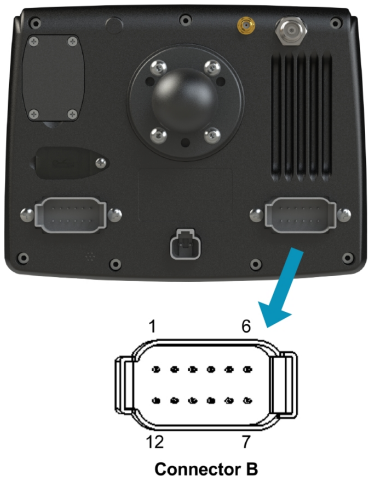
Connector Power

1. Battery - (Main Supply)
2. Battery + (Main Supply)



Connector B

1. Power Output
2. Sensor M Input
3. Buzzer Output
4. Sensor A Input
5. Power Output
6. Serial 2 RS232 TX
7. GND
8. Serial 2 RS232 RX
9. Sensor B Input
10. GND
11. GND
12. Sensor P Input



4. Equipment's installation

4.1 Displays's fixation

Warning	The display installation must be performed by a qualified technician. Read the safety instructions before performing the installation steps.

Ti5 display fixation

Choose an appropriate location for securing the display monitor within reach of the operator while seated in a normal operating position and in front of the operator’s field of vision.

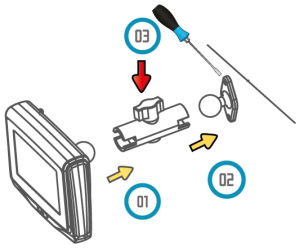


Figure - Display installation

Warning	Do not mount the display where it can be struck by an airbag.

To perform the installation, proceed as follows:

1. Mount the clamp to the desired location in the vehicle;
2. Connect the clamp to the monitor (01) and the support ball (02), firmly securing using the handle;
3. Position the assembly in a location visible to the operator and check if it is firm and secure;
4. Connect the power cable to a battery or to a location indicated by the vehicle manufacturer and connect the other end to the back of the display;

Ti7 display fixation

Choose an appropriate location for securing the display monitor within reach of the operator while seated in a normal operating position and in front of the operator’s field of vision.

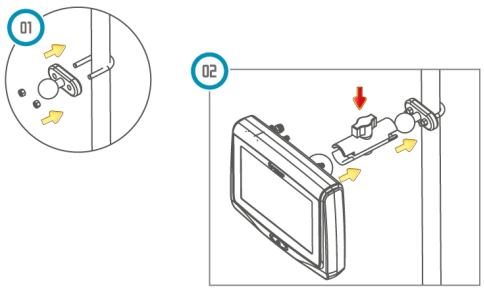


Figure - Display installation

Warning	Do not mount the display where it can be struck by an airbag.

To perform the installation, proceed as follows:

1. Mount the clamp to the desired location in the vehicle. To mount the clamp, wrap the bow around the tube, insert the base, and fasten with hex nuts. Use a socket wrench for better tightening;

2. Connect the clamp ball and the monitor to the mounting arm, firmly securing using the handle;
3. Position the assembly in a location visible to the operator and check if it is firm and secure;
4. Connect the power cable to a battery or to a location indicated by the vehicle manufacturer and connect the other end to the back of the display;
5. Connect the horn cable to the input/output connector.

4.2 SIM card installation

Warning	The viability of installing the SIM card should be checked by a qualified technician for the Ti5 display.

To enable remote communication on systems equipped with an internal modem, a SIM card is required.

Important	Only required in Wi-Fi + Mobile network version.

To install the SIM card, proceed as follows:

1. On the back of the display, remove the four screws as shown in the figure. Use the lowered space to make it easier to open the lid;

Figure - Opening the lid

2. Pull the insert down and open to a 90-degree angle;

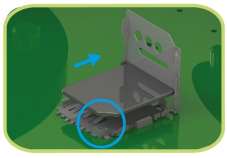


Figure - SIM card housing step 1

3. Insert the SIM card into the slot, ensuring its proper positioning;
4. Close the opening and push up until you hear the locking sound;

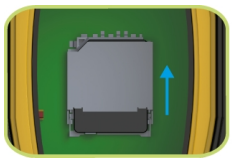


Figure - SIM card housing step 2

5. Put the back lid on and screw the removed screws.

4.3 Antenna installation

Warning	• The display antenna must be mounted on the roof of the vehicle, preferably front and center on the flat part of the roof; • The antenna must be mounted horizontally and must not me tilted in order to ensure the best GNSS signal reception; • It is necessary to keep the antenna as far away as possible from obstacles in order to ensure that the signal is received in all directions; • A clear view of the sky to the horizon in all directions is recommended for the ideal reception of satellites, as obstacles close to the antenna prevent the reception of signals; • Keep the GNSS antenna as far away from the radio antennas as possible;

	• If the antennas are installed too close to each other there may be interaction between the antennas and a consequent loss of sensitivity.

To install the antenna, proceed as follows:

1. Clean and dry the roof of the vehicle to prepare the installation. We recommend isopropyl alcohol;
2. Check if the installation area on the roof is clean and dry;
3. Attach the GNSS antenna. It has magnets that attach to the vehicle's metallic roof. In case it is not metallic, use a metal bracket for fastening, using double-sided tapes on the back of the holder. Remove the tape's plastic protection and make it adhere to the roof of the vehicle;
4. Connect the antenna cable to the back of the display. The cable cannot be cut, twisted, or excessively bent, as its performance may be degraded causing the system to fail.

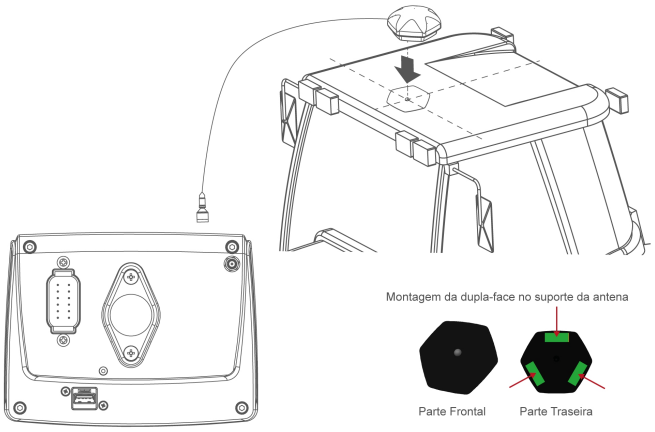


Figure - Ti5 display antenna installation

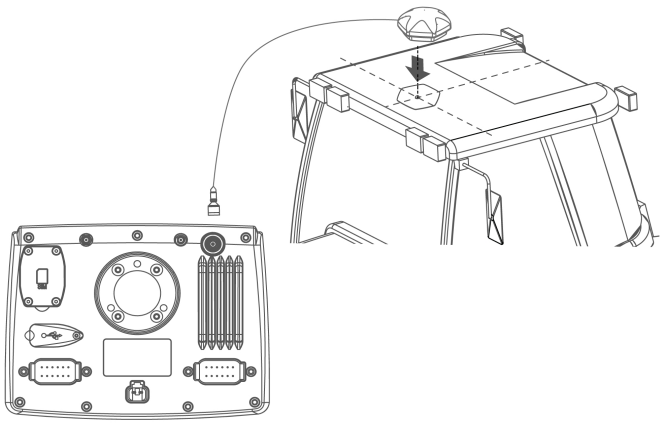


Figure - Ti7 monitor display antenna installation

5. Running display for the first time

Warning	We recommend starting the vehicle before turning the display on.

5.1 Starting the device

To turn the monitor on, proceed as follows:

1. Press the **On** Button on the front panel of the display for one second;
2. The display will show the screen for selecting **Language**, **Time Zone**, and **Theme**;
3. Enter the desired settings and confirm;
4. If operating in the quick launch mode, when starting your display for the first time, the new work session setup wizard will show. Go to topic New job section on fast start mode;
5. If operating in the conventional launch mode, go to next topic Job section.

Important	The fast start mode is only available for the display with solely and exclusively the **Guidance** activated. To enable or disable this function, select the **Fast mode ON/OFF** option located on the right side of the work session list. The display will always start in the same startup mode it was operating in when it was turned off (quick launch mode or conventional launch mode).

Figure - Language and time zone selection

5.2 Shutting down the monitor

To shutdown the monitor of your display, proceed as follows:

1. Press the Off button on the front of the module;
2. A confirmation message will be displayed;
3. Confirm the operation by selecting **Yes**;
4. Wait for the screen to turn off.

Warning	Do not remove the power source without the screen turning off completely.

6. Job section

A **job section** consists of the combination of various information that characterize a performed job, such as the performed activity, in which farm, in which field, etc.

In order to operate the display, there must always be a running work session, which may have been previously created or completely new. For this reason, when the device is turned on, the system directs the user to the **Job section** management screen.

Important	The **Job section** management may also be accessed at any time by the used through the **Configuration menu**.

Job section in conventional mode

From this screen one may **select**, **delete**, or **create a new** job section.

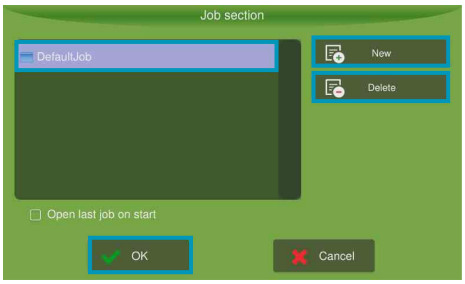


Figure - Conventional job section

Job section on fast start mode

The job section on fast start mode is only available for the displays with solely and exclusively the **Guidance** activated. To enable or disable this function, select the **Fast mode ON/OFF** option located on the right side of the job section list. The display will always start in the same startup mode it was operating in when it was turned off (fast start mode or conventional mode).

From this screen one may select, delete, or create a new job section, enable or disable the fast start mode, or view the settings of the last implement used.

Figure - Job section on fast start mode

6.1 Selecting a job section

Job section selection is the same for both launch modes. See topic Job section.

To select a job section, proceed as follows:

1. Select a **Job section** among those presented on the screen;
2. Press **OK** to start the operation.

Important	Regardless of the **Job section** selected from the list, display will always use the settings for the last implement used. To check the current values, on fast start mode they are displayed in the indicator boxes on the right side of the screen.

6.2 Inserting a job section

If operating in conventional mode, go to next topic New job section in conventional mode, otherwise go to topic New section on fast start mode.

6.2.1 New job section in conventional mode

To create a new job section in conventional mode, proceed as follows:

1. On the **Job section** screen, select option **New**;
2. A message will be displayed informing the necessary input fields for creating a new job section;
3. Click **OK** to confirm reading the message;
4. The list of farms is presented;
5. Select a farm from the list or select **New** to insert a new farm;
6. Enter the farm name and select **OK** to confirm;
7. Confirm the name presented on the list and click **OK** to select;
8. The list of fields is presented;
9. Select a field from the list or select **New** to insert a new field;
10. Enter the field name and select **OK** to confirm;
11. Confirm the name presented on the list and click **OK** to select;
12. The list of activities is presented;
13. Select an activity from the list or select **New** to insert a new activity;
14. Enter the activity name and select **OK** to confirm;
15. Confirm the name presented on the list and click **OK** to select;
16. The new job section is created.

Important	The **Farm**, **Field**, and **Activity** fields only allow names with at most twelve characters. There cannot be work sessions with the same name (Farm, Field, and Activity).
Warning	When the **Open last session when starting** box is activated, the work session screen will no longer be displayed when the device is started. Instead, it will start directly at the operation window for the last used work session.

6.2.2 New job section on fast start mode

To create a new job section on fast start mode, proceed as follows:

1. Click on **New**;
2. On the **Implement and Vehicle** screen, insert the implement's width and the distance from the vehicle's antenna to the implement;
3. Confirm the operation selecting the **Save** option;
4. A message informing that the new job section has been created will be displayed;
5. Confirm you have read the message by selecting **OK**;
6. The operation screen will be displayed.

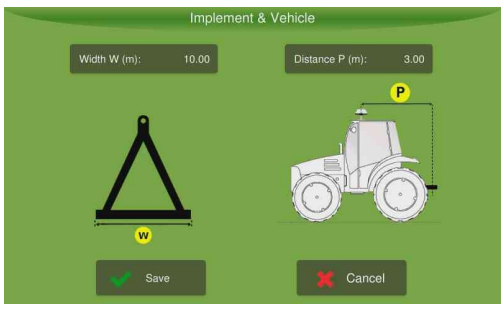


Figure - Implement and vehicle

6.3 Removing a job section

To remove a job section on fast start mode, proceed as follows:

1. Select a **Job section** among those presented on the screen;
2. Select option **Delete;**
3. A confirmation message will be displayed;
4. Confirm the operation by selecting **Yes**;
5. The Job **section** is deleted.

Important	The system will not allow deleting the **Job section** currently in use.

7. Operation screen

The operation consists of the main screen where the activities are in fact executed according to all the configured parameters and activations.

The display currently has two operation modes and the activities can only be executed in one of them. The operation mode depends on the vehicle and related activity. For example, truck-type vehicles performing trips use the **Mode of operation with routes**, while tractors in the field use the **Mode of operation with lightbar.**

Warning	In case alerts exist, they will be displayed above the operation screen before execution begins.

Mode of operation with Guidance

During operation, in order to provide a broader view of the field, only the following information and features will be visible:

1. Alerts
2. Notifications bar
3. Connectivity information
4. Operation bar
5. Lightbar
6. Suspended operation
7. Operation information

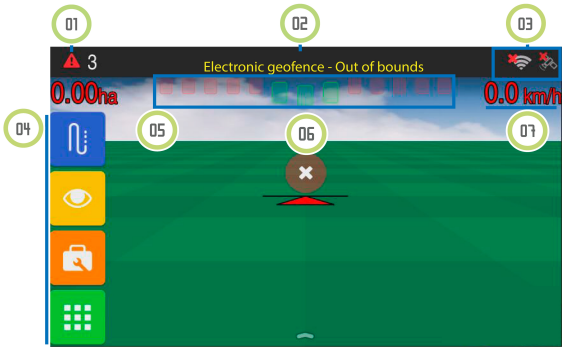


Figure - Operation screen with lightbar

Mode of operation with routes

The **Mode of operation with routes** is a distinguished operation mode used to assist vehicles in executing routes. The display loads these routes, which come from the **Control Room** web system, monitoring and guiding the driver to the destination. During the route, the driver receives alerts such as departure from the original route (virtual fence) and/or maximum speed limit reached.

Important	It is only possible to operate on **Mode of operation with routes** if **Monitoring mode** is activated.

During the operation with routes, some differences are displayed on the screen when compared to the light bar operation screen.

01 - The light bar is removed to give access to the route server connection icon;
02 - The left side menu options are altered.

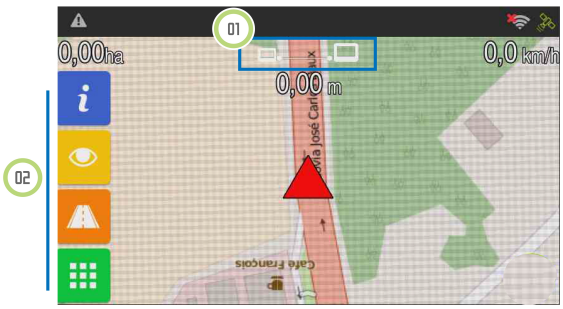


Figure - Operation screen with routes

7.1 Upper bar

7.1.1 Alerts

Important	Before starting any operation, make sure that are no active alerts.

Alerts are displayed automatically on the screen during the operation. The operator may close them, but if the condition which triggered the alert continues to occur, the alert will be displayed on the top of the screen.

Slide the notification bar downwards to visualize the list of notifications and to preview the messages. Slide the bar upwards to close it again.

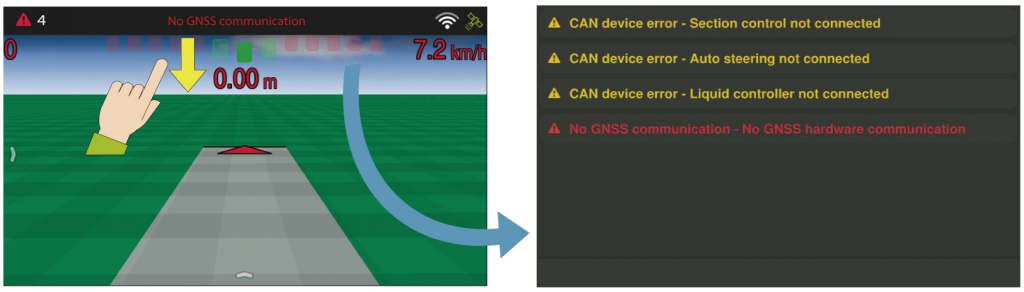


Figure - Alert notification

Important	When a notification message is clicked on, it is removed from the notification list but is still accessible through the alert icon on the upper left corner.

Click on the alert icon to access all active alarms and to obtain more detailed information on how to troubleshoot the problem.

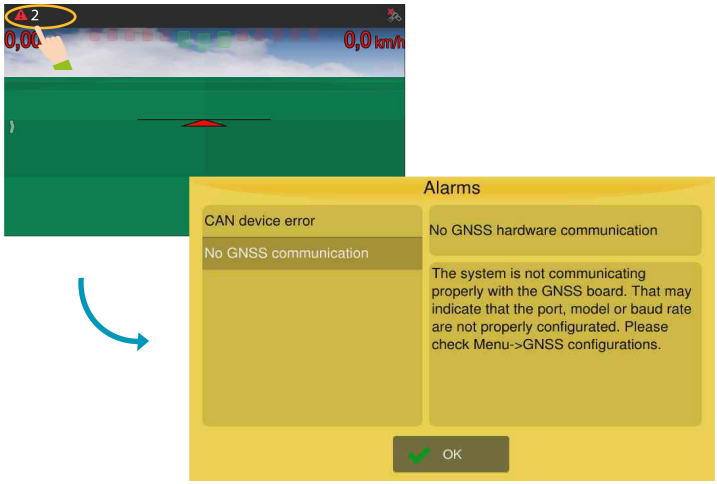


Figure - Alerts - Solutions

The following alarm categories are issued by the display:

- GNSS information;
- Odometer information;
- CAN information (connection to the drivers);
- Power supply;
- Anticide;
- Speed limit;
- Memory;
- Planting monitor;
- Auto steering;
- Fertilization;
- Seed controller;
- Sprayer;
- SIM Card;
- CPU temperature;
- Chat messages;
- Routes.

Warning	Anti-lock alarms are issued when the temperature and/or memory reach critical levels. In this situation, the used is informed of the required procedure. In case the message is ignored, operation is suspended.

7.1.1.1 Alert descriptions

The display's alert table is presented below:

Name	Summary	Description
Monitoring alert	Rule violated	A monitoring rule has been violated. Contact your supervision.
High temperature	High system temparature	Operation suspended due to overheating. Turn off device, let it cool for a few minutes, and then turn it on again. Contact technical support if the problem persists.
Scale	Communication error	The system is unable to communicate with the weighing module. Ensure that the cable is connected and has not been damaged.
Incompatible Titanium database	Incompatible Titanium database	Incorrect version of the Titanium database, which may cause strange behavior and failure. If this occurs, please restore the factory settings to create a correct version.
Virtual fence	Out of bounds	You are outside the operating area. Please return to the allowed area.
GNSS connection	Disconnected GNSS antenna	Please ensure that the cable is properly connected.
Input controller	Outside the speed range	You are operating outside the speed range deemed appropriate for good input application. You may improve the speed range by changing the system calibration.
Input controller	Motor stopped	The system is unable to detect motor movement. Ensure that the hydraulic system is on, the motor speed sensor is connected, and no other alarms are active.
Input controller	No auxiliary power	The input control driver is not getting power to start the motor. Check the auxiliary power cord connections.
Input controller	Desired rate not reached	The system is unable to reach the recommended dosage. If you have not received an alert that the operations is outside the speed range, the calibration or the minimum and maximum motor speed parameters may be wrong.
Liquid controller	Outside the speed range	You are operating outside the proper speed range for good application. You can improve the speed range by altering the spray nozzle.
Liquid controller	Desired rate not reached	The system is unable to reach the spray recommendation. If you have not received an alert that the operation is outside the speed range, the selected nozzle may be incorrect or there may be a problem with the pump.
Seed controller	Outside the speed range	You are operating outside the proper speed range for good planting. You can improve speed range by changing the seed disks.
Seed controller	Motor stopped	The system is unable to detect motor movement. Ensure that the hydraulic system is on, the motor speed sensor is connected, and no other alarms are active.
Seed controller	No auxiliary Power	The seed control driver is not getting power to start the motor. Check the auxiliary power cord connections.
Seed controller	Desired rate not reached	The system is unable to reach seed recommendation. If you have not received an alert that the operation is outside the speed range, the calibration or the minimum and maximum motor speed parameters may be wrong.
Short-circuit	Short-circuit	A short-circuit has been detected involving the red/black power fires of either the CAN bus or the seed sensors. Ensure that the cables are not damaged.

Incompatible monitoring database	Incompatible monitoring database	Incorrect monitoring database version, which may cause strange behavior and failure. Please, update to an appropriate version. Insert a pendrive with an updated database and login with user hxgnguest (blank password). Go to Menu > System Settings > About > Update Database.
Manual anticide application error	Empty line	Please ensure that the anticide tank is not empty and the sensor is not obstructed.
CAN device error	Gate controller disconnected	The gate controller configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
CAN device error	Controller disconnected	The input or seed variable rate controller configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
CAN device error	Controller disconnected	The logic controller configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
CAN device error	Anticide controller disconnected	The anticide controller configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
CAN device error	Liquid controller disconnected	The liquid controller configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
CAN device error	Section cut off	The section cut controller configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
CAN device error	Transport driver disconnected	The transport module configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
CAN device error	Planting monitor disconnected	The planting monitoring module configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
CAN device error	Monitoring disconnected	The monitoring module configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
CAN device error	Automatic pilot disconnected	The automatic pilot controller configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
CAN device error	Depth gauge disconnected	The depth gauge configured for this implement is disconnected. Ensure that the CAN bus cables are properly connected and that the module is not damaged.
Automatic pilot driver error	Initialization error	There was an error during driver sensor initialization. Please reboot the system completely. Contact technical support if the problem persists.
Anticide error	Empty line	Please ensure that the anticide tank is not empty and the sensor is not obstructed.
Communication failure	Communication failure	The system is not receiving client messages correctly.
GNSS - Low precision	Number of available GNSS satellites too low.	There are not enough satellites to determine the position. Please, ensure that the antenna and the cables are properly connected and unobstructed. The GNSS card may take a few minutes to sync.
GNSS - Low precision	No GLIDE	The GLIDE positioning system is inactive, which leads to low GNSS accuracy. The system takes six minutes after GNSS syncing to sync the GLIDE signal, but problems with the cable or antenna may cause GNSS malfunction.
GNSS - Low precision	No RTK	The system is not using RTK positioning, which leads to low GNSS accuracy. Ensure that the RTK base is on, the radio is connected, the baud is correct, and that there are no damages to the cables or the antenna. Upon receipt of the RTK corrections, the system may take up to ten minutes for proper positioning.
GNSS - Low	No SBAS	The system is not using SBAS positioning, which leads to low GNSS accuracy. Ensure that there are no damages to the cables or the

precision		antenna, and that the SBAS correction service is available in your region.
GNSS - Low precision	Inactive TERRASTAR	The system is not using TERRASTAR correction, which may lead to loss of overall GNSS accuracy. Please ensure that your TERRASTAR subscription is valid and has not expired. If you are using the subscription for the first time, it may take up to three hours to activate the TERRASTAR correction.
GNSS - Low precision	TERRASTAR-C not synced	The system is not using TERRASTAR-C correction, which may decrease GNSS accuracy. Ensure that the cables, antennas, and connections are properly connected. The TERRASTAR-C correction may take up to forty minutes to converge.
GNSS - Low precision	TERRASTAR-L not synced	The system is not using the TERRASTAR-L correction, which may reduce GNSS accuracy. Ensure that the cables, antennas, and connections are properly connected. The TERRASTAR-L may take up to five minutes to converge.
GNSS without communication	No communication with GNSS hardware	The system is not communicating correctly with the GNSS hardware, which means that the port, the model, or the baud (when available) selected in Menu > GNSS is incorrect. Select the correct data and click OK.
GNSS syncing	Syncing GNSS	The system is communicating correctly with the GNSS hardware, but is still syncing. The sync time should not be longer than ten minutes, given the antenna is outdoors, i.e., it is not under roofs, trees, electric transmission lines, or others that may interfere with the system. If the above conditions are met and the sync is still taking more than ten minutes, it may be indicative of a problem with the antenna whip or the antenna itself.
Guide	End of guide	The system is approaching the end of the guide. Get ready to maneuver the vehicle.
Guide - Loading	Guide is loading	The selected guide is loading. This alert will automatically disappear as soon as the guide is loaded and the automatic pilot is ready for use. Please wait.
Joystick	No joystick commands	The system is not reading joystick commands. Please ensure that the cables are properly connected.
Speed limit	Speed limit exceeded	The speed limit has been exceeded. Please slow down.
Login	Login before operating the vehicle	Please login before moving or operating the vehicle in any way.
Full memory	Insufficient memory	The available memory is insufficient thus the operation has been suspended. Close this work session and star a new one.
Insufficient memory	No available space	There is no space available thus the operation has been suspended. Export your flash files, then delete them from the system to free up space.
Satellite modem	Satellite modem not connected	Please ensure that the cable is properly connected.
Fertilizer monitor	Line without fertilizer	Ensure that the fertilizer bin is not empty and that the sensor is not dirty.
Seed monitor	Line without seeds	Ensure that the seed container is not empty and that the sensor is not dirty.
Monitoring – Incorrect task	Select new task	According to the parameters set, no task has been selected or the current task does not match. Indicate a new task on the monitoring screen.
Ntrip	Intermittent corrections	The Ntrip client connected successfully, but is not receiving enough corrections. Ensure that the Internet connection is working.
Ntrip	Disconnected	There was a problem connecting to the Ntrip server. Please go to the Ntrip status screen (Menu > GNSS > Ntrip Status) for more information.
Odometer	Close to the limit	The system is approaching the established distance limit. You must be careful not to damage the implement when the limit is reached.
Odometer	Limit reached	The system has exceeded the established distance limit. You must be careful not to damage the implement.
Autosteering pilot	Outside the speed	You are operating out of the proper speed range.

	range	
Autosteering pilot	Displacement direction solution	The double antenna solution did not converge.
Autosteering pilot	Steer Direct communication	The automatic pilot driver is not receiving messages from the motor. Please ensure that the cables and connections are correct.
Autosteering pilot	Failure during alignment	The error or the angle in relation to the line is too high. Activate the device near the trajectory to be followed or change the safety parameters in the General Settings menu.
Autosteering pilot	No auxiliary battery	The automatic pilot is not receiving auxiliary power from the battery. Ensure the cables and connections are correct.
Autosteering pilot	Encoder hall reading	Inconsistent sensor reading.
Autosteering pilot	Electric pilot precision	It was not possible to estimate the vehicle trajectory. Please drive close to twenty meters performing smooth maneuvers.
Autosteering pilot	Unknown wheel position sensor	The system is unable to read the wheel positioning. The sensor may be disconnected or the cable may be broken. Check the installation of the wheel positioning sensor.
Autosteering pilot	Disengaged steering wheel	The vehicle's direction is not responding to the control. Ensure that the actuator is correctly installed
Autosteering pilot	Manual operation detected	The system has detected an external action on the steering wheel. If you did not move the steering wheel, it is possible that the sensitivity parameter is set incorrectly.
Autosteering pilot	Driver overheating	The activation system is overheating. This may be due to excessive stress or due to high external temperature. Modifications to the aggressiveness setting may decrease the heating.
Autosteering pilot	Communication failure	The system is unable to establish proper communication with the automatic pilot controller. Check the CAN communication cables.
Autosteering pilot	Shut off remotely	The automatic pilot button or footswitch has been triggered.
Autosteering pilot	Very rough terrain	The system is unable to maintain the trajectory due to excessive cabin swings. Ensure the inclination compensation module is securely attached.
Autosteering pilot	GNSS precision loss	The system has lost GNSS positioning accuracy. Ensure that there are no obstacles near the antenna.
Autosteering pilot - control message	Control message error	The automatic pilot system is not receiving GNSS information as expected. Please ensure that the GNSS is syncing before attempting to operate the automatic pilot.
Pneumatic	Pneumatic	Tire pressure not reached.
CAN port	Insufficient ports	The system is configured to use both the monitoring driver and the CAN ISOBUS, but only one CAN is available. Please reconfigure the system to identify which will be used.
Low memory	Little available memory	The system is operating with little available space. Export your flash files, then delete them to free up space.
Low memory	Little available memory	The system memory is almost fully occupied. If you proceed, the system will become slow. Exit the current work session and start a new one.
Plate	Plates are off	Ensure that the plate sensor is working properly and that the hydraulic is correctly engaged.
Sensor	Unresponsive sensor	The system is not reading the sensor. Please ensure that the cables and connectors are properly installed and/or the sensor is not damaged.
Critical level temperature	Critical system temperature	The system is overheating and the operation has been suspended. Turn the device off and contact technical support.
Low voltage	Power supply – low voltage	There is a problem with the battery to which the device is connected. The voltage is too low or with above normal oscillation. This is common while starting the tractor with the device turned on. In this case, it is recommended to start the tractor with the display turned off and only turn it on afterwards.
High voltage	Power supply – high voltage	There is a problem with the battery to which the device is connected. The voltage is too high or with above normal oscillation. This is common while starting the tractor with the device turned on. In this case, it is recommended to start the tractor with the display turned off and only turn it

		on afterwards.
Critically low voltage	Power supply – critically low voltage	There is a problem with the battery to which the device is connected. The voltage is low, which generally happens when the tractor is started with the device turned on. If this is the case, it is recommended to restart the tractor and then the controller.
External Wi-Fi	External Wi-Fi disconnected	The external Wi-Fi adaptor configured for this device is not connected. Please ensure that the adaptor is connected and not damaged.

7.2 Connectivity information

For further **GNSS information**, click on the icon located in the upper right corner.

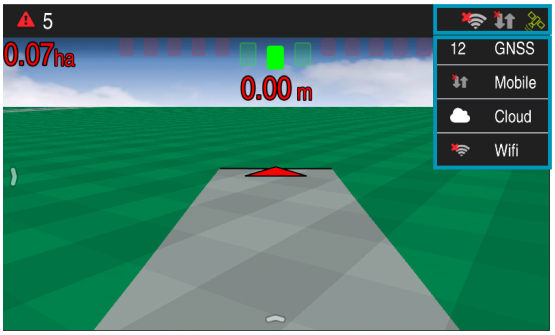


Figure - Connectivity information

The information presented is:

- GNSS: Displays the total number of connected satellites. When pressed, it displays a window with the satellite constellation types. When used Novatel models, shows the information on the location's accuracy, which allows more accurately identify the positioning of the vehicle.

Figure- Accuracy

Important	Horizontal accuracy is the probability of a measured point is inside a radius area centered on average coordinate along time. For that reason, Distance Root Mean Squared (DRMS) is applied to set a probability of 65% of this point stay in this region and this value is calculated at every positions package received. This accuracy is used as trigger to transition from GNSS syncing status to converged.
Important	This is valid only for Novatel receivers and does not consider altitude, only horizontal coordinates.

For configuration details, access topic GNSS;

- Mobile: Indicates connectivity to mobile data networks. For details, access topic 3G;
- Cloud: Ensured the display is online and authenticated on the Hexagon Agriculture services;
- Wi-Fi: Indicates whether or not the display is connected to a Wi-Fi network. When pressed, it displays details about the network connection. For configuration details, access topic Wi-Fi.

7.3 Lightbar

The lightbar is displayed at the top of the operation screen and displays the deviation of the vehicle from the guide being executed. The squares represent the LEDs that light up when the configured offset is reached. Visually they light up right or left indicating the deviation side. The sensitivity in meters of the 5 center position LEDs are configurable by the operator, as shown in the Parameters topic.

Figure - Light bar in operation

7.4 Information configuration

Up to three pieces of information may be displayed on the operations screen. To modify or enter the presented information, proceed as follows:

1. Click for two seconds on the information you want to change;
2. A new window will be presented with the possible options as shown in the figure;
3. Select the information you want to display;
4. The window is closed and the selected information is presented.

Figure – Information configuration

Important	If there is no information, just follow the same procedure above, pressing the empty space to select the information you want to display, as indicated in the center of the figure below. To do the inverse, simply select the empty information so that it disappears on the screen.

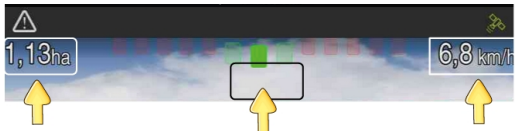


Figure – Insert and remove information

Important	To make the current time available on the operation screen, select **Time** as one of the information options.

7.5 Main menu

When dragging your finger from the left corner of the screen to the center, a tab will be displayed with the main menu buttons.

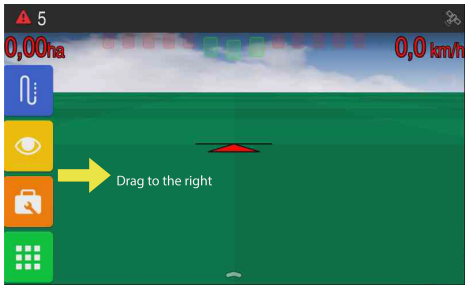


Figure – Options to the left of the screen

7.5.1 Guide

Guidance types are used to define a guideline on the field. The display operates with the following:

Icon	Description
	Wayline management
	Parallel line
	Parallel curve
	Adaptive curve
	Pivot
	Line A + Angle

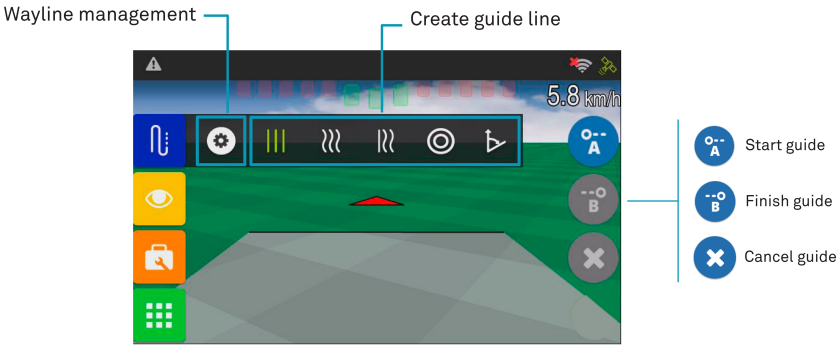


Figure - Guide creation

Important	For further explanations on each guide item, refer to topic Guidance.

7.5.2 Visualization

By clicking on the **Visualization** option, the options for visual presentation of the job on the operation screen are presented.

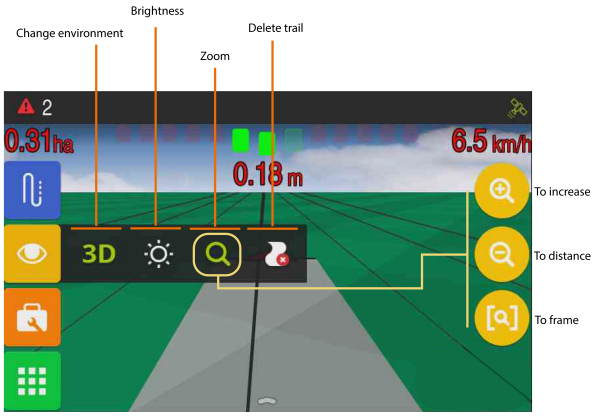


Figure - Visualization

Change environment

Alternates the visualization on the operation screen between 2D and 3D.

Brightness

Alters the brightness of the display screen.

Zoom

Increases or decreases the zoom on the operation screen.
You can zoom in and out of the maps using the pinch gestures, making it quicker and easier for the user to zoom in and out.

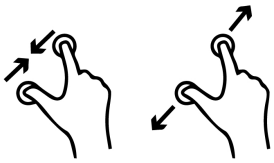


Figura - Pinch gesture

Delete trail

Clears the trace, total input, and deletes the area processed in the current session.

7.5.3 Tools

In the **Tools** option, functions related to perimeter and flag marking are available.

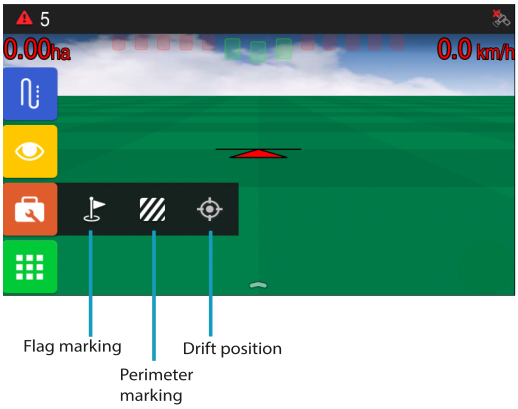


Figure - Tools

7.5.3.1 Flag marking

In the **Tools** option, you can place flag-type markers on the map to Mark the location of obstacles or other points of interest such as rocks, holes, anthills, and wet areas. To do this, proceed as follows:

1. Press on the **Marker** option and then on the **Flag** icon to mark the desired location.

Important	In this option, the system will create the flags grouped in a layer with the default name given by the system. The flag name and color cannot be changed. If you want the flag in a layer with a specific name, you must select it in advance as described below.

To create different layers of markers with specific names, you must create them in advance before using them on the map. To do so, proceed as follows:

1. Press on the **Marker** option and then press the **Manage flag layers** icon;
2. In the layer manager, press option **Create new flag layer**;
3. Insert a new name for the layer and confirm. Example: anthills or holes. The name cannot be changed later;
4. The new layer is not displayed on the list;

Important	When you select the layer, you can see a drawing of the marker which indicates the color that the system associated with the layer. You cannot change the color. For each new layer, a new marker color is associated by the system.

5. Select the layer whose markers you wish to visualize on the field or to which you want to add a new marker and press **OK**;
6. On the operation screen, when you press the **Flag** icon a marker will be placed according to the color of the layer which was pre-selected in the manager.

Important	In the layer manager it is possible to select multiple layers at the same time to visualize all the markers on the Field. However, when you click on the flag icon, only one layer will be edited. The new marker will be created on the layer indicated with the pencil icon.

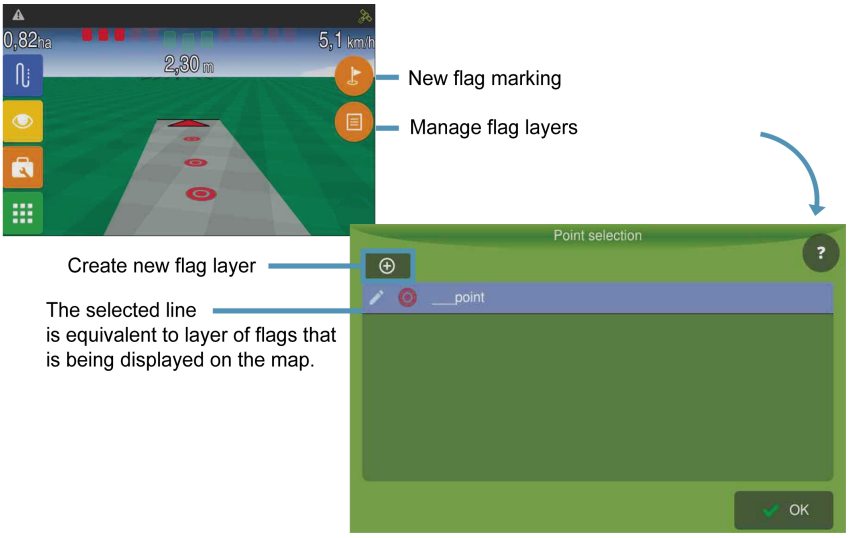


Figure - Flags

Important	It is possible to import/export the flag maps on the file transfer screen. For more information, check the Files chapter.

7.5.3.2 Perimeter marking

On the **Tools** option it is possible to delimit an area's perimeter. In order to do so, proceed as follows:

1. Press the **Perimeter** option and then press the option to **begin** marking;
2. Insert the name of the new **map** and press **OK** to confirm;
3. Inform the **lateral displacement** (m) for marking the perimeter and press **OK** to confirm;
4. The system will begin marking the perimeter;
5. When you finish marking, press the **stop** option;
6. The system will display a message to confirm creating the new map and the option to load it;
7. Press **OK** to load the map.

Important	For positive values, the line is moved outside of the farming machine's marking, and for negative values the line is moved inside the marking. For example, if you are operating a sprayer with an 18-meter bar from inside the field, add nine positive meters so that the sprayer passes over the line at the end of the field.

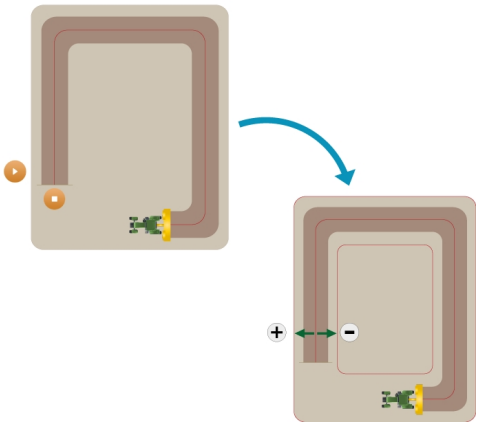


Figure - Perimeter

Important	The display will remove loops made while tracing the perimeter.

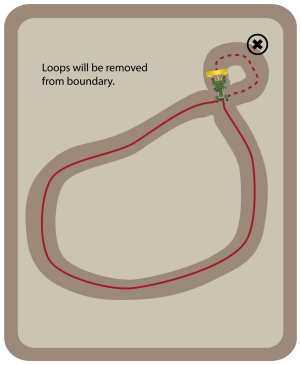


Figure - Removing perimeter loops

7.5.3.3 Drift position

In the **Tools** option, it is possible to use the **Drift position** feature to demarcate a known field position and later use it to sync the GNSS position.

Icon	Description
	New marker
	Position adjustment
	Undo adjustment

Important	In order for the Drift position feature to be available, there must be a GNSS signal.
Important	In order to insert a new marker or perform the adjustment, the vehicle cannot me in operation or in motion.

New marker

To mark a new position, proceed as follows:

1. Position the tractor where you want to add the marker;
2. On the Operation screen, select the **Tools** option;
3. Press the **Drift position** option;
4. Select the **New marker** option;
5. Select **Yes** to confirm the insertion;
6. The system draws a mark on the floor of the operation screen.

Important	Be sure to physically mark the demarcated location (by inserting a stake or other marking medium).

Position adjustment

Important	This option will only be available if there is a previously made mark on the field.

To adjust the position, proceed as follows:

1. Position the tractor on the same physical location on the Field where the marked was inserted;
2. On the Operation screen, select the **Tools** option;
3. Press the **Drift position** option;

4. Select the **Position adjustment** option;
5. The system will correct the GNSS position, bringing the marked to the indicated location.

Important	To use the position adjustment, the vehicle cannot be more than thirty meters from the marker.

Undo the adjustment

Important	This option will only be available in case the used has made a position adjustment.

To undo a position adjustment, proceed as follows:

1. On the Operation screen, select the **Tools** option;
2. Press the **Drift position** option;
3. Select the **Undo position adjustment** option;
4. The system goes back to the GNSS position prior to the adjustment.

7.5.4 Configuration menu

On the **Configuration menu** all the application parameter settings are made available.

Important	To view all the available settings, alter the system mode to **Advanced.**
Important	When you start the system for the first time, only the **Vehicle**, **Implement**, and **Job section** options will be available. In order for the **Guidance**, **Auto steering pilot, Fertilisation control**, **Sprayer control**, and **Planting control** options to be active, it is necessary to activate the display and to register the vehicle and implement.

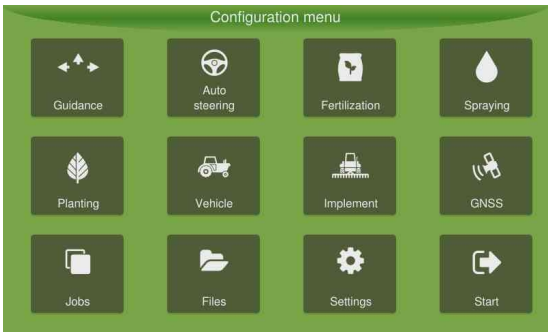


Figure - Configuration menu

Function	Description
Guidance	Guidance settings.
Auto steering	Auto steering settings.
Fertilisation control	Dosage or map settings and calibration of the fertilisation input.
Sprayer control	Dosage and spray nozzle settings.
Planting control	Planting settings.
Bait control	Bait control settings. This shows on the planting button position.
Vehicle	Selection of the vehicle to be used on the operation.
Implement	Selection of the implement to be used on the operation and for performing tests.
GNSS	GNSS settings. Inactive on normal mode.
Job section	Selection of the directory in which to save the data collected by the monitor.
Files	Selection of the location to extract the data and/or insert maps using a pendrive.
System settings	Shows the System settings.
Operate	Enters operation mode.

7.6 Lower bar

Some system features enable a black bar at the bottom of the operation screen, usually displaying the controls and information for using these applications. To access the bar for a feature, proceed as follows:

1. On the **Operation** screen, with one touch, drag the bottom of the screen upwards;
2. The bar will be displayed.

Important	In case the operator is using more than one system feature that includes a bar, the current bar will need to be dragged from right to left in order to view the other feature bar, and so on.

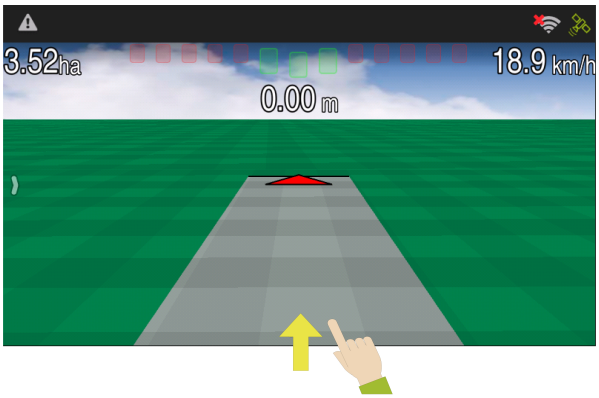


Figure - Drag touch

Figure - Feature bar

The following features/products present a bar:

- Auto steering;
- Bait control;
- Odometer;
- Fertilisation control;
- Planting monitor;
- Sprayer control;
- Machine monitoring.

8. GNSS

The GNSS settings are available on the **Configuration menu – GNSS.**

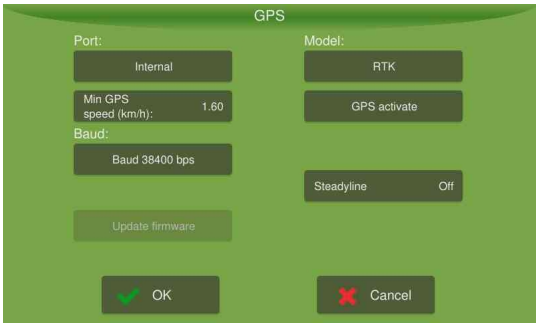


Figure - GNSS

Port

Serial GNSS communication port. Three options are available:

- **Internal:** GNSS internal to the display;
- **External:** external GNSS;
- **Simulator:** for use with the internal GNSS simulator.

Minimum GNSS speed

Enter the speed in which the vehicle will be considered to be in movement.

Model

Select the GNSS model used on your device. The available options are:

- **External GGA:** NMEA external GNSS. Messages provided and recommended frequencies: GGA (highest possible up to 20Hz), VTG (highest possible up to 20Hz), and ZDA (1Hz);
- **External RMC:** NMEA external GNSS. Messages provided and recommended frequencies: RMC (highest possible up to 20 Hz), GGA (1Hz), and ZDA (1Hz);
- **Max7**: L1;
- **NTRIP**: OEM628 with NTRIP;
- **Novatel**: L1 and Glide;
- **Novatel SBAS**: L1+SBAS;
- **OEM7**: L1+L2 and Glide;
- **OEM7 NTRIP**: L1+L2 with NTRIP;
- **OEM7 PPP**: Terrastar-C paid signal;
- **OEM7 PPP BASIC**: Terrastar-L paid signal;
- **OEM7 SBAS**: L1+ SBAS;
- **OEM7 RTK**: L1+L2 with RTK;
- **OEM617**: L1+L2 and Glide, dual antenna;
- **OEM617 NTRIP**: L1+L2 with NTRIP, dual antenna;
- **OEM628:** L1+L2 and Glide;
- **OEM628_PPP**: Terrastar-C paid signal;
- **OEM628 PPP BASIC**: Terrastar-L paid signal;
- **OEM628_SBAS**: RTK (RTCM, CMR, Novatel);
- **RTK:** OEM628 with RTK;
- **Simulator**: simulator (external or internal).

Important	For the **OEM6** and **OEM7** models, the employed correction service is the **TerraStar-C**. Na alarm will indicate that the precision is low in case the service is not synced correctly.

Baud

Important	This configuration will only be available when selecting the following GNSS models: **External GGA, External RMC, RTK, and OEM7 RTK.**

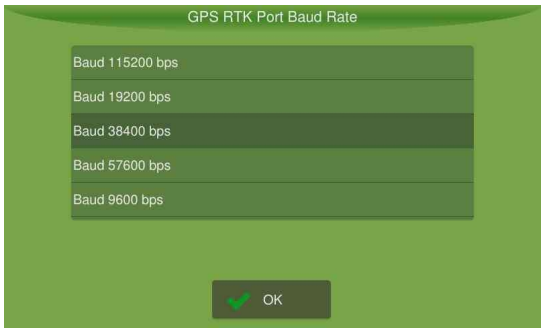


Figure - Baud

GPS simulator

Important	This option will only be available in case the **Simulator** option in the **Model** option is selected**.**

In this option the desired file must be selected to run the simulation. The simulation is shown on the operation screen.

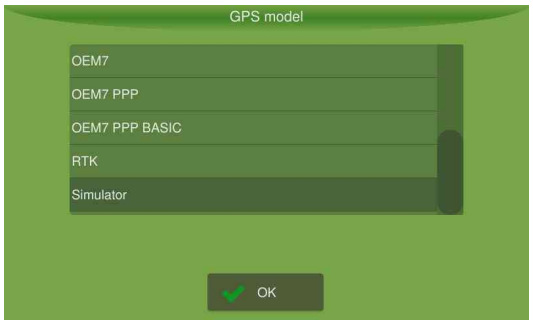


Figure - Models

Activate GPS

Important	This setting is available for all GNSS models except External GGA, External RMC, and MAX7.

Enter the activation code to release GNSS board models:

Figure - Activate GNSS

NMEA output

Important	This setting is only available for the **Novatel** and **OEM** (without RTK correction) GNSS models.

The NMEA output is a serial output that may be used to circulate log messages for the Novatel GNSS, see topic NMEA output.

NTRIP output

Important	This setting will only be available for the NTRIP GNSS models, which in turn are only available for the display Ti7 device.

NTRIP is a RTK service for which the correction is transmitted through the Internet, using the available 3G or Wi-Fi networks. See topic NTRIP.

Firmware update

Important	This setting will be available for all GNSS models except External GGA, External RMC, and MAX 7.

This option is useful for manually updating the GNSS firmware:

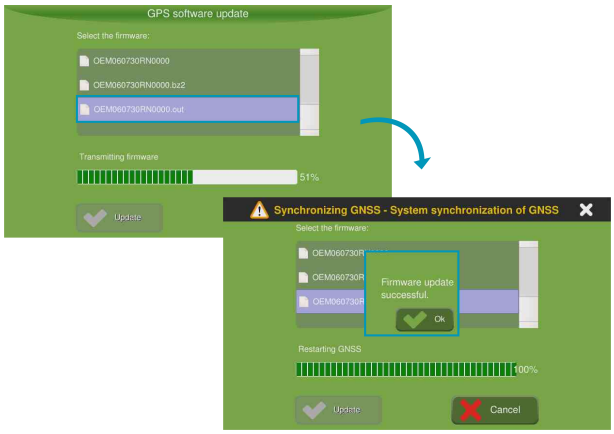


Figure - Firmware update

Important	When the device starts, if there is a firmware update available, the device will ask if you wish to update to the newest version.

Steadyline

Important	This setting will only be available for the GNSS model with RTK/NTRIP.

This option reduces the position jumps that may occur when a GNSS receptor alters the positioning modes. This effect is visible when a receptor switches from a high-precision RTK position solution to a less accurate solution such as PPP (TerraStar), DGPS, SBAS + GLIDE, or even autonomous GLIDE™. Smooth transitions are extremely important for precision farming applications, for which sudden jumps are damaging.

Figure - Steadyline

8.1 NTRIP server

NTRIP is a RTK service in which the correction is transmitted through the Internet, using the available 3G or Wi-Fi network. To activate **NTRIP** support, press the **GNSS** option in the **Settings menu.**

Important	The system mode must be set to Advanced so that the GNSS option is made available.
Important	This option will only be available for the display **Ti7**.

1. In the **GNSS model**, select **NTRIP**;
2. Enter the **User** and **Password**;
3. Enter the **Address** and the **Port**;
4. In **Stream**, the closest correction points will be listed. Select the desired location and press **OK**.

The NTRIP server settings option will become available on the GNSS screen.

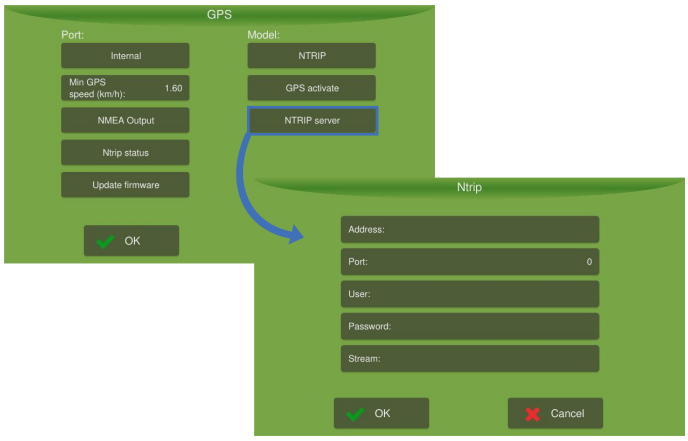


Figure - NTRIP server

Important	The **NTRIP** server is only effective for the display **Ti7** with GNSS OEM628 and OEM617 boards. The RTK needs to be enabled, otherwise an alert will be presented continuously on the operation screen.

8.1.1 NTRIP status

NTRIP status: indicates whether or not NTRIP is connected. If it is disconnected, it informs the reason. The possible states are:

- Connected;
- Connected - intermittent corrections;
- Disconnected;
- Incorrect username or password;
- Incorrect base (or too distant);
- Missing GGA messages;
- Not configured;
- Internal error or no connection.

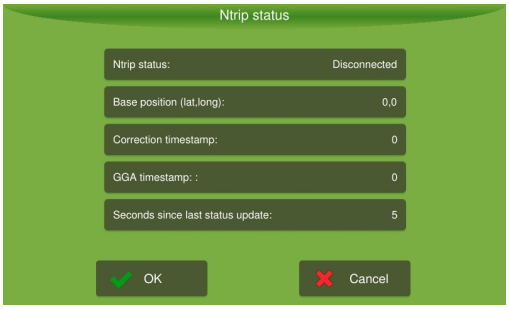


Figure - NTRIP status

- **Base position**

Indicates in which latitude and longitude position the NTRIP base is sending the corrections.

- **Timestamp correction**
  Time of the last correction received from the base.
- **GGA Timestamp**
  Time of the last vehicle position reference sent to the base.
- **Seconds since last update**
  Indicates the number of seconds that have passed since the last Timestamp correction update in regards to the vehicle position.

8.2 NMEA output

The NMEA output is a serial output that may be used to circulate log messages for the Novatel GNSS.

Important	The NMEA output is unavailable for GNSS with RTK correction.
Important	The NMEA output uses the Serial 2 output of the chicoteTi7 display (Connector B), and a suitable cable is required.

To activate this output, proceed as follows:

1. In **Settings menu**, select option **GNSS**;

Important	The system mode should be advanced so that the GNSS option becomes available.

2. In **GNSS model**, select one of the **Novatel** or **OEM** models (without RTK correction);
3. Select the **NMEA output** option that has become available;
4. The system will open the settings screen;

Figura - NMEA output

5. On the **NMEA output** screen, press the **Baud** option;
6. Select the output rate among the predefined values of 4800, 9600, 19200, 38400, 57600, and 115200bps and press **OK**;

Warning	Messages are restricted by the baud so that the port can always transmit messages without loss of characters.

7. Select the output messages that must be sent and their transmission frequency, which will be restricted by the previously chosen *baud*. This will allow external devices to use this data, which have a standardized format, in their operation.

   The message options are:

   - (GP) GGA;
   - (GP) GSA;

- (GP) GST;
- (GP) GSV;
- (GP) RMC;
- (GP) VTG;
- (GP) ZDA.

8. Ensure your information was entered correctly and press **OK.**

Important	The GSV messages send data to at most four visible satellites at a time.
Important	The compatibility module is available for the **OEM** and **Novatel** models.

The **Compatibility mode** is used to transmit the desired GAA correction quality parameter, regardless of the actual correction quality of the GNSS board. It is critical in order to work accurately on third-party devices such as plate traders (Horsch, for example). Generally, planter controllers accept the NMEA signal, which reports the high-precision correction (RTK) quality and stops whenever the system changes to GLIDE.

Figure - Compatibility mode

9. Vehicle

To select a vehicle, proceed as follows:

1. Select the **Vehicle** option on the **Configuration menu**;
2. Select the desired vehicle on the box to the left of the screen;
3. Ensure the settings are correct and press **OK**.

Warning	Incorrect vehicle selection may compromise the entire validity of the work.

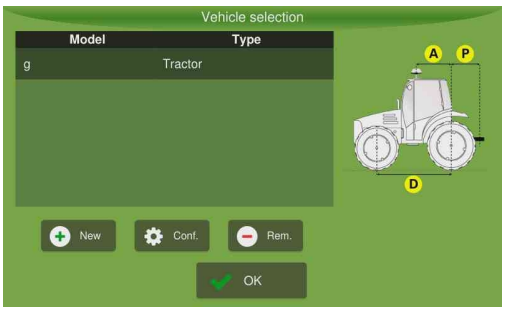


Figure - Vehicle selection

Important	If no vehicles have been created, it will not be possible to access the **Configuration menu** for the auto steering pilot.

9.1 Inserting a new vehicle

Important	Feature available only in **Advanced** mode.

To enter a new vehicle, proceed as follows:

1. Select the **Vehicle** option in the **Configuration menu**;
2. Select option **New**;

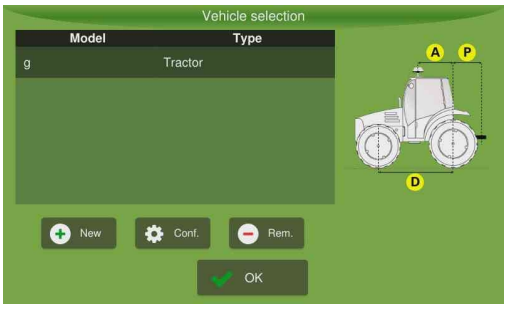


Figure - Entering a new vehicle

3. Select the **Vehicle type** and enter the required settings;
4. Confirm the operation selecting **Save.**

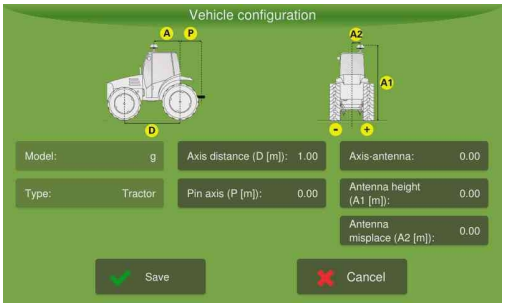


Figure - Vehicle settings

The following parameters must be set:

- **Wheelbase**: distance, in meters, from the center of the rear axis to the Center of the front axis. Fundamental for calculating the control routine.
- **Antenna axis**: distance, in meters, from the center of the rear axis to the antenna. Fundamental to the tilt compensation system, for approaching the line, and for working on the curved guides.
- **Pin axis:** distance, in meters, from the center of the rear pin.

Important	• For the treadmill tractor, the vehicle axis is considered to be at the center of the treadmill. Thus, this should be the starting point for measuring the distances to the center of the pin (P in meters) to the center of the antenna (A in meters); • For the self-propelled, the distance from the axis to the pin equals the distance from the axis to the section closes to the spray bar. In this case, the pin axis in the implement's configuration should be zeroed; • As for the truck, the axis distance equals the distance from the axis to the application line.

- **Antenna height**: distance, in meters, from the ground to the center of the antenna. Fundamental for the tilt compensation system and for line parallelism.
- **Antenna offset**: distance, in meters, from the antenna lateral offset. Fundamental for line parallelism.

Warning	Enter your vehicle measurements in meters. For measurements smaller than one meter, enter the value fractionally. For example, given a 60 centimeter measurement, enter 0.60. Before taking the measurements, ensure the vehicle is in level ground and in straight position, with the center line parallel to the wheels.

9.2 Editing the vehicle

Important	Feature available only in **Advanced** mode.

To edit a vehicle, proceed as follows:

1. Select the **Vehicle** option in the **Configuration menu**;
2. Select the vehicle you wish to edit on the list;
3. Select the **Configuration** option;
4. Alter the desired fields in the **Vehicle configuration** screen;
5. To confirm, select the **Save** option.

9.3 Removing the vehicle

Important	Feature available only in **Advanced** mode.

To remove a vehicle, proceed as follows:

1. Select the **Vehicle** option in the **Configuration menu**;
2. Select the vehicle you wish to remove;

3. Select the **Delete** option**;**
4. Confirm the operation selecting the **Save** option.

10. Implement

Important	Depending on the selected implement, features may be enabled or disabled on the display. For example, when selecting the Guidance, only the Guidance and auto steering pilot features will be enabled (in case there is a vehicle configured).

To select an implement, proceed as follows:

1. Select the **Implement** option in the **Configuration menu**;
2. Select the desired implement in the box to the left of the screen;
3. Ensure the settings are correct and press **OK**.

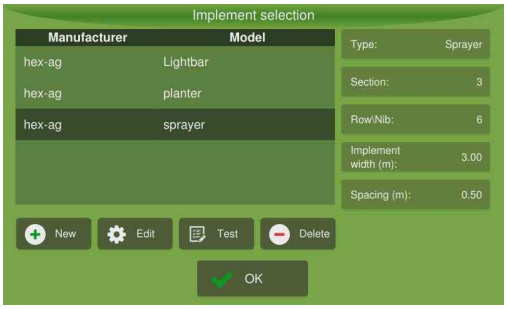


Figure - Implement selection

10.1 Inserting a new implement

Important	Feature available only in the **Advanced** mode.

To enter a new implement, proceed as folows:

1. Select the **Implement** option in the **Configuration menu**;
2. Select the **New** option;
3. Enter the initial implement data, such as **Type**, **Manufacturer**, and **Model** and press Create;
4. Enter the farming implement settings and press **Save.**

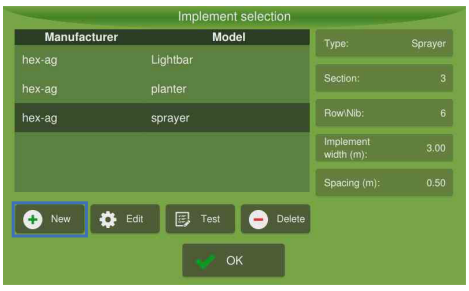


Figure - Entering a new implement

Warning	Enter the implement measurements in meters. For measurements smaller than one meter, insert the value fractionally. For example, given a 60 centimeter measurement, enter 0.60. Before taking the measurements, ensure the implement is in level ground and in straight position.

10.2 Editing the implement

Important	Feature available only in **Advanced** mode.

To edit an implement, proceed as follows:

1. Select the **Implement** option in the **Configuration menu**;
2. Select the implement you wish to edit on the list;

3. Select the **Edit** option;
4. Alter the desired fields;
5. To confirm, select the **Save** option.

10.3 Removing the implement

Important	Feature available only in **Advanced** mode.

To remove an implement, proceed as follows:

1. Select the **Implement** option in the **Settings menu**;
2. Select the implement you wish to remove;
3. Select the **Delete** option;
4. Confirm the operation selecting option **Yes**.

10.4 Testing the implement

To have access to the tests related to an implement, proceed as follows:

1. Select the **Implement** option in the **Configuration menu**;
2. Select the implement you wish to test;
3. Select the **Test** option;
4. The system will present the test options for the selected implement.

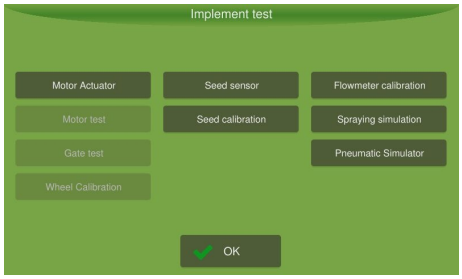


Figure - Implement test

Important	For tests using the implement hydraulic motors, use the motor speed recommended by the manufacturer (e.g.,1800RPM for a tractor) in order to have a minimum 48l/min flow in the hydraulic system.

10.4.1 Motor actuator

Important	In order to be able to run the tests, you must first select the proper implement.

10.4.1.1 Control test and motor test

The purpose of this test is to ensure the hydraulic motors are working properly.

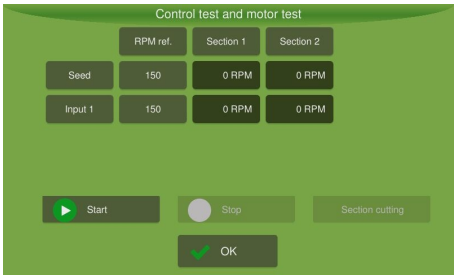


Figure - Motor start test

To perform the test, proceed as follows:

1. Select the **Motor actuator** option;
2. Start the vehicle's hydraulic system and put it in the working rotation;
3. Press **Start**;
4. Decrease the reference value until the value read no longer coincides with the established value. The read value is the **Minimum RPM** value;
5. Increase the reference value until the value read no longer coincides with the established value. The read value is the **Maximum RPM** value;
6. Check if the readings are compatible with the reference;
7. Press **Stop** to finish.

10.4.1.2 Section cutting

The purpose of this test is to check the section opening and closing operation.

Important	Test available only for planters equipped with clutches.

To perform the test, proceed as follows:

1. Select the **Motor actuator** option;
2. Select the **Section cutting** option;
3. Press **Start**;
4. Press the buttons to check the operation: **Open all**, **Close all;** or
5. Individually select each section you wish to turn on and off by pressing the respective numbers;
6. Press **Stop** after ensuring they are operating properly.

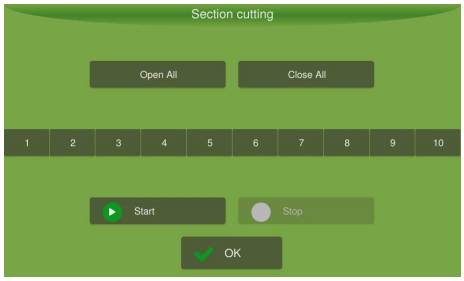


Figure - Section cutting

10.4.2 Seed sensor

Important	To be able to run the tests, you must first select the proper implement.

The purpose of this test is to check or install the inputs and modules connected to the sensors. They are available in two modes:

- **Test**

  Used to check if the lines are properly connected to the module ports, starting the sensors by passing seeds or fertilizer.
- **Installation**

  Used for the semi-automatic configuration of the inputs connected to each seed and/or fertilizer sensor.

10.4.2.1 Test mode

To perform the test, proceed as follows:

1. Select the **Seed sensor** option;
2. Select the **Restart** option;
3. Put seed or fertilizer so to start the sensor and check which input, module, and line was activated;
4. Check if it is correct.

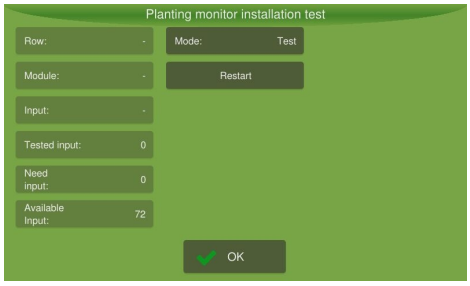


Figure - Planting monitor installation test

10.4.2.2 Installation mode

To perform the installation mode test, proceed as follows:

1. Select the **Planting sensors** option;
2. Press the **Mode** box (item 01) to alternate to **Installation**;
3. Check if the box indicates **Seed** (item 02);
4. Press **Start** (item 03);
5. The number of the line where the sensor must start will be indicated;
6. Insert at least three seeds on the line. The module input to which the sensor is connected will be automatically identified;
7. After the line test is finished, the next line will be presented for testing and so on.

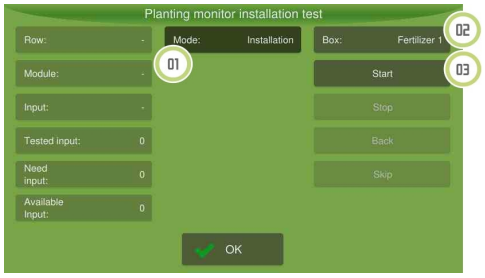


Figure - Planting monitor installation test

10.4.3 Flowmeter calibration

Important	In order to be able to run the tests, you must select a **Sprayer** implement or a **Seeder** with liquid control.

The purpose of this test is to check the flow meter calibration or to enter the flowmeter constant according to manufacturer data.

Important	Ensure you set the reference to a value within the system's operation range.

To run the test, proceed as follows:

1. Select the **Flowmeter calibration** option;
2. Configure the **Reference (PPS)** with the average work pressure for the used spray nozzle. For example, if you are using a spray nozzle that works from 2 to 6 BAR, adjust the PPS for reading 4 BAR in the gauge;

Important	In case you do not know the average work pressure for the spray nozzle, use the **Sprayer simulation** to find out.

3. Put the sprayer in working rotation and place the container in the correct position;
4. Adjust the time using the arrows and press **Start**;
5. The system will issue a calibration start alert and star counting the test time;
6. Check if the value read on the flow meter during calibration is close to the reference value;
7. After the test time is over, the system will close the sections automatically;
8. Inform the **Volume** in **Liters** to the display by multiplying the value collected from one nozzle (or the average value in case you use multiple nozzles) by the total number of nozzles;
9. The display will inform the **Ratio (PPL)**.

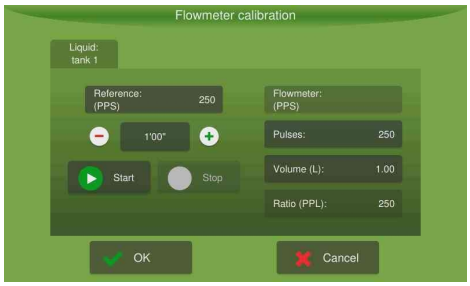


Figure - Flow meter calibration

10.4.4 Seed calibration

Important	In order to run the tests, you must first select the proper implement.

The purpose of this test is to check:

- The operation of the hydraulic seed dosing motors;
- Wheel speed; and
- The correct detection of the number of seeds on each line.

To run the test, proceed as follows:

1. Select the **Seed calibration** option;
2. Enter the RPM **Reference** for the hydraulic motors;
3. Select the **Section number** that will be active during the simulation;
4. Select the section number of the wheel that will be used as speed reference;
5. Press **Start**;
6. Check if the counters and the motors are working properly;
7. Press **Stop**;
8. Check if the number of seeds read by the sensor and the amount collected are the same;
9. In case the values diverge more than 5%, adjust the value in **Sensor adjustment (%)**, informing the calculated percentage difference. Use the following formula for calculation:

$$\textbf{Sensor adjustment (\%)} = [(\underline{\text{Seeds collected}}) - 1] \times 100$$

(Seeds read)

Figure - Seed calibration

10.4.5 Sprayer simulation

Important	In order to run the tests, you must first select the proper implement.

The purpose of this test is to check the opening and closing of the section valves. The test screen simulates a sprayer in motion, enabling to check:

- The operation of the flow meter (reading);
- The dosage control given the speed variation; and
- The minimum and maximum flow rates for the spray nozzle used (operation limits).

To run the test, proceed as follows:

1. Select the **Sprayer simulation** option;
2. Enter the **dosage** value (L/ha);
3. Turn the water pump on and put the sprayer in work rotation;
4. Press **Start**;
5. Open and close one section at a time in order to check if all the valves are working properly, checking if the start order and the opening/closing logic are correct;
6. Set the reference value to **0 PPS** and gradually increase it, checking if the **Flowmeter (PPS)** follows, until the gauge in the hydraulic command indicates the minimum pressure value for the used spray nozzle or until the range of application is satisfactory;
7. Repeat the process from the minimum value until the gauge indicates the maximum pressure value or until the range of application is satisfactory, checking if the **Flowmeter (PPS)** follows the reference;
8. In case the speeds (km/h) are incompatible, change the nozzles for others with different flow rates.

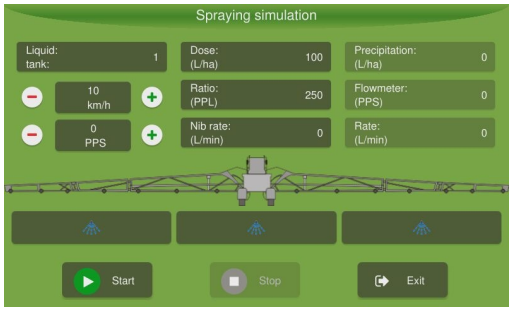


Figure - Sprayer simulation

Important	Since the system flow rate is different for each type of nozzle, this procedure must be repeated every time there is a nozzle change.

10.4.6 Bait control test

Important	In order to run the tests, you must first select the appropriate implement.
Important	Before performing the bait control test, it is necessary to set the dosage values (small, medium and large) on the screen of the Bait control, located in the Configuration menu.
Important	The sensors displayed on the Bait control test screen are related to the settings previously made in the Bait control configuration.

The test screen of the bait control implement is used to verify the application of the dosages configured and the response of the respective sensors.

If the operator clicks the **Systematic dosage** button, the amount of formicide that has been configured for the system to be applied in an automated manner will be released. If you have enabled the use of sensors 1 and 2 in the Implement configuration screen, you will be informed of the detection of the triggering of these sensors.

For the other buttons, the amount of formicide configured for the localized application. Small, Medium and Large dosages will be released. By clicking on each sensor, the sensor is informed (if it exists).

If the implement has been configured with an applicator and unique sensor for localized dosing, "M Sensor" detection will be displayed. If the implement does not have a unique applicator and has Sensors 1 and 2, the detection of these sensors will be displayed.

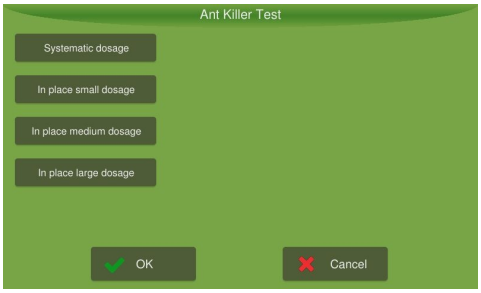


Figure - Bait control test

11. Guidance

The navigation aid systems allow input economy and better use of the work area, once they minimize the overpass during input application and culture treatments.

They have the following work precisions up to 95% of the time:

Use this setting	For
GNSS L1 - GPS+Glonass	28 cm (15 min each pass)
GNSS L1/L2 - GPS+Glonass	15 cm (15 min each pass)
GNSS L1/L2 with TerraStar	4 cm (absolute)
RTK	2 cm (absolute)

11.1 Settings

The following settings are available:

- Width (in meters);
- Sensitivity (in meters);
- Side overlap (in meters);
- Activity overlap: Yes or No;
- Overlap rate (%);
- Wayline settings;
- Reverse detector;
- Odometer: On or Off;
- Perimeter;
- Erase perimeter;
- Coverage info outside map.

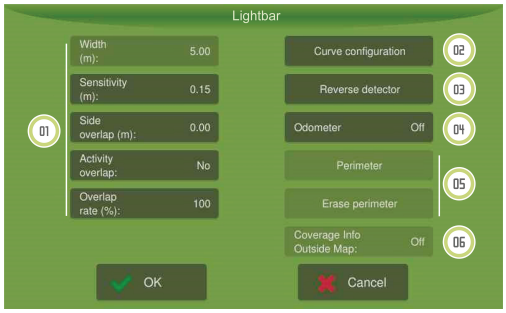


Figure - Guidance

11.1.1 Parameters

To alter the light bar parameters, proceed as follows:

1. Access the **Guidance** option from the **Configuration menu**;
2. Select the parameter you wish to alter;
3. Enter the desired values;
4. Press **OK** to confirm the operation.

The following parameters are available for setting:

- **Width (in meters)**
  Indicates the width of the stride according to the selected implement.

Important	This parameter can only be altered here for the Guidance product. For the others products, the width must be altered directly on the implement's settings.

- **Sensitivity (in meters)**
  Specifies the offset required for a LED in the light bar to light up. This value is associated with the five LEDs in the center of the light bar. For the other LEDs, the on-board computer divides the rest of the stride width among each LED. To increase sensitivity, decrease the spacing and to decrease sensitivity, increase the spacing. Example: to enter a 15 centimeter sensitivity, enter 0.15.

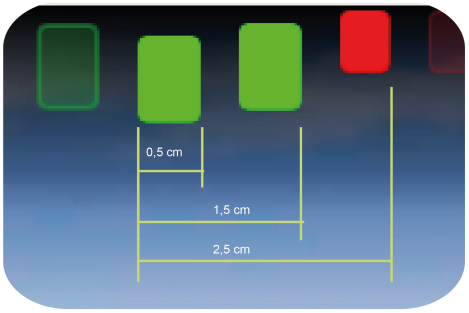


Figure - Lightbar sensitivity

- **Lateral overlap (in meters)**
  Overlap the application (reassemble). Used mainly in sprayer implements.

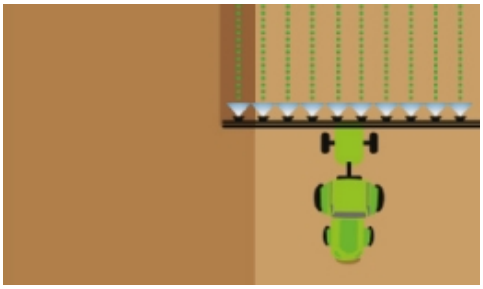


Figure - Lateral overlap

- **Activity overlap (Yes or No)**
  Reapplies to an already treated area, overlapping the activity on the application map. For example, if an implement passes over an area where it has already been applied, it does not shut off and continues application normally, thus overlapping application in that area.

- **Overlap rate (in %)**
  The **Overlap rate** parameter is only enabled when the **Activity overlap** is set to **No**. Insert the overlap percentage needed for the application or a section shuts off automatically. For example, if the overlap rate is adjusted at 50% and the section has a 4-meter length, when 2m of overlap are reached, the implement will shut off. The **Overlap rate** is calculated based on the implement width.

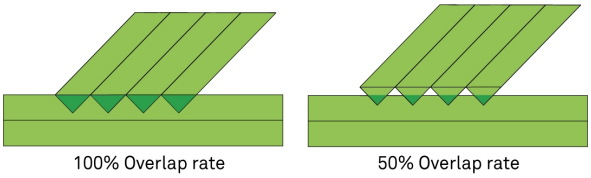


Figure - Overlap rate

Important	The **Overlap rate** parameter must be set even if **No** is selected for the overlap, because there is an acceptable rate that the implement cannot avoid so that it can detect that it is over an

	already treated area.

11.1.2 Wayline settings

This screen is divided into two types of settings. It contains the settings for saving the guide in the operation, and also for the parameters used for curves and maneuver detection, as described in the following topics.

11.1.2.1 Save mode

The type of guide saving must be previously defined. To define the way the guides are saved, proceed as follows:

1. Select the **Guidance** option in the **Configuration menu**;
2. Select the **Wayline settings** option.

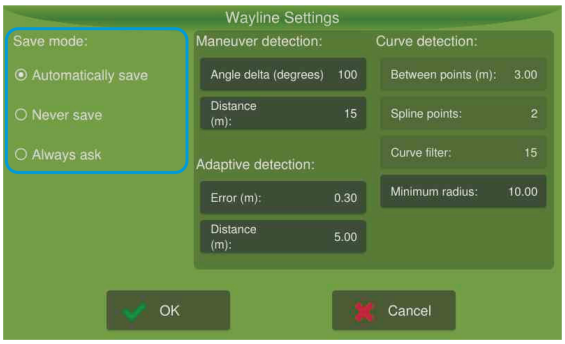


Figure - Save mode

The following saving options are available:

Automatically save
By selecting this option, the system will automatically save the guide without asking the user for a name. A name is given by the system comprising a numeric system containing the date followed by other numbers.

Never save
By selecting this option the system will never save the created guide. This way, the guide will be available for saving as a temporary guide.

Always ask
By selecting this option, the system will always ask if you want to save the guide. An option to edit the filename will open and you will be able to save the guide.

11.1.2.2 Curve configuration

To change the **Curve configuration,** proceed as follows:

1. Access the **Guidance** option in the **Configuration menu**;
2. Select the **Wayline settings** option;
3. Enter the desired values for the curve configurations;
4. Press **OK** to confirm the operation.

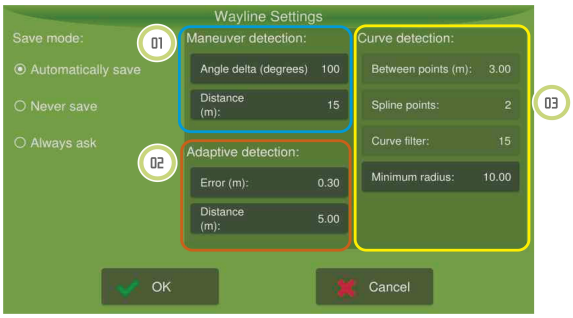


Figure - Wayline settings

The following parameters are available for setting:

01 - Maneuver detection

The maneuver detection settings affect how the device detects that the vehicle has performed a **U** movement to exit a guide line and enter another. This detection is used to automatically determine modifications to the adaptive guide, thus saving operator actions.

- **Angle delta** (degrees): determines the vehicle direction variation relative to the guide line needed to characterize exiting that guide line.
- **Distance** (meters): is the limit to the **U** movement distance that can be removed automatically.

For example, the display will consider that the operator finalized capturing the adaptive curve and will generate new lines based on the new reference as soon as the vehicle direction varies more than 100 degrees (delta angle) in the last 15 meters (distance).

It is important to note that the course during the **U** movement will automatically be removed and will not be present in both the modified guide line and its parallel lines.

02 - Adaptive detection

Important	The process of modifying the current guide line when an adaptive guide line is used requires the operation to be enabled. If it is not, the process will never begin. If it is disabled after modification begins, it will be finalized and incorporated into the current guide line and its parallels.

- **Error** (meters): expected error to consider capturing a new line.
- **Distance** (meters): distance to consider capturing a new line.

Situation 1

For the **adaptive detection**, the operator enters the parameters used to begin and end capturing a new modification of the adaptive curve. For example, using the data in the figure, as soon as the operator drives over 5m (**Distance**) with an error lower than 0.3m (**Error**), the approximation to the guide line will be classified as successful and the display will begin capturing the modification of the guide line.

Situation 2

However, this will not be visible to the operator yet. After this initial stage, if the vehicle drives over 5m (**Distance**) with an error larger than 0.3m (**Error**), the user's intention of modifying the current guide line will be detected and the new trajectory will be visible along with the old guide line.

Situation 3

If the vehicle drives over 5m (**Distance**) with an error lower than 0.3m (**Error**), it will be detected that the operator deviated from an obstacle and wished to return to the old guide, so the capture will be finalized and the guide line will be modified, as will its parallels.

03 - Curve detection

Parameters for filtering (pilot navigation) and smoothing the guide lines obtained when using adaptive guides and curves.

- **Between points**

For this parameter, instead of using all the saved points to generate the reference path, the display will generate a smoother path by keeping a distance between consecutive points as indicated in the **Between points** field. High values may prevent closed curves (small radii) from being considered when generating the final path.

Important	The value of this parameter will only be considered when the **Activate distance filter** option is selected.

- **Spline points**

This parameter smoothes the final trajectory by inserting intermediary points on the curve to be shown to the operator. The value does not affect the pilot's behavior, however increasing it causes a larger processor load and slowness in calculating the parallel lines. The recommended value is 3.

- **Noise filter**

With this parameter the final path is smoothed by eliminating noise and vibrations obtained while capturing the desired guide. Reducing this value will yield a smoother path, which will make the pilot perform softer maneuvers as well. However, the path may be different from expected. Increasing the value, the filtration is reduced, yielding a path closed to the actual points obtained while capturing the guide. However, noise and vibrations in the points will not be removed, which may result in abrupt maneuvers.

Important	The value for this field will only be considered when the **Activate noise filter** option is selected. Typical values vary between 10 and 20.

- **Minimum radius**

This value corresponds to the smallest curve radius that can be comfortably made without causing damage to the vehicle or implement. In this field you can enter a radius value more appropriate for your vehicle. For example, in generating a new curve, in case there is a trajectory with a radius smaller than this value, the display will smooth the affected area to make it possible for the pilot to pass.

Important	Check the vehicle's manual for the smallest radius allowed. The minimum allowed for this field is 1.00, and a typical value is around 10.00.

- **Activate distance filter**

If this option is enabled, the device will take into account the **Between points** value, otherwise it will be ignored.

- **Activate noise filter**

If this option is enabled, the device will take into account the **Noise filter** value, otherwise it will be ignored.

11.1.3 Reverse detector

Enable this function for the display to automatically detect when the vehicle is in reverse.

Warning	For using the automatic pilot, the reverse detector must be activated.

To alter the automatic reverse detection settings, proceed as follows:

1. Access the **Guidance** option from the **Configuration menu**;
2. Select the **Reverse detector** option;
3. Press the **Detect reverse** option to alternate between **Yes** and **No**;
4. Press **OK** to confirm the operation.

Origin: pilot or display.

In case you want to inform the display that the reverse direction is inverted, simply select the **Invert direction** option.

Important	It is recommended to keep the **Reverse detector** active for correctly marking the trail.

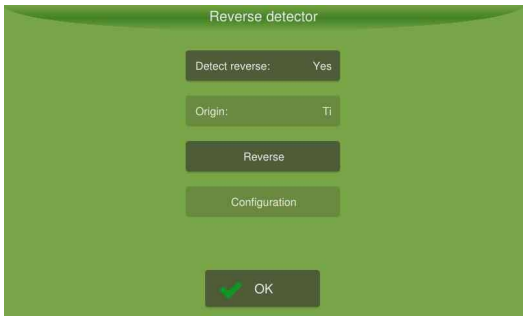


Figure - Reverse detector

On the operation screen, while the display detects reverse, a red backwards arrow will show. When the display is detecting forward movement, a green forward arrow will show for ten seconds, as shown in the figure below.

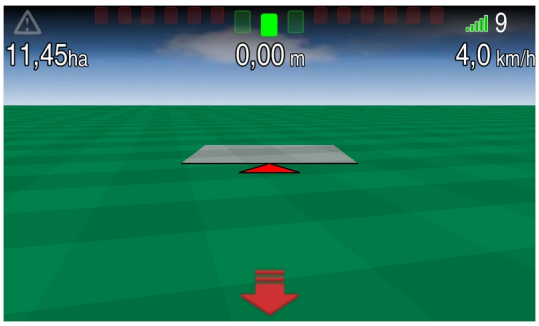


Figure - Reverse detector in operation

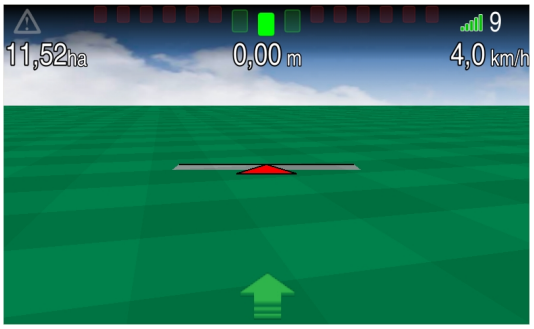


Figure - Operation

Warning	If the implement is performing the opposite motion to that indicated by the arrows on the screen, the operator must simply press the arrow to indicate that the movement is inverted. The occurrence of a false movement is more common at first GNSS syncing or after the vehicle has been stationary for a long time. However, it can occur even with the vehicle in motion.

11.1.4 Odometer

The **Odometer** function is intended to measure the distance traveled by the vehicle using the GNSS positions and allows controlling the applied area by loading maps into the system.

In sugarcane mills, for example, it is used to control the stretch of the vinasse hoses, avoiding the need for markers (flags) and eliminating the risk of breakage. To enable or disable the odometer, proceed as follows:

1. Access the **Guidance** option from the **Configuration menu**;
2. Select the **Odometer** option to alter between **On** and **Off**;
3. Press **OK** to confirm the operation.

Important	To learn how to use the odometer and its features in operation, check topic Monitor the operation.

The odometer's function is to measure the distance traveled. The number that shows indicates the distance already traveled by the vehicle and the range below shows the relation between traveled and total distance. The range will be green while the distance is normal, yellow when the traveled distance reaches the alert range and red when the distance exceeds the maximum limit. Pressing the alarm icon (bell), the operator may indicate the distance for which an alert is emitted. Pressing the ruler length icon (ruler), the operator may indicate the total route distance. The reset icon zeros the odometer to start over.

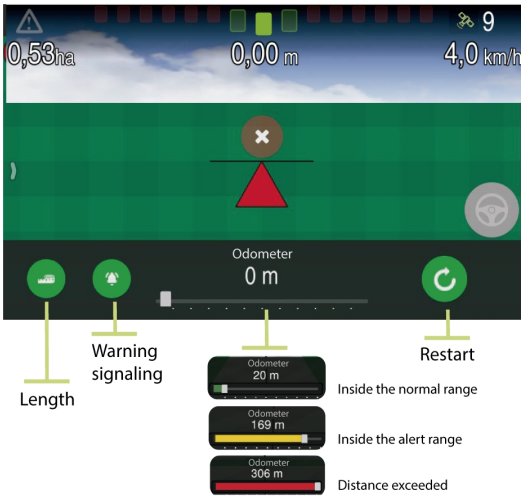


Figure - Fertilization operation

11.1.5 Perimeter

The **perimeter** function is used to load the saved perimeters.

Important	In order for the **Perimeter** and **Clear perimeter** options to be enabled, the **Guidance** option must be selected first. The **perimeters** are saved through the operation screen, on the **Tools** menu.

To load a perimeter, proceed as follows:

1. Access the **Guidance** option from the **Configuration menu**;
2. Select the **Perimeter** option (item 01);
3. Among the items available, select the perimeter you wish to load (item 02);
4. Press **OK** (item 03);
5. Press **OK** to confirm the operation.

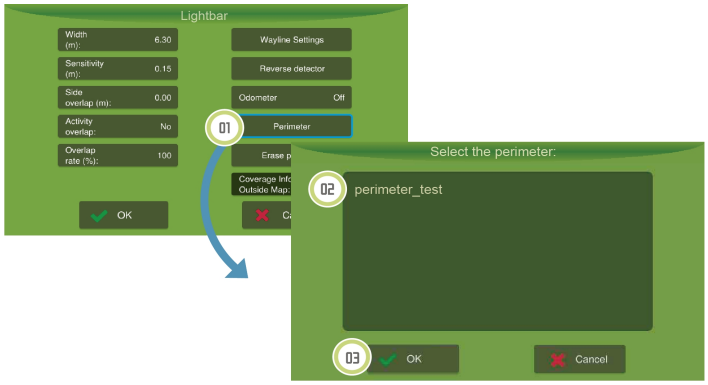


Figure - Select perimeter

To clear the loaded perimeter, select the **Clear perimeter** option.

11.1.6 Coverage info outside map

The **Apply off the map** function is used to load previously saved perimeters.

Important	In order for the **Perimeter** and **Clear perimeter** options to be enabled, the **Guidance** option must be selected first. The **perimeters** are saved through the operation screen, on the **Tools**

	menu.

Para carregar um perímetro, proceda da seguinte forma:

1. Access the **Guidance** option from the **Configuration menu**;
2. Select the **Apply off the map** option to alter between **On** and **Off**;
3. If it is on, the device will not stop application when the vehicle leaves the delimited perimeter;
4. If it is off, the application will be suspended automatically when the vehicle exceeds the perimeter limit.

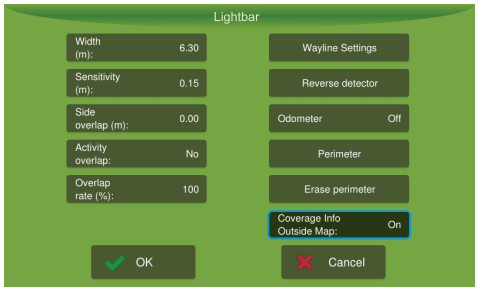


Figure - Apply off the map

11.2 Operation

The operation is started by selecting the suspended operation option in the center of the operations screen.

Important	The application will only begin when the implement moves and exceeds the minimum speed set for the GNSS.

Select the type of operation you desire, see the available types on the following topics.

11.2.1 Creating a guide line

Important	Before starting the operation, it is important to ensure the vehicle and implement dimensions are correct.
Warning	In order for the guide to work properly, the GNSS must be operating properly. Do not start while the “GNSS Syncing”, “GNSS without communication”, “No Glide”, or “No RTK” alert show, or while the device is connected to less than four satellites.

Guidance types are used to define a guide line in the field. Display operates with:

- Parallel line;
- Parallel curve;
- Adaptive curve;
- Pivot;
- Line A + Angle.

Warning	To set the way of saving the guide, visit topic Guide settings.

11.2.1.1 Parallel line

The A-B linear trajectory is used to define a line in the field to which all work lines will be parallel.

Configuring trajectory

Icon	Description
	Guide

	Parallel line
	Point A
	Point B

To draw the guide line, proceed as follows:

1. On the operation screen, select the **Guide** option on the left side menu;
2. Select the trajectory mode as **Parallel line**;
3. Position your vehicle on the field over the point where you wish to start and press **Point A** to mark the beginning of the line;
4. Drive until the desired end point on the field and press **Point B** to mark the end of the trajectory.

Warning	The smallest distance between points of line A-B is of 30 meters.
Important	You can cancel a guide creation by selecting the option with an “X” at any time.

At the end of this procedure, the reference line 0 (zero) is created, as well as the parallel lines on both sides of the reference. Lines to the right will be positive (+) and lines to the left will be negative (-). Consider that point A is behind the vehicle and point B is ahead. Even if you do not drive straight between points A and B, the references to this guide will be taken only from two points marked.

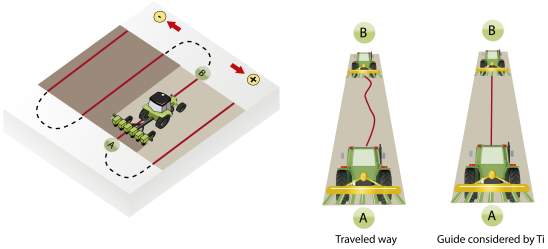


Figure - A-B line

11.2.1.2 Parallel curve

Parallel curve A-B is used when you wish to work on an area with smooth curves. This option stores the actual trajectory you made between points A and B, instead of creating a straight line between them. All following guide lines will be parallel to the original curve. The current curve and the parallel curves immediately to the right and to the left are shown

Configuring trajectory points

Icon	Description
	Guide
	Parallel curve
	Point A
	Point B

To draw the guide, proceed as follows:

1. On the operation screen, select the **Guide** option on the left side menu;
2. Select the trajectory mode as **Parallel curve**;

3. Position your vehicle on the field over the point where you wish to start and press **Point A** to mark the beginning of the curve;
4. Drive to the desired end point on the field and press **Point B** to mark the end of the trajectory.

Warning	The smallest distance between points A and B is of 30 meters.

Warning	In case reference curve A-B intersects with itself, a closed circuit will be created with the curve inside the intersection.

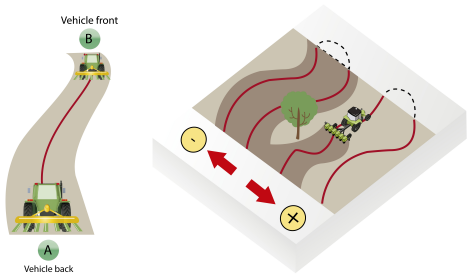


Figure - Parallel curve

11.2.1.3 Adaptive curve

The adaptive curve pattern provides guidance along the curve and updates the orientation after each curve considering the deviations that have been made. To record a deviation, it is necessary to be inside the set adaptive detection requirements. The device continuously records the course and provides guidance to match the last course performed.

Configuring trajectory points

Icon	Description
	Guide
	Adaptive curve
	Point A
	Point B

To draw the guide line, proceed as follows:

1. On the operation screen, select the **Guide** option on the left side menu;
2. Select the trajectory mode as **Adaptive curve**;
3. Position your vehicle on the field over the point where you wish to start and press **Point A** to mark the beginning of the curve;
4. Drive to the final desired point on the field and press **Point B** to mark the end of the trajectory.

Warning	The smallest distance between points A and B is of 30 meters.

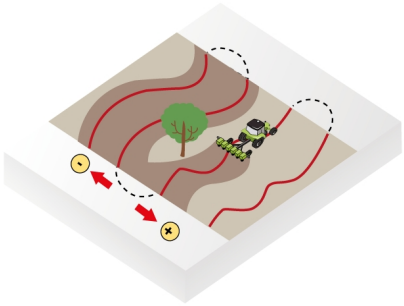


Figure - Adaptive curve

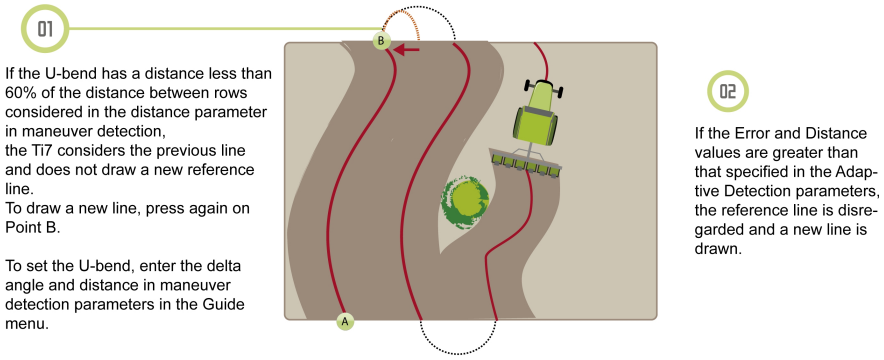


Figure - Adaptive curve considerations

11.2.1.4 Pivot

Use the pivot guidance mode in areas that use central pivot irrigation. With this option, the work lines are concentric circles defined by three route points.

Configuring the trajectory points

Icon	Description
	Guide
	Pivot
	Point A
	Point B
	Point C

To draw the guide, proceed as follows:

1. On the operation screen, select the **Guide** option on the left side menu;
2. Select the trajectory mode as **Pivot**;
3. Position your vehicle at the beginning of the curve trajectory;
4. Press **Point A**;
5. Drive to route point B and press **Point B**;
6. Drive to route point C and press **Point C**.

Figure - Pivot

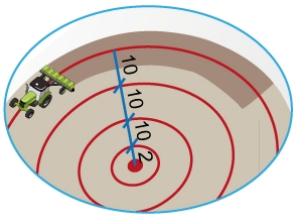


Figure - Curve generation

Points A, B, and C may be pressed at any point in the circumference. Parallel circumferences are generated from the one determined by the points ABC, according to the implement width.

11.2.1.5 Line A + Angle

The Line A + Angle trajectory is used to define a line in the field to which all work lines will be parallel and is defined through an initial route point and an angle with north or with an existing guide.

Configuring trajectory points

Icon	Description
	Guide
	Line A+Angle
	Point A

To draw the guide line, proceed as follows:

1. On the operation screen, select the **Guide** option on the left side menu;
2. Select the trajectory mode as **Line A + Angle**;
3. Position your vehicle on the field over the point where you wish to start;
4. Press the **Point A** to have access to the configuration screen for the reference angle;
5. It is possible to chose as reference guide North or a previously saved guide;
6. If you choose north as the reference, it is necessary to inform the deviation angle for creating a new guide. The angle is a value from 0 to 360, where 0 points to the North;
7. If you choose the existing guide field, it is necessary to choose one of the listed guides and then enter the deviation angle for creating a new guide. The angle is a value from 0 to 360, where 0 refers to the chosen guide;
8. Press **OK**.

Important	The saved guides that may be used as reference are only those of type Parallel line A-B.

At the end of this procedure, a reference line 0 (zero) is created, as well as parallel lines in both sides. Lines to the right will be positive (+) while lines to the left will be negative (-).

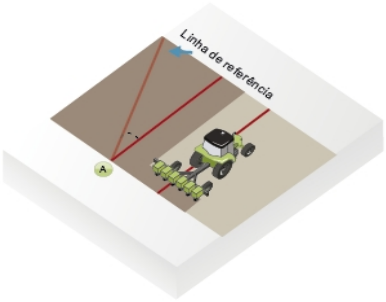


Figure - Line A + Angle

11.2.2 Working with an active guide

Important	The Realign, Nudge, and Unload active guide options will only be visible when a guide is loaded onto the field.

Icon	Description
	Realign
	Nudge
	Unload active guide

11.2.2.1 Realign

The GNSS system is subject to information variation. It is recommended to use the **Realign** function if, after pausing the operation for a while, the guide does not show the same location as before when you start over again. The **Realign** function transfers the line over the point where the antenna/vehicle is, aligning it with the guide (zero error). To perform a realignment adjustment, proceed as follows:

1. With the guide active, click on icon **Realign**;
2. The guide is adjusted according to the vehicle's antenna position.

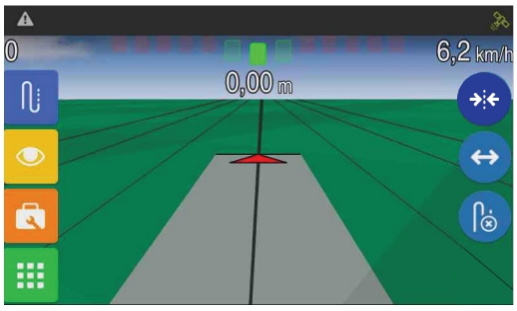


Figure - Realign

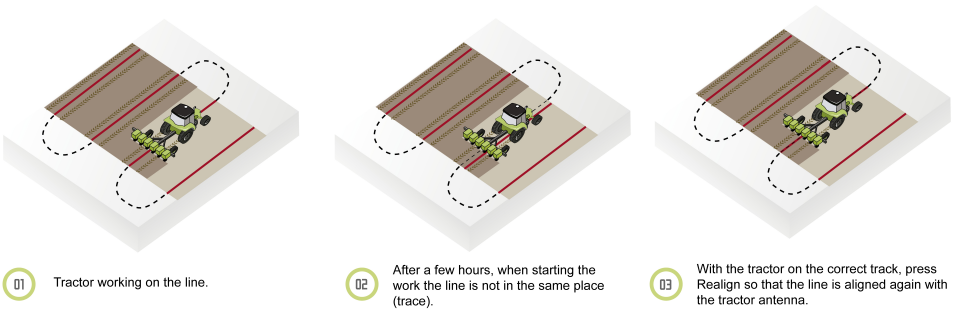


Figura - Realign proceedure

11.2.2.2 Nudge

Field displacement is used to move the line 2cm at a time to the right or to the left. It is recommended when it is necessary to make a fine adjustment to the line that may have dislocated.

To displace the field guide, proceed as follows:

1. With the guide active, press option **Field displacement**;
2. Arrows for adjusting the displacement will be presented on the top of the screen;
3. Press the arrows for the desired direction.

Important	Each time the arrow is pressed, the line is moved 2cm to the chosen side.

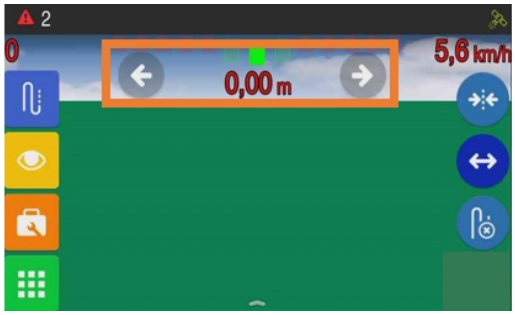


Figura - Nudge

11.2.2.3 Unload active guide

This field is used to unload a guide that is active.

Important	This button does not delete the guide from the system, it only unloads it from the field so that the user can create a new guide or load another one from the **Guide manager.**

To unload a guide from the field, proceed as follows:

1. With the guide active, press the **Unload guide** option;
2. An option asking if you wish to deactivate the guide will be shown;
3. Select **Yes** to confirm the operation.

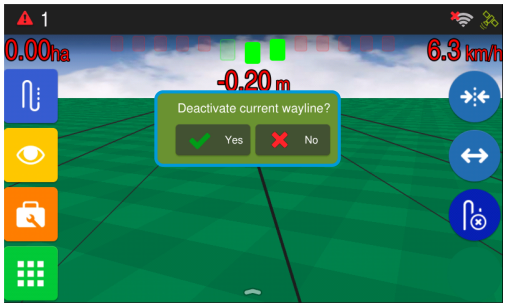


Figure - Unload guide

11.2.3 Managing guides

The **Wayline management** screen allows managing some functions, such as:

- View information on a guide;
- Load a previously saved guide to the field;
- Save a temporary guide. See topic Save guide;
- Import a guide. See topic, Import guide;
- Export a guide. See topic Export guide;
- Edit a guide's name. See topic Edit a guide's name;
- Delete a guide. See topic Delete guide.

Guide list

On the management screen it is possible to visualize the list of guides that have been created in all work sessions on the same field.

Important	All guides created for the same field from the current work session are visible, so it is possible to use a guide saved in another work session but for the same physical location.

When selecting a guide from the list, the system presents the following information on it:

- Guide name;
- Name of the farm where the guide was created;
- Name of the field where the guide was created;
- Guide type;
- Data of creation of the guide.

By clicking on the **View details option**, you are able to preview the guide according to its type (curve, angle, or pivot, for example). On the list it is possible to recognize the **Active guide** on the field through the icon marked with a lightning image.

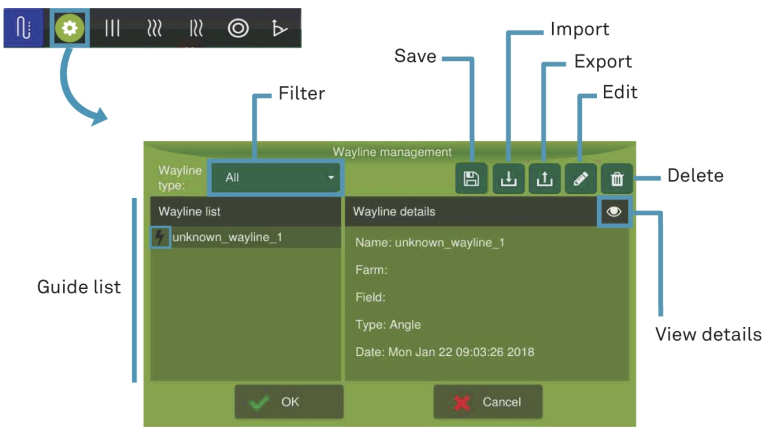


Figure - Guide management

The visualized guides may be filtered by **Guide type**:

- Curve;
- Linear;
- Pivot;
- Angle;
- Adaptive;
- Line map.

Important	Line maps are not created through the operation screen. They are only available on the list through guide importing. See topic Import guide.

Line map

Guides of type **Shape file** actually correspond to a set of lines known as a **Line map**. On the on-board computer, the map can only appear through importing and can be externally created in three ways:

- It can be created in an office using a specific software;
- It can be created by exporting a guide from the on-board computer that the user exported in a **Line map** format. See topic Export guide;
- It may be a guide created in an on-board device from a manufacturer other than Hexagon Agriculture. In this case, if there is incompatibility, the guide is imported as a **Line map**.

To learn how to import a **Line map** to the on-board computer, check topic Import guide.

11.2.3.1 Save guide

Important	This feature will only be available if the selected guide is temporary.

When a new guide is created, if the used had selected guide saving options **Never save** or **Always ask** and denied saving the guide, it will still be available in the **Wayline management** as a temporary guide and the user will have a chance to save it again.

Important	While the active guide is not saved, it can be accessed as a temporary guide. However, in case a new guide of the same type is created, the previous temporary guide will be lost and replaced by the new one. The system allows one temporary guide of each guide type. To ensure you can access it again, save your temporary guide.
Warning	When you try to save a guide with the same name as a previously saved one, you will be asked if you wish to overwrite it.
Important	To configure the way of saving guides, visualize top Managing guides.

Icon	Description
	Guide
	Guide management
	Save

To save a temporary guide to the system, proceed as follows:

1. On the operation screen, select the **Guide** option followed by **Wayline management**;
2. Select the temporary guide you wish to save from the list of guides;
3. Select option **Save**;
4. Edit the temporary guide's name;
5. Press **OK** to confirm.

Figure - Save guide

11.2.3.2 Import guide

In this option it is possible to import guides to display to use them at a later time.

Icon	Description
	Guide
	Guide management
	Import

To import guides through the **Guide manager**, proceed as follows:

Important	First insert the pendrive with the guide(s) you wish to import.

1. On the operation screen select the **Guide** option followed by **Guide management**;
2. Select option **Import**;
3. he system will show the pendrive files that can be imported;
4. Select the desired files and press **OK** to confirm;
5. Wait for the progress bar to finalize importing.

Figure - Import guide

Warning	Beware of the following restrictions when loading a line map: • The display imports existing lines on your map, but does not create the parallel lines; • Your map must contain at least 75 points to be imported.

The imported guides will show on the list of guides.

Important	In case the imported guide has the same name of a previously saved guide, a number will be added to the end of the file name. The previously saved guide will not be overwritten.

If the imported guide was created in a Hexagon Agriculture display, it can be imported as an **Original guide** or as a **Line map**, depending on how it was exported. See topic Export guide.

Important	If the guide was created on an on-board device from a manufacturer other than **Hexagon Agriculture** and is **incompatible**, the guide(s) will always be imported as a **Line map.**

11.2.3.3 Export guide

Important	This feature will not be available if the selected guide is temporary.

This option allows exporting guides from the display to a pendrive.

Important	The export format is a shape file (.shp).

Guides can be exported in two ways:

Original guide

In this case, only the original guide is exported, without its parallels. In this format, the equipment recognizes the original guide and may import it again in the same format, then create the parallels.

Important	This option is not available for exporting a Line map, in which case it is impossible to know which is the original guide.

Line map

Exports the set of guides (original + parallels) according to the set number of guides to the left and to the right. Exporting creates a **Line map**, for which it is no longer possible to identify the original guide.

Icon	Description

	Guide
	Guide management
	Export

To export guides through the **Guide manager**, proceed as follows:

Important	First insert the pendrive for exporting the guide(s).

1. On the operation screen, select the **Guide** option followed by **Guide management**;
2. Select the guide you wish to export from the list of guides;
3. Select option **Export**;
4. Select the desired option: **Original guide (proprietary)** or **Parallel guides (generic)**;
5. If the **Original guide** option is selected, wait for the exporting on the next screen;
6. If the **Parallel guides** option is selected, specify the number of lines to the right or to the left and press **OK**;
7. Wait for the file transfer.

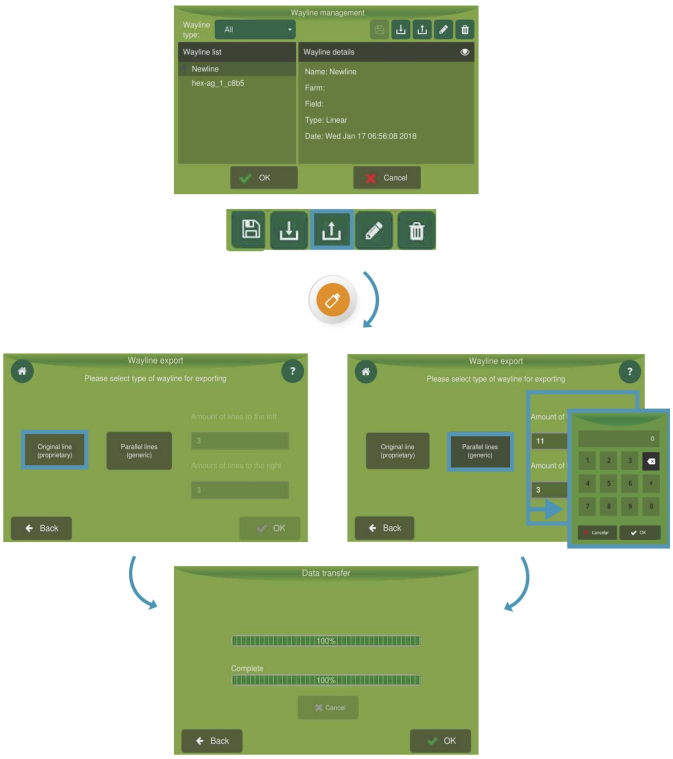


Figure - Export guide

11.2.3.4 Edit guide name

Important	This feature will not be available if the selected guide is temporary.

This option allows editing the name of a saved guide.

Icon	Description
	Guide

	Guide management
	Edit

To edit a guide name through the **Guide manager**, proceed as follows:

1. On the operation screen, select the **Guide** option followed by **Guide management**;
2. Select the guide you wish to edit from the list of guides;
3. Select the **Edit** option;
4. Edit the name of the temporary guide;
5. Press **OK** to confirm.

Important	It is not possible to save a guide with the same name of a preexisting guide; the maximum number of characters is 32.
Warning	When editing a guide name with the same name as preexisting guide, you will be asked if you want to overwrite it.

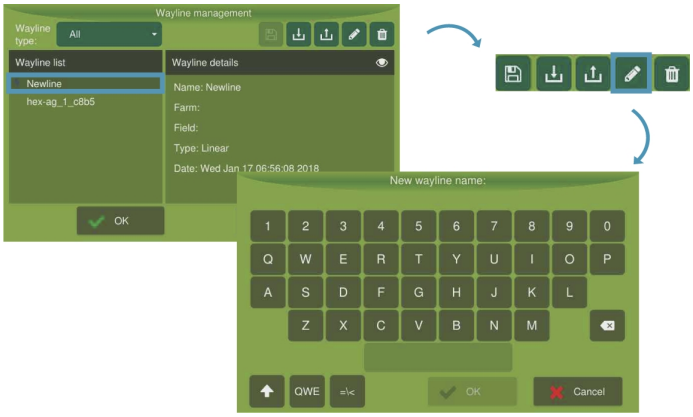


Figure - Edit guide name

11.2.3.5 Delete guide

Important	This feature will not be available if the selected guide is temporary.

This option allows deleting a previously created guide.

Icon	Description
	Guide
	Guide management
	Delete

To edit a guide name through the **Guide manager**, proceed as follows:

1. On the operation screen, select the **Guide** option followed by **Guide management**;
2. Select the guide you wish to delete on the list of guides;
3. Select the **Delete** option;
4. Press **Yes** to confirm;
5. Wait for the operation to be confirmed.

Warning	Be sure you want to delete the guide. It will be deleted from all the work sessions in the same field.

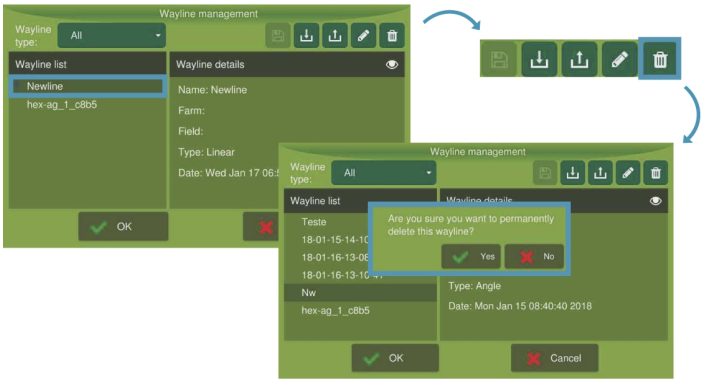


Figure - Delete guide

12. Auto steering

The purpose of the Auto steering is to ensure greater accuracy in the route and to minimize overpass during input application and crop treatment.

The Auto steering may be hydraulic or electric.

Important	Product available only upon activation.
Warning	The Auto steering must only be used in farming machinery, and its installation is not described in this manual since it must be done by qualified technicians.
Important	For the PVED type pilot some problems or parameters may only be available in the specific valve manual.
Important	For proper operation, check the wear of the steering components. When turning the steering wheel, the wheels should start moving. Otherwise, refer to the vehicle manufacturer's maintenance manual.
Warning	A GNSS signal is required in order for the Auto steering to work. In case the device loses GNSS connection, even momentarily, the automatic pilot will be disabled automatically.

To use the Auto steering on your device, perform the following steps in order:

1. To be able to use the Auto steering, you need to have a preconfigured vehicle. Follow the steps in topic Inserting a new vehicle;

Warning	Whenever a new vehicle is created, all the automatic pilot configuration, calibration, and adjustment steps must be performed again.

2. Check if the Auto steering is On;

3. Then, activate the reverse detector, see topic Reverse detector;
4. Perform the curve settings as described in topic Curve configuration;
5. Select the proper pilot type, see topic Setting the pilot type;
6. Perform the installation tests, see topic Testing the pilot installation;
7. Make the calibrations required for operation, see topic Calibration;
8. If necessary, perform adjustments, see topic Adjustment.

Warning	Attention to the drift filter adjustment for using the electric pilot.

12.1 Auto steering configuration

When entering automatic pilot option for the first time, it is necessary to alter the installed pilot type, and this is only possible if there is a preconfigured vehicle.

Warning	Only authorized technical personnel entering a support password can perform this step.

To change the pilot type, follow the steps:

1. In the **Configuration menu**, press option **Settings**;

2. Select option **Support** and enter the password. Press **OK**;
3. Confirm to return to the **Configuration menu** and then press **Auto steering**;
4. Select option **Support** (image 01);
5. Select option **Auto steeting configuration** (image 02);
6. Press the field **Type pilot** (image 03) and choose the type of automatic pilot. Press **OK.**

Figure - Auto steering configuration

12.2 Auto steering pilot settings

Warning	Only authorized technical personnel with an assistance password can perform this step.

Hydraulic, Eletric and Caterpillar pilot

To alter these auto steering pilot settings, follow the steps below:

1. In the **Configuration menu,** press the **Settings** option;
2. Select the **Support** option and enter the password. Press **OK**;
3. Confirm to return to the **Configuration menu** and press the **Auto steering;**
4. Select the **Support** option (image 01);
5. Select the **Auto steering configuration** option (image 02);
6. Select the type of pilot;
7. Alter the settings as desired and confirm.

Figure - Auto steering configuration

Setting parameters

- **Type pilot**
  Alters the selected pilot type, as described in topic Type pilot.
- **Calibration**
  Informs the type of curve to be used to estimate the calibration parameters for the HP sensor. This is always disabled.

- **Maximum wheel position calibration (%)**
  Alters the maximum wheel position during the last curve. With 100% it will go to maximum, and with values below 100 avoid that the wheel is controlled in its maximum position.

- **Configuration reset**
  Erases all the data for the selected pilot.

- **GPS emulator**
  Uses the pilot driver as GPS simulator. Widely used in fairs and demonstrations (one needs to mount the cabling).

- **Calibration number of turns for each side**
  Decreases the number of turns for the calibration when the space is small. Normally, when calibrating the pilot performs three curves, one more closed, on intermediary, and one more open. For small spaces, this parameter may be altered so that only two curves are performed (in this case, the more open curve is not performed) or just the more closed curve.
- **Motor PPR**
  Alters the type of motor used in the hexdrive. The latest motor has 133 pulses, while the oldest had 60 pulses.

- **Drift filter**
  The wheel position for the electric pilot is estimated using a series of information from the GNSS and the gyroscope. This reading may be noisy and it is necessary to filter the data to obtain a reliable value. The drift filter value serves to smooth the wheel angle estimation. This is only available for electric pilot settings.

- **GPS min. quality**
  Allows to select four types of signals: high precision (more basic correction, Glide, of Novatel); (signal with no correction at all, with high error), pay signal (TERRASTAR) and RTK (best possible accuracy using the RTK correction).

Warning	The smaller the value, the more the pilot tends to move the wheels, mainly when passing through holes and changes in terrain slopes. The larger the value, the more stable the wheel becomes, but the pilot tends to zigzag.

PVED pilot

To alter the auto steering PVED pilot settings, follow the steps below:

1. In the **Configuration menu,** press the **Settings** option;

2. Select the **Support** option and enter the password. Press **OK**;
3. Confirm to return to the **Configuration menu** and press the **Auto steering;**
4. Select the **Support** option (image 01);
5. Select the **Auto steering configuration** option (image 02);
6. Select the **PVED-CL** option;
7. Select the **PVED Configuration** option (image 02)
8. Alter the settings as desired and confirm.

Figure - PVED configuration

12.3 Testing the pilot installation

The pilot test options vary according to the selected pilot type, according to topic Auto steering configuration.

Hydraulic pilot

For the hydraulic pilot, the following tests will be available on the main auto steering screen:

01. Wheek position sensor installation, see topic Sensor install;
02. Hydraulic installation, see topic Hydraulic installation;
03. Installation INS. See topic INS install.

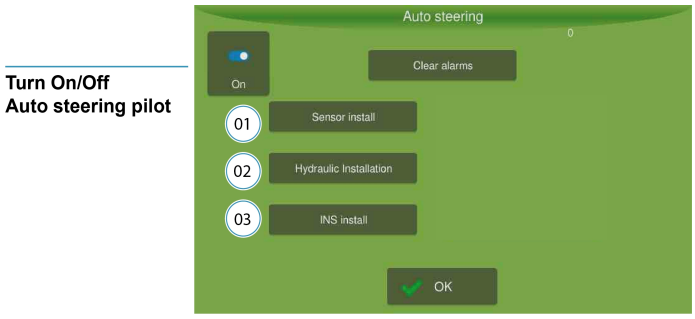


Figure - Hydraulic install

Electric steering pilot

For the electric steering pilot, the following tests will be available on the main auto steering screen:

01. Hexdrive installation, see topic HexDrive install;
02. Installation INS. See topic INS install.

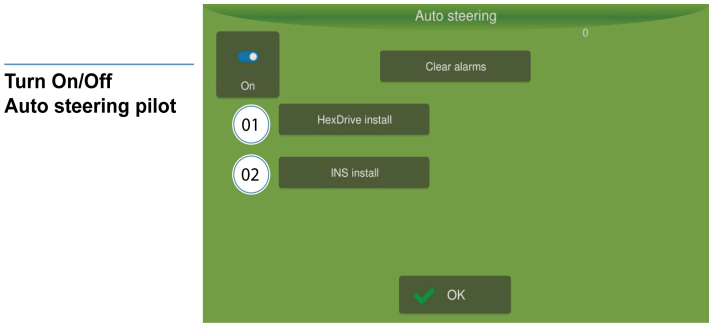


Figure - Hexdrive install

PVED pilot

For the PVED pilot, the following tests are available on the main auto steering screen:

01. Installation INS. See topic INS install.

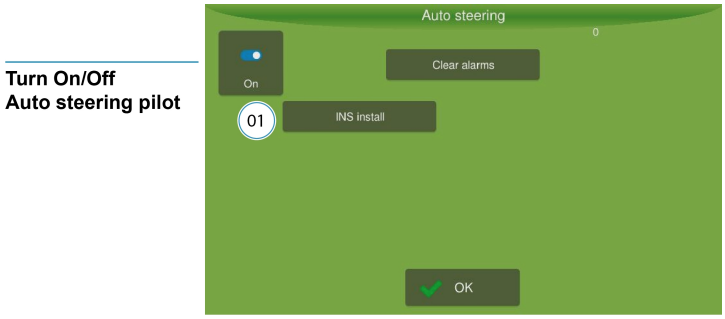


Figure - PVED install

12.4 Hydraulic pilot

12.4.1 Sensor installation

Warning	Test performed only for the hydraulic pilot.

This option assists in checking the operation and installation of the wheel position sensor. The **PWM** field shows the gross value reading, which varies from 0 to 36000. It is important that, when the vehicle wheels are aligned, the value in this field is in the intermediate reading range. Avoid values close to 0 and 36000. If necessary, reposition the sensor to suit the recommended reading range. To do so, simply remove the sensor from the holder and reposition by rotating 180 degrees.

Important	The **PWM** must have a minimum variation of 9000. For example, if the steering wheel is all the way to the left and the PWM value is 15000 and then all the way to the right and the value is 24500, there was a 9500 variation, thus satisfying this requirement.

The **Angle (degrees)** field shows the reading for the wheel position sensor converted into degrees. When turning the steering wheel to the right, the value must be positive, and to the left it must be negative.

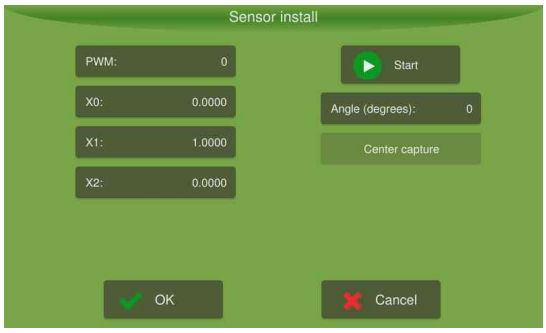


Figure - Sensor install

To check the wheel sensor operation, proceed as follows:

1. Press **Start**;
2. Observe if there are no skips in the reading of the **Angle (degrees)** field and if the value is evenly changed (it is not necessary to turn the steering wheel too much for the value to change).

Important	If there is a problem in reading, it is recommended to change the sensor position or modify the coupling rod.
Warning	The wheel sensor pre-calibration is required in order to properly calibrate the hydraulic part. If you experience any problems with the wheel sensor, ask a qualified technician for help performing the pre-calibration.

12.4.2 Hydraulic installation

This option assists in checking the operation and installation of the hydraulic valve.

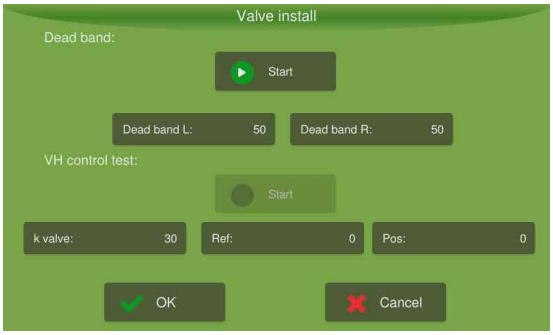


Figure - Valve install

Warning	Before performing the dead band, ensure the valve start cable (item 03548) is properly installed and is not inverted. To do so, in the HV controller test, press **Start** and enter a reference of 25 degrees. The wheel should go right, if it goes left, the cable is inverted.

12.4.2.1 Dead band

Identifies the minimum voltage that must be applied to the valve for it to start moving the wheels. The system will automatically increase the voltage applied to the valve terminals from zero until wheel movement is detected (variation of about 0.5°). To perform the test, proceed as follows:

Warning	Do not use the steering wheel or move the vehicle's wheels during the test.

1. Align the vehicle's wheels;
2. Accelerate to 1500 rpm;
3. Press **Start** and wait for the test to end. The steering wheel will turn right and left automatically. The value in the **Dead band** field will be modified to the calibrated value and the **Start** option will be modified.

Important	The **Dead band** after calibration is around 300. In case the value is very different, it is recommended to perform the test again.

12.4.2.2 HV control test

The purpose of this test is to check the proper operation of the wheel control system, as well as the correct installation of the hydraulic valve:

- **K valve**
  Hydraulic valve response rate
  - Low values will cause the system to be slow, as well as display a larger error following the reference;
  - High values indicate a faster response and reduction in position error, however values too high tend to make the wheels oscillate.

- **Reference**
  Value that indicates the position (in degrees) to which the wheel will go during the test.
  - Positive values make the wheel turn right;
  - Negative values make the wheel turn left.

Warning	For security reasons, the entered values are limited to the -15° to 15° range.

- **Position**
  Indicates the wheel position detected by the sensor.

To perform the test, proceed as follows:

Warning	Ensure that the wheel sensor is working properly. In case the wheels turn to the opposite side or there is any other unforeseen event, immediately turn the Ti off to avoid damage.

1. Press **Start**;
2. Alter the **Reference** values (positive and negative). Positive values will make the wheel turn right, while negative values make it turn left;
3. Observe the response. In case it is slow or the difference between the values for the **Position** and **Reference** fields are larger than one, increase the value of the **K valve** field. In case the direction oscillates too much to reach the reference, reduce the value in the **K valve** field.

12.4.3 INS installation

The values shown on the following screen depend on the current vehicle position.

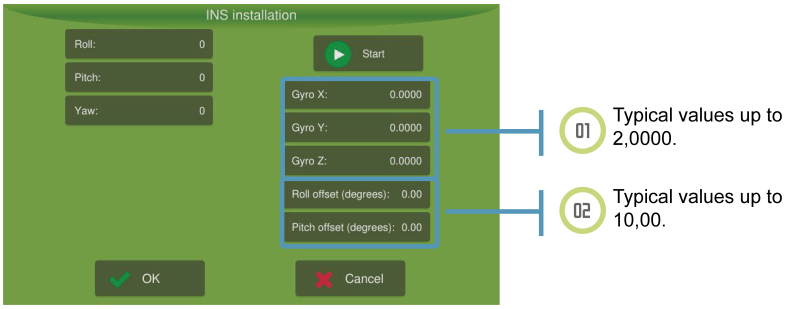


Figure - INS installation

To perform the installation, proceed as follows:

1. Position the vehicle horizontally and press **Start**;
2. Tilt the vehicle to the right. The **Roll** reading must be positive. By tilting the vehicle to the left, the **Roll** must be negative;

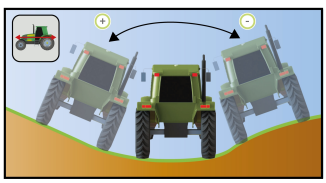


Figure - Roll

3. Position the vehicle on sloping ground. With the front of the vehicle tilted down, the **Pitch** reading must be negative. With the front tilted up, the **Pitch** must be positive;

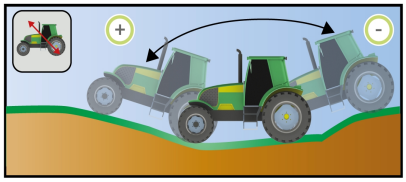


Figure - Pitch

4. The **Yaw** reading will only be different than zero with the vehicle in motion.

Figure - Yaw

Warning	Check if the Yaw, Pitch and Roll readings stabilize quickly after stopping the vehicle. In case this does not occur or there are inconsistencies with the read values, check if there is a problem with mounting the driver or any defective components.

12.4.4 Support mode activation

12.4.4.1 Control

Warning	Only authorized technical personnel with advanced visualization passwords can perform this step.

To adjust the controls, proceed as follows:

1. In the **Settings menu**, press the **System settings** option;
2. Select the **Advanced** option and enter the password. Press **OK**;
3. Confirm to go back to the **Settings menu** and press **Automatic pilot**;
4. Select the **Control** option (image 01);
5. Set the desired parameter values (image 02);
6. Confirm the operation.

To refine the system adjustment, check the following topics:

- Overshoot, see topic Overshoot.
- Aggressiveness, see topic Aggressiveness.
- Sensitivity, see topic Sensitivity.
- Speed gain, see topic Speed gain.
- Curve aggressiveness, see topic Curve aggressiveness.
- Adjustment recommendations see topic Adjustment recommendations.

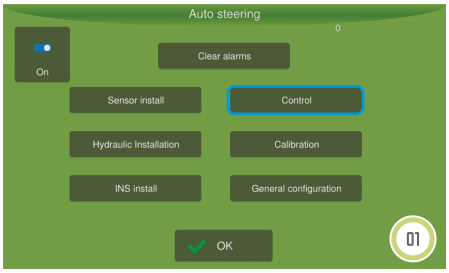


Figure - Control

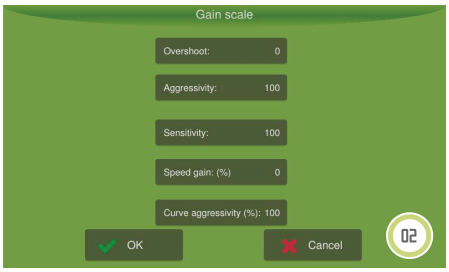


Figure - Control parameters

Overshoot

Overshoot controls the rate in which the vehicle will drive on the guide line and the rate in which the vehicle will end as it approaches the line. The default value is zero and must only be altered if you cannot eliminate the overshoot through **Aggressiveness** and **Sensitivity**.

- Overshoot can be defined between 0 and 200%. By default it has a zero value, which means it is disabled.
- Increasing the value, the pilot converges more aggressively to the line. There is a tendency to increase overpass.
- Decreasing the value, the pilot converges more gently to the line, reducing overpass.

As an adjustment orientation, it is recommended to modify the value from zero to 100. If the system still presents overshoot, the value must be reduced. In case it aligns without overshooting but away from the line, increase the value.

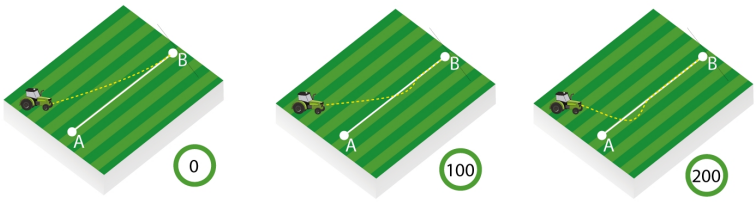


Figure - Overshoot

Aggressiveness

Aggressiveness controls the rate in which the vehicle attacks the guide line and how it keeps itself on the line. It can be defined between zero and 200. The default setting is 100.

- When, for example, the farming vehicle exceeds the guide line, it is necessary to reduce the aggressiveness. High values tend to make the vehicle zigzag;
- When the vehicle takes time to reach the guide line, it is necessary to increase aggressiveness. A value too low tends to make the pilot align faster and thus take more time to converge on the guide line.

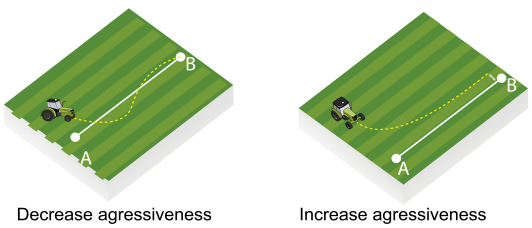


Figure - Agressiveness

Sensitivity

Sensitivity controls the rate in which the vehicle turns and its sensitivity when it is on the line. It mainly acts over the line.

- When, for example, the vehicle oscillates over the application line, it is necessary to reduce sensitivity. A high value tends to make the vehicle respond more quickly to small ground variations, possibly causing a zigzag trajectory.
- When the farming vehicle does not follow the application line, it is necessary to increase sensitivity. A value too low tends to make the vehicle take longer to respond to error variations.

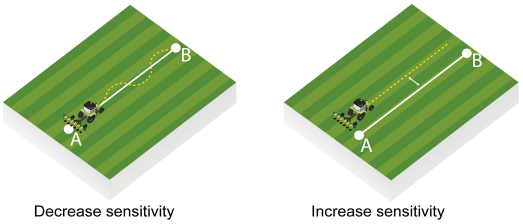


Figure - Sensitivity

Speed gain

Speed gain adjusts the gains (**Aggressiveness, Sensitivity,** and **Overshoot**) automatically based on vehicle speed.

- In case the application has great speed variations during the operation, adjust the gain to 100% and adjust the aggressiveness, sensitivity, and overshoot options when operating at 7km/h to the values that best adapt to your needs. After this initial adjustment, use the pilot on a different speed range and observe the response;
- In case the pilot is slowly converging to a zero error, increase the speed gain;
- In case the pilot is oscillating, reduce the speed gain. When the speed gain is set to zero, the system will alter the gains automatically based on vehicle speed (ideal for applications with low speed variations of around 3km/h).

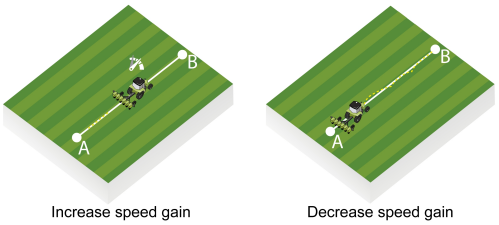


Figure - Speed gain

Curve aggressiveness

This option adjusts the gain increase and loss on the curves.

- When, for example, the farming vehicle opens on the curve (larger radius), it is necessary to increase curve gain;
- When the farming vehicle is closing the curve (smaller radius), it is necessary to reduce the curve gain.

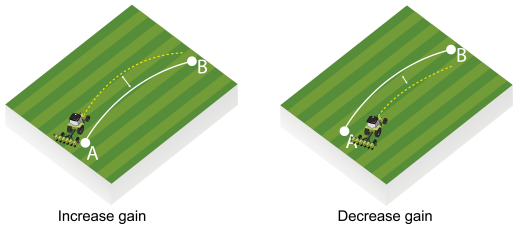


Figure - Curve aggressiveness

Adjustment recommendations

Follow the steps below as control adjustment suggestions:

1. **Observe the entry (linear guide)**

   Activate the pilot after it is properly calibrated with the factory gain values:

   - Aggressiveness: 100

- Sensitivity: 100
- Overshoot: 0

Warning	Perform the adjustment close to the working speed.

Field response	Description
If the response oscillates with a zigzag trajectory, the response is aggressive (quick wheel movement) or exceeds the line (<30cm).	Reduce the **Aggressiveness** and the **Sensitivity** together until you have a stable and secure response.
If the response is slow, slowly converges to zero error, and the alignment is away from the reference line.	Increase the **Aggressiveness** and **Sensitivity** together until you have a stable and secure response.

2. **Aggressiveness and Sensitivity Adjustment**

After obtaining a stable and secure entry response, adjust the Aggressiveness and the Sensibility separately to obtain the best performance possible:

- Increase the aggressiveness for a larger “attack” on the line during entry. In case the pilot is too aggressive or presents large overpass, reduce the parameter value;
- During operation over the line, in case the pilot is acting too much on the wheels with a tendency to zigzag, reduce the sensitivity value;
- If it takes too long to respond to land slopes or tends to go parallel with the line with an error over 1cm, increase the sensitivity.

3. **Overshoot Adjustment**

If it is difficult to reconcile a good entry time with a good response time over the line and in case the pilot still presents overshoot upon entry:

- Alter the overshoot value from 0 to 100;
- In case the overshoot is still high, reduce the value;
- In case the pilot is away from the line, increase the value.

4. **Curve Gain Adjustment**

Firstly, aggressiveness and sensitivity must be adjusted during operation of a linear guide:

- If the trajectory is always more open than the reference, increase the gain;
- If the trajectory is always more closed than the reference, reduce the gain.

Warning	The **Maximum saturation**, **Minimum saturation**, and **Maximum delta** values (available in the **General settings** option) directly affect the curve gain response. Low values for these parameters tend to make the response slow. Increasing curve gain, in this case, will not improve performance.

12.4.4.2 Calibration

Important	Only authorized technical personnel with an advanced visualization password can perform this step.

Important	Before starting the calibration procedure, ensure the vehicle dimensions are properly set (**Wheelbase, Antenna height**, and **Antenna offset)**.

To perform the calibration, proceed as follows:

1. In the **Configuration menu**, press the **System settings** option;
2. Select the **Advanced** option and enter the password. Press **OK**;
3. Confirm to return to the **Configuration menu**, then press **Auto steering**;
4. Select the **Calibration** option;
5. Perform the calibration step by step according to the descriptions in the following topics.

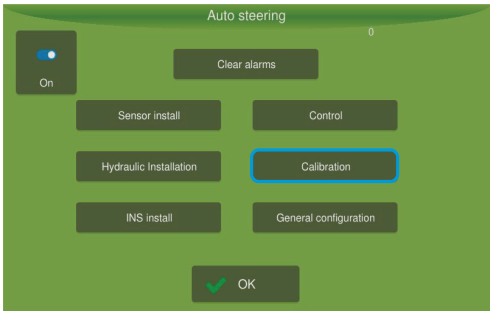


Figure - Calibration

On the calibration screen, it is possible to configure the following device parameters:

- Control driver position (ATCD);
- Accelerometer/Gyro calibration – relative position between the control driver and the vehicle;
- Gyroscope;
- Wheel sensor test;
- Wheel position.

Calibrating the driver position

1. Choose the correct driver installation position and press **Next.**

Warning	• Install the driver on a flat surface; • Install the driver on the same structure and, if possible, close to the antenna; • Never install the driver on a hard surface or the antenna on a dampened surface; • Always screw the driver onto the vehicle's frame.

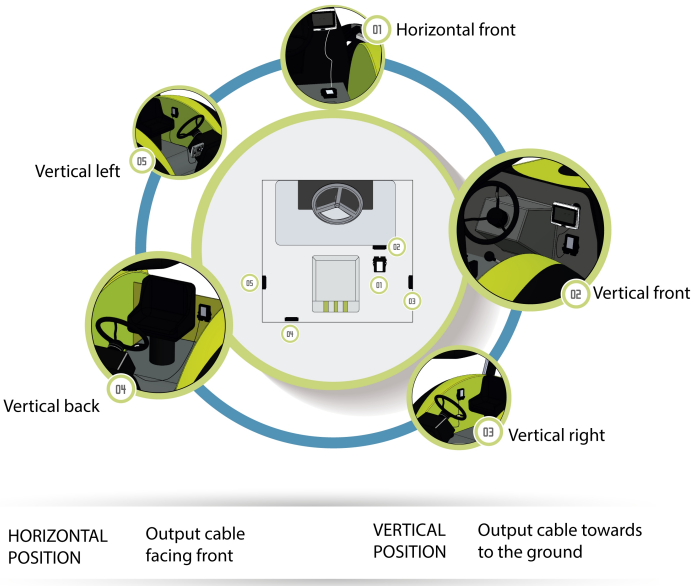


Figure - Driver position

Figure - Driver position

Calibrating the accelerometer

Determines the relative position (rolling and pitching angles) between the vehicle and the drive installation position.

Warning	Before starting calibration, consider the following: • Perform the tests with the motor in work rotation; • Do not swing the vehicle during this step; • This step is performed in two parts and the vehicle will be moved and should return to the same location, thus it is recommended to mark the ground where the vehicle wheels are positioned; • Perform the tests at a flat location; • Whenever the driver is removed from its position (for cleaning or any other purpose), the accelerometer calibration must be re-done, even if the device has been placed in the same location.

Figure – Accelerometer

To perform the calibration, proceed as follows:

1. Increase the motor rotation for working rotation (1500-2000rpm);
2. Press the vehicle image to the left and wait ten seconds;
3. Wait until the vehicle image to the right is green;
4. Position the vehicle in the same place, however in the opposite direction (for example, if the vehicle is facing north, it must now face south);
5. Press the vehicle image to the right and wait ten seconds;
6. As soon as both images are green, a window will be displayed showing the values found. Press **OK** to save and press **Next**.

Important	If the result shows some angle (rolling or pitching) larger than ten degrees, it is recommended to re-evaluate the installation position (the tilt compesation may not operate as expected).

Calibrating the gyroscope

The purpose is to estimate errors in the data provided by the gyroscopes.

Warning	• Do not move or swing the vehicle during the test; • This test is performed automatically whenever the vehicle is stopped;

To perform calibration, proceed as follows:

1. Press the **Calibrate Gyroscope** option;
2. After twenty seconds a window will show with the values found. Confirm with **OK** so that the data is saved.

Important	Values higher than 5 degrees/second may indicate component malfunctioning.

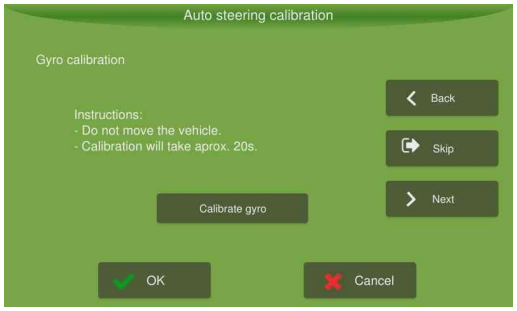


Figure - Gyroscope

Calibrating the wheel sensor test

To perform the calibration, proceed as follows:

1. Position the wheels in the central position and press **Save Reading Center**;
2. Position the wheels all the way to the left and press **Save Reading Left**;
3. Position the wheels all the way to the right and press **Sava Reading Right**;

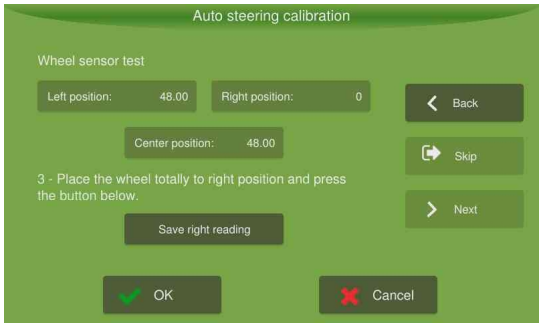


Figure - Wheel sensor test

4. Position the wheel in the central position to enable the test commands;
5. Make sure there are no obstacles near the wheels and that the vehicle is stopped;
6. Press **Test** starting;
7. A test confirmation screen will show.

Calibrating the wheel position

Important	This step requires the vehicle to be in motion, requiring a wide, unobstructed are for completion.
Warning	Caution do not use the steering wheel or change wheel positions during the test.

Hydraulic pilot procedure

To perform the calibration, proceed as follows:

1. Press **Start;**
2. In this step, the automatic pilot will drive the vehicle in circles of varying radii, three to the right and three to the left. The operator must control the breaks during this step and be aware of obstacles in the vehicle's trajectory. If there are obstacles in the trajectory, the operator must stop the test using the **Stop** button. The test will restart from the last curve you were performing;
3. A window will be displayed with the parameters calculated during the calibration. Data will be saved when pressing **OK.**

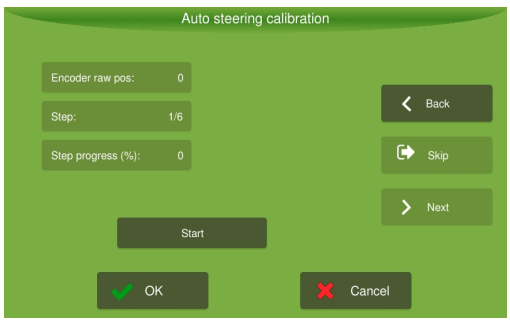


Figure - Wheel position

12.4.4.3 General configuration

Important	This step is the same for the electric and the hydraulic pilots.
Important	Only authorized technical personnel with an advanced visualization password can perform this step.

To adjust the general settings, proceed as follows:

1. In the **Configuration menu**, press option **Settings**;
2. Select the **Advanced** option and enter the password. Press **OK**;
3. Confirm to return to the **Configuration menu** and then press **Auto steering**;
4. Select the **General configuration** option (image 01);
5. Alter the parameters as desired (image 02);
6. Confirm the operation.

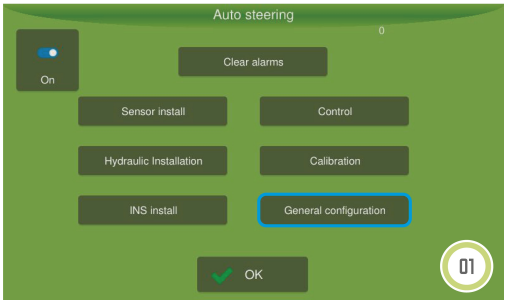


Figure - General configuration

Figure - General configuration

Security parameters

- **Override gain**

  Adjusts the effort needed by the operator to resume steering the vehicle from the automatic pilot. The larger the value, the more difficult it is. The smaller, the more easy (0-1000).

- **Error sec. (meters)**
  Blocks the automatic pilot use in case the vehicle positioning error is above the configured value, thus avoiding abrupt maneuvers.

- **Angle sec. (degrees)**

  Blocks the automatic pilot use in case the vehicle positioning error is above the configured value, thus avoiding abrupt maneuvers.

- **Wheel alarm (degrees)**

  Checks the wheel sensor operation and, in case of anomaly, disables the auto steering.
- **Alarm behavior**

  Indicates if the automatic pilot alarms will turn the operation off or not (section cut, fertilizing, etc).

- **Maximum speed allowed**

  Corresponds to the value that the user uses as cutting speed in the operation. If the equipment is operating above the set maximum speed, the autopilot can not be switched on. If the equipment exceeds the maximum

speed set with the autopilot on, it will be disarmed.

- **Road mode inactive time**

  It corresponds to the time configurable by the operator so that the pop up warning appears. This warning relates to autopilot downtime.

Operation parameters

- **Maximum saturation (degrees)**

  Maximum steering angle at low speeds.

- **Minimum saturation (degrees)**

  Maximum steering angle at high speeds (25km/h).

- **Maximum delta (degrees)**

  Maximum speed for changing wheel direction.

Important	Low values for these parameters tend to harm entry and the pilot response on a curved guide (slowness to perform maneuvers).
Warning	High **Minimum saturation** and **Maximum delta** values may cause abrupt vehicle movement, which impairs operation safety on high speeds.

- **PWM C control logic**

  Configuration of the third output of the steering driver. It is possible to configure the MOTOR C output when using hydraulic auto steering.

12.5 Hexdrive pilot

Warning	Test performed only for the electric pilot.

To run the electric pilot installation test, press **Auto steering** – **HexDrive install.**

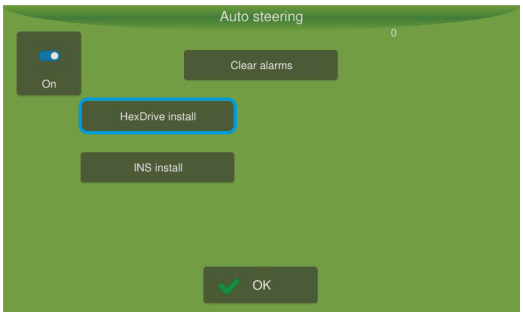


Figure - Hexdrive installation

12.5.1 Hexdrive installation

12.5.1.1 Gain adjustment

In this option it is possible to test the starting and perform the steering wheel position control adjustment.

Figure - Gain adjustment

To perform the gain adjustment, proceed as follows:

1. Turn the steering wheel all the way to the left and press **Save reading**;
2. Turn the steering wheel all the way to the right and press **Save reading**;
3. Return the steering wheel to the starting position, with the wheels directed forward;
4. Press **Start**;
5. Alter the **Reference** value to positive and negative values (values in the wheel movement range, as determined in steps 1 and 2) and observe the response:
    - For each **Ref** variation, the pilot must respond. If the variation has to be right (over 1.0), in order for the pilot to start responding it is necessary to change the **Kp vel** value for the steering wheel to follow the reference;
    - If the **Kp vel** value is too high, the steering wheel will shake and it will be necessary to reduce the value;
    - If the steering wheel is too slow, increase the **Kp pos** value;
    - If the positioning error is high (difference between the **Reference** and **Position** values), increase the **Kp pos** value;
    - If the over-sign is high or there is system instability, reduce the **Kp pos** value.
6. At the end of the test, the value in **Reference** needs to be the same as the position.

12.5.1.2 Dead band test

Identifies the minimum voltage that needs to be applied to the actuator in order to start wheel movement.

Warning	Do not use the steering wheel or change wheel positions during the test.
Warning	Ensure the area surrounding the steering wheel is clear, since it may make sudden movements during the test and hurt the operator if he or she is close to the steering wheel.

To perform the test, proceed as follows:

1. Align the wheels with the main axis of the vehicle (pointing forward);
2. Press **Start** and wait for the test to end. The steering wheel will turn right and left automatically. The **Dead band** value will be modified to the calibrated value and the **Start** option will be modified.

Important	The Dead band value after calibration should be around 210. If the value found it too different from this, it is recommended to redo the test.

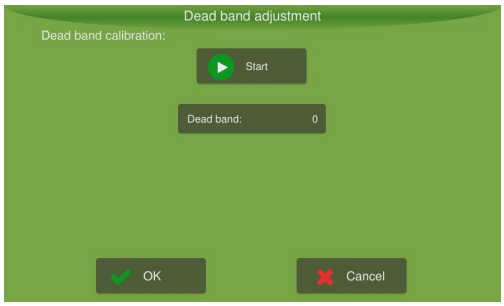


Figure - Dead band adjustment

12.5.2 INS installation

The values shown on the following screen depend on the current vehicle position.

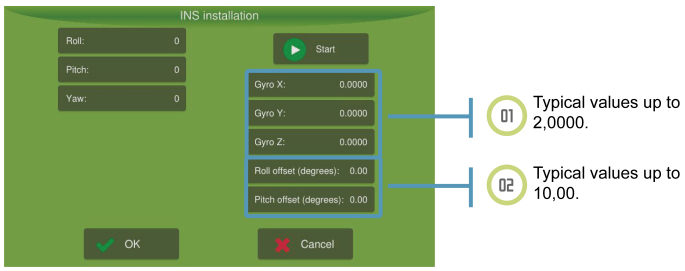


Figure - INS installation

To perform the installation, proceed as follows:

1. Position the vehicle horizontally and press **Start**;
2. Tilt the vehicle to the right. The **Roll** reading must be positive. By tilting the vehicle to the left, the **Roll** must be negative;

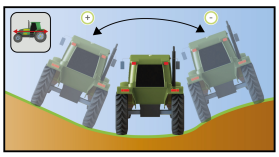


Figure - Roll

3. Position the vehicle on sloping ground. With the front of the vehicle tilted down, the **Pitch** reading must be negative. With the front tilted up, the **Pitch** must be positive;

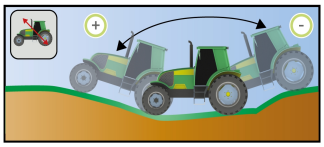


Figure - Pitch

4. The **Yaw** reading will only be different than zero with the vehicle in motion.

Figure - Yaw

Warning	Check if the Yaw, Pitch and Roll readings stabilize quickly after stopping the vehicle. In case this does not occur or there are inconsistencies with the read values, check if there is a problem with mounting the driver or any defective components.

12.5.3 Support mode activation

12.5.3.1 Control

Warning	Only authorized technical personnel with advanced visualization passwords can perform this step.

To adjust the controls, proceed as follows:

1. In the **Settings menu**, press the **System settings** option;
2. Select the **Advanced** option and enter the password. Press **OK**;
3. Confirm to go back to the **Settings menu** and press **Automatic pilot**;
4. Select the **Control** option (image 01);
5. Set the desired parameter values (image 02);
6. Confirm the operation.

To refine the system adjustment, check the following topics:

.

- Overshoot, see topic Overshoot.
- Aggressiveness, see topic Aggressiveness.
- Sensitivity, see topic Sensitivity.
- Speed gain, see topic Speed gain.
- Curve aggressiveness, see topic Curve aggressiveness.
- Adjustment recommendations see topic Adjustment recommendations.

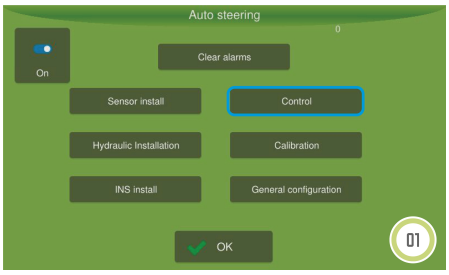


Figure - Control

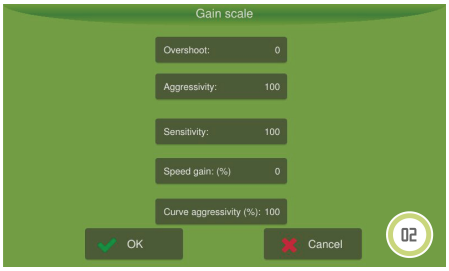


Figure - Control parameters

Overshoot

Overshoot controls the rate in which the vehicle will drive on the guide line and the rate in which the vehicle will end as it approaches the line. The default value is zero and must only be altered if you cannot eliminate the overshoot through **Aggressiveness** and **Sensitivity**.

- Overshoot can be defined between 0 and 200%. By default it has a zero value, which means it is disabled.
- Increasing the value, the pilot converges more aggressively to the line. There is a tendency to increase overpass.
- Decreasing the value, the pilot converges more gently to the line, reducing overpass.

As an adjustment orientation, it is recommended to modify the value from zero to 100. If the system still presents

overshoot, the value must be reduced. In case it aligns without overshooting but away from the line, increase the value.

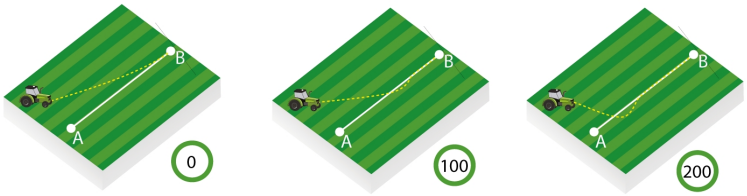


Figure - Overshoot

Aggressiveness

Aggressiveness controls the rate in which the vehicle attacks the guide line and how it keeps itself on the line. It can be defined between zero and 200. The default setting is 100.

- When, for example, the farming vehicle exceeds the guide line, it is necessary to reduce the aggressiveness. High values tend to make the vehicle zigzag;
- When the vehicle takes time to reach the guide line, it is necessary to increase aggressiveness. A value too low tends to make the pilot align faster and thus take more time to converge on the guide line.

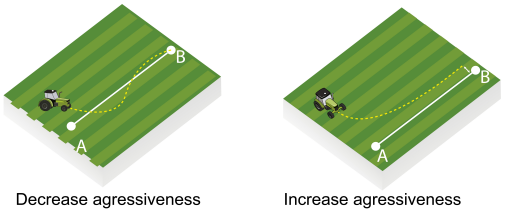


Figure - Agressiveness

Sensitivity

Sensitivity controls the rate in which the vehicle turns and its sensitivity when it is on the line. It mainly acts over the line.

- When, for example, the vehicle oscillates over the application line, it is necessary to reduce sensitivity. A high value tends to make the vehicle respond more quickly to small ground variations, possibly causing a zigzag trajectory.
- When the farming vehicle does not follow the application line, it is necessary to increase sensitivity. A value too low tends to make the vehicle take longer to respond to error variations.

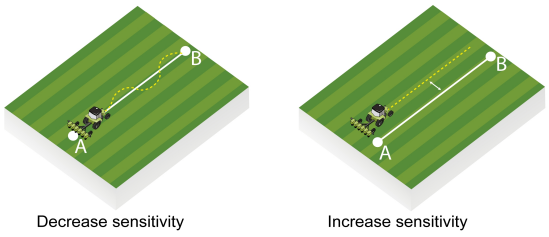


Figure - Sensitivity

Speed gain

Speed gain adjusts the gains (**Aggressiveness, Sensitivity,** and **Overshoot**) automatically based on vehicle speed.

- In case the application has great speed variations during the operation, adjust the gain to 100% and adjust the aggressiveness, sensitivity, and overshoot options when operating at 7km/h to the values that best adapt to your needs. After this initial adjustment, use the pilot on a different speed range and observe the response;
- In case the pilot is slowly converging to a zero error, increase the speed gain;
- In case the pilot is oscillating, reduce the speed gain. When the speed gain is set to zero, the system will alter the gains automatically based on vehicle speed (ideal for applications with low speed variations of around 3km/h).

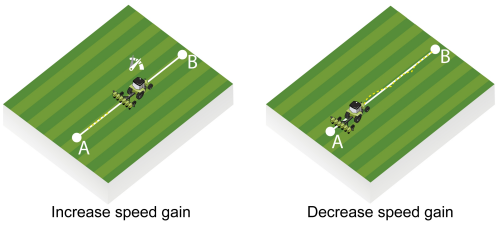


Figure - Speed gain

Curve aggressiveness

This option adjusts the gain increase and loss on the curves.

- When, for example, the farming vehicle opens on the curve (larger radius), it is necessary to increase curve gain;
- When the farming vehicle is closing the curve (smaller radius), it is necessary to reduce the curve gain.

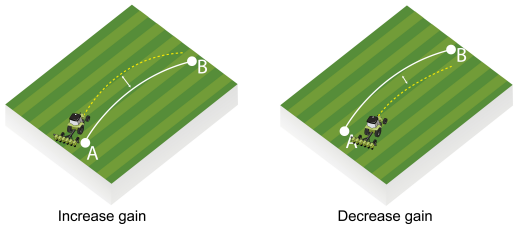


Figure - Curve aggressiveness

Adjustment recommendations

Follow the steps below as control adjustment suggestions:

1. **Observe the entry (linear guide)**

Activate the pilot after it is properly calibrated with the factory gain values:

- Aggressiveness: 100
- Sensitivity: 100
- Overshoot: 0

Warning	Perform the adjustment close to the working speed.

Field response	Description
If the response oscillates with a zigzag trajectory, the response is aggressive (quick wheel movement) or exceeds the line (<30cm).	Reduce the **Aggressiveness** and the **Sensitivity** together until you have a stable and secure response.
If the response is slow, slowly converges to zero error, and the alignment is away from the reference line.	Increase the **Aggressiveness** and **Sensitivity** together until you have a stable and secure response.

2. **Aggressiveness and Sensitivity Adjustment**

After obtaining a stable and secure entry response, adjust the Aggressiveness and the Sensibility separately to obtain the best performance possible:

- Increase the aggressiveness for a larger “attack” on the line during entry. In case the pilot is too aggressive or presents large overpass, reduce the parameter value;
- During operation over the line, in case the pilot is acting too much on the wheels with a tendency to zigzag, reduce the sensitivity value;
- If it takes too long to respond to land slopes or tends to go parallel with the line with an error over 1cm, increase the sensitivity.

3. **Overshoot Adjustment**

If it is difficult to reconcile a good entry time with a good response time over the line and in case the pilot still presents overshoot upon entry:

- Alter the overshoot value from 0 to 100;
- In case the overshoot is still high, reduce the value;
- In case the pilot is away from the line, increase the value.

4. **Curve Gain Adjustment**

Firstly, aggressiveness and sensitivity must be adjusted during operation of a linear guide:

- If the trajectory is always more open than the reference, increase the gain;
- If the trajectory is always more closed than the reference, reduce the gain.

Warning	The **Maximum saturation**, **Minimum saturation**, and **Maximum delta** values (available in the **General settings** option) directly affect the curve gain response. Low values for these parameters tend to make the response slow. Increasing curve gain, in this case, will not improve performance.

12.5.3.2 Calibration

Important	Only authorized technical personnel with an advanced visualization password can perform this step.
Important	Before starting the calibration procedure, ensure the vehicle dimensions are properly set (**Wheelbase, Antenna height**, and **Antenna offset)**.

To perform the calibration, proceed as follows:

1. In the **Configuration menu**, press the **System settings** option;
2. Select the **Advanced** option and enter the password. Press **OK**;
3. Confirm to return to the **Configuration menu**, then press **Auto steering**;
4. Select the **Calibration** option;
5. Perform the calibration step by step according to the descriptions in the following topics.

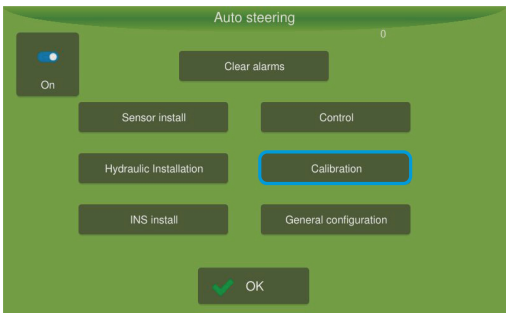


Figure - Calibration

On the calibration screen, it is possible to configure the following device parameters:

- Control driver position (ATCD);
- Accelerometer/Gyro calibration – relative position between the control driver and the vehicle;
- Gyroscope;
- Wheel sensor test;

- Clockwise and counterclockwise.

Calibrating the driver position

1. Choose the correct driver installation position and press **Next.**

Warning	• Install the driver on a flat surface; • Install the driver on the same structure and, if possible, close to the antenna; • Never install the driver on a hard surface or the antenna on a dampened surface; • Always screw the driver onto the vehicle's frame.

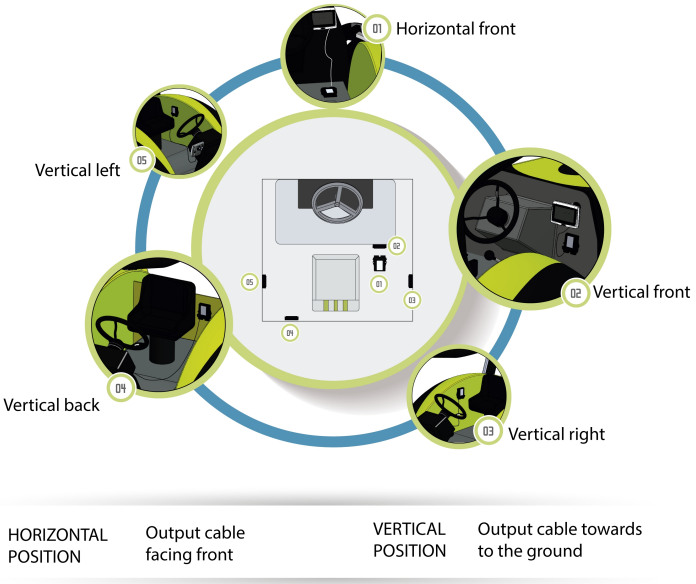


Figure - Driver position

Figure - Driver position

Calibrating the accelerometer

Determines the relative position (rolling and pitching angles) between the vehicle and the drive installation position.

Warning	Before starting calibration, consider the following: • Perform the tests with the motor in work rotation; • Do not swing the vehicle during this step; • This step is performed in two parts and the vehicle will be moved and should return to the same location, thus it is recommended to mark the ground where the vehicle wheels are positioned; • Perform the tests at a flat location; • Whenever the driver is removed from its position (for cleaning or any other purpose), the accelerometer calibration must be re-done, even if the device has been placed in the same location.

Figure – Accelerometer

To perform the calibration, proceed as follows:

1. Increase the motor rotation for working rotation (1500-2000rpm);
2. Press the vehicle image to the left and wait ten seconds;
3. Wait until the vehicle image to the right is green;
4. Position the vehicle in the same place, however in the opposite direction (for example, if the vehicle is facing north, it must now face south);
5. Press the vehicle image to the right and wait ten seconds;
6. As soon as both images are green, a window will be displayed showing the values found. Press **OK** to save and press **Next**.

Important	If the result shows some angle (rolling or pitching) larger than ten degrees, it is recommended to re-evaluate the installation position (the tilt compesation may not operate as expected).

Calibrating the gyroscope

The purpose is to estimate errors in the data provided by the gyroscopes.

Warning	• Do not move or swing the vehicle during the test; • This test is performed automatically whenever the vehicle is stopped;

To perform calibration, proceed as follows:

1. Press the **Calibrate Gyroscope** option;
2. After twenty seconds a window will show with the values found. Confirm with **OK** so that the data is saved.

Important	Values higher than 5 degrees/second may indicate component malfunctioning.

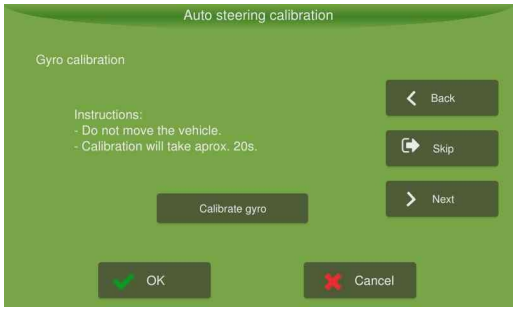


Figure - Gyroscope

Calibrating the wheel sensor test

To perform the calibration, proceed as follows:

1. Position the wheels in the central position and press **Save Reading Center**;
2. Position the wheels all the way to the left and press **Save Reading Left**;
3. Position the wheels all the way to the right and press **Sava Reading Right**;

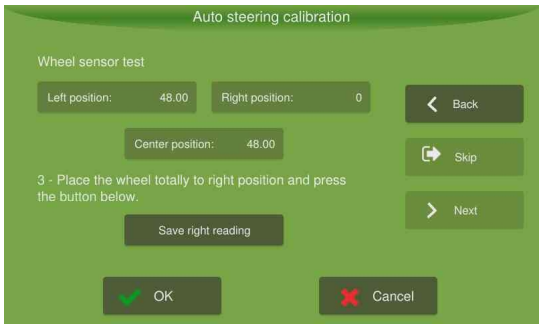


Figure - Wheel position

4. Position the wheel in the central position to enable the test commands;
5. Make sure there are no obstacles near the wheels and that the vehicle is stopped;
6. Press **Test** starting;
7. A test confirmation screen will show.

Calibrating clockwise and counterclockwise

Electric steering and ES Direct Plus procedure

Warning	Before starting the test, consider the following facts: clockwise means to turn to the right, and counterclockwise means to turn to the left.

To perform the calibration, proceed as follows:

1. Set the vehicle in a circular clockwise motion and press **Start**;

2. Keep the same steering wheel position until the end of the test;
3. Once the second circle is completely green, press **Stop**;
4. Press **Next;**

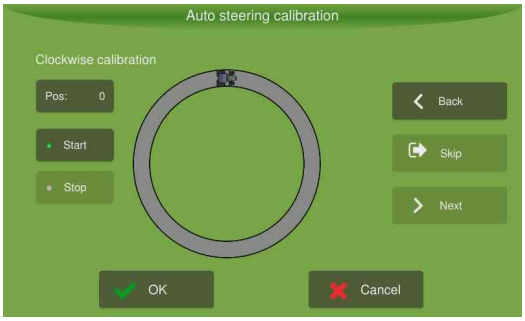


Figure - Clockwise calibration

5. Now set the vehicle in a circular counterclockwise motion and press **Start**;
6. Keep the same steering wheel position until the end of the test;
7. Once the second circle is completely green, press **Stop**;
8. A window will be displaced with the values calculated during calibration. Press **OK** to save the data.

Important	Proper values depend on the vehicle type, geometry, and other factors. For sprayers it would be something above 2000, and for tractors, between 400 and 800.

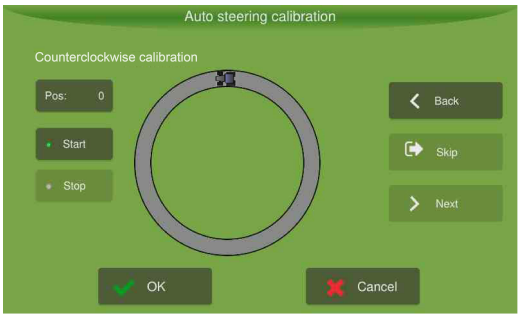


Figure - Counterclockwise calibration

12.5.3.3 General configuration

Important	This step is the same for the electric and the hydraulic pilots.
Important	Only authorized technical personnel with an advanced visualization password can perform this step.

To adjust the general settings, proceed as follows:

1. In the **Configuration menu**, press option **Settings**;
2. Select the **Advanced** option and enter the password. Press **OK**;
3. Confirm to return to the **Configuration menu** and then press **Auto steering**;
4. Select the **General configuration** option (image 01);
5. Alter the parameters as desired (image 02);
6. Confirm the operation.

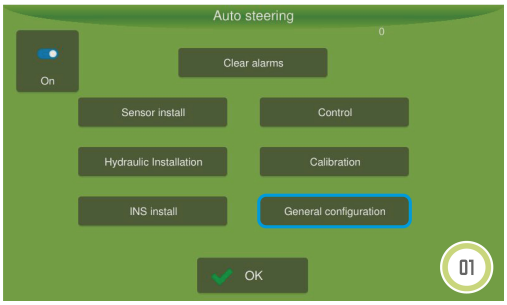


Figure - General configuration

Figure - General configuration

Security parameters

- **Override gain**

  Adjusts the effort needed by the operator to resume steering the vehicle from the automatic pilot. The larger the value, the more difficult it is. The smaller, the more easy (0-1000).

- **Error sec. (meters)**
  Blocks the automatic pilot use in case the vehicle positioning error is above the configured value, thus avoiding abrupt maneuvers.

- **Angle sec. (degrees)**

  Blocks the automatic pilot use in case the vehicle positioning error is above the configured value, thus avoiding abrupt maneuvers.

- **Wheel alarm (degrees)**

  Checks the wheel sensor operation and, in case of anomaly, disables the auto steering.
- **Alarm behavior**

  Indicates if the automatic pilot alarms will turn the operation off or not (section cut, fertilizing, etc).

- **Maximum speed allowed**

  Corresponds to the value that the user uses as cutting speed in the operation. If the equipment is operating above the set maximum speed, the autopilot can not be switched on. If the equipment exceeds the maximum speed set with the autopilot on, it will be disarmed.

- **Road mode inactive time**

  It corresponds to the time configurable by the operator so that the pop up warning appears. This warning relates to autopilot downtime.

Operation parameters

- **Maximum saturation (degrees)**

  Maximum steering angle at low speeds.

- **Minimum saturation (degrees)**

  Maximum steering angle at high speeds (25km/h).

- **Maximum delta (degrees)**

  Maximum speed for changing wheel direction.

Important	Low values for these parameters tend to harm entry and the pilot response on a curved guide (slowness to perform maneuvers).
Warning	High **Minimum saturation** and **Maximum delta** values may cause abrupt vehicle movement, which impairs operation safety on high speeds.

- **PWM C control logic**

  Configuration of the third output of the steering driver. It is possible to configure the MOTOR C output when using hydraulic auto steering.

12.6 PVED pilot

12.6.1 INS installation

The values shown on the following screen depend on the current vehicle position.

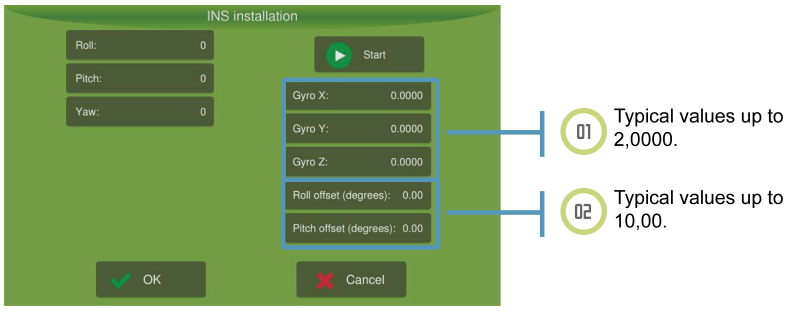


Figure - INS installation

To perform the installation, proceed as follows:

1. Position the vehicle horizontally and press **Start**;
2. Tilt the vehicle to the right. The **Roll** reading must be positive. By tilting the vehicle to the left, the **Roll** must be negative;

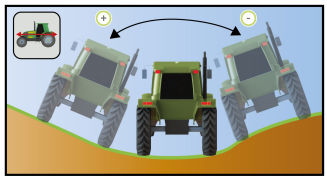


Figure - Roll

3. Position the vehicle on sloping ground. With the front of the vehicle tilted down, the **Pitch** reading must be negative. With the front tilted up, the **Pitch** must be positive;

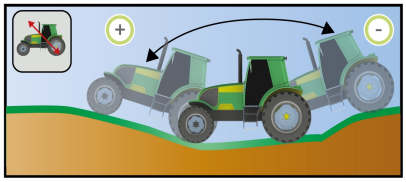


Figure - Pitch

4. The **Yaw** reading will only be different than zero with the vehicle in motion.

Figure - Yaw

Warning	Check if the Yaw, Pitch and Roll readings stabilize quickly after stopping the vehicle. In case this does not occur or there are inconsistencies with the read values, check if there is a problem with mounting the driver or any defective components.

12.6.2 Support mode activation

12.6.2.1 Control

Warning	Only authorized technical personnel with advanced visualization passwords can perform this step.

To adjust the controls, proceed as follows:

1. In the **Settings menu**, press the **System settings** option;
2. Select the **Advanced** option and enter the password. Press **OK**;
3. Confirm to go back to the **Settings menu** and press **Automatic pilot**;
4. Select the **Control** option (image 01);
5. Set the desired parameter values (image 02);
6. Confirm the operation.

To refine the system adjustment, check the following topics:

- Overshoot, see topic Overshoot.
- Aggressiveness, see topic Aggressiveness.
- Sensitivity, see topic Sensitivity.
- Speed gain, see topic Speed gain.
- Curve aggressiveness, see topic Curve aggressiveness.
- Adjustment recommendations see topic Adjustment recommendations.

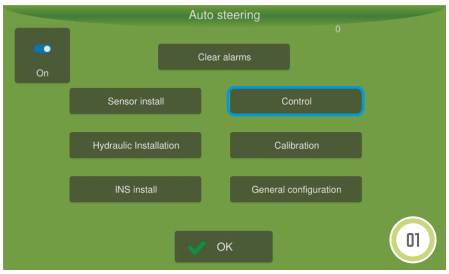


Figure - Control

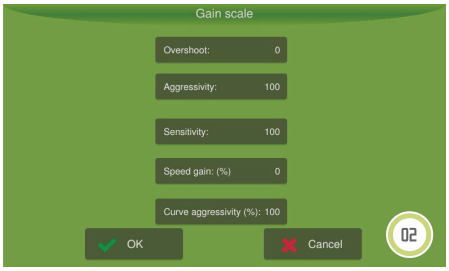


Figure - Control parameters

Overshoot

Overshoot controls the rate in which the vehicle will drive on the guide line and the rate in which the vehicle will end as it approaches the line. The default value is zero and must only be altered if you cannot eliminate the overshoot through **Aggressiveness** and **Sensitivity**.

- Overshoot can be defined between 0 and 200%. By default it has a zero value, which means it is disabled.
- Increasing the value, the pilot converges more aggressively to the line. There is a tendency to increase overpass.
- Decreasing the value, the pilot converges more gently to the line, reducing overpass.

As an adjustment orientation, it is recommended to modify the value from zero to 100. If the system still presents overshoot, the value must be reduced. In case it aligns without overshooting but away from the line, increase the value.

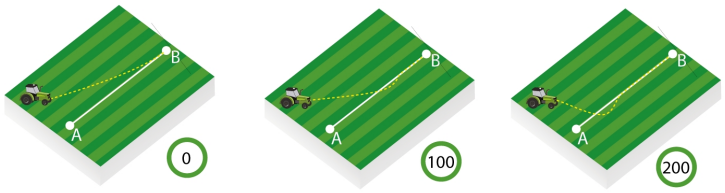


Figure - Overshoot

Aggressiveness

Aggressiveness controls the rate in which the vehicle attacks the guide line and how it keeps itself on the line. It can be defined between zero and 200. The default setting is 100.

- When, for example, the farming vehicle exceeds the guide line, it is necessary to reduce the aggressiveness. High values tend to make the vehicle zigzag;
- When the vehicle takes time to reach the guide line, it is necessary to increase aggressiveness. A value too low tends to make the pilot align faster and thus take more time to converge on the guide line.

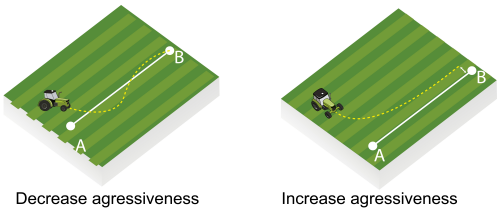


Figure - Agressiveness

Sensitivity

Sensitivity controls the rate in which the vehicle turns and its sensitivity when it is on the line. It mainly acts over the line.

- When, for example, the vehicle oscillates over the application line, it is necessary to reduce sensitivity. A high value tends to make the vehicle respond more quickly to small ground variations, possibly causing a zigzag trajectory.
- When the farming vehicle does not follow the application line, it is necessary to increase sensitivity. A value too low tends to make the vehicle take longer to respond to error variations.

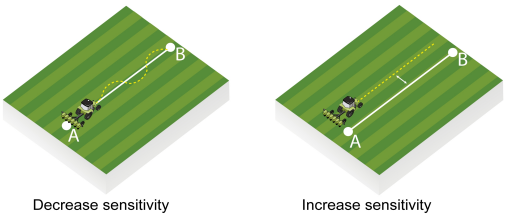


Figure - Sensitivity

Speed gain

Speed gain adjusts the gains (**Aggressiveness, Sensitivity,** and **Overshoot**) automatically based on vehicle speed.

- In case the application has great speed variations during the operation, adjust the gain to 100% and adjust the aggressiveness, sensitivity, and overshoot options when operating at 7km/h to the values that best adapt to your needs. After this initial adjustment, use the pilot on a different speed range and observe the response;
- In case the pilot is slowly converging to a zero error, increase the speed gain;
- In case the pilot is oscillating, reduce the speed gain. When the speed gain is set to zero, the system will alter the gains automatically based on vehicle speed (ideal for applications with low speed variations of around 3km/h).

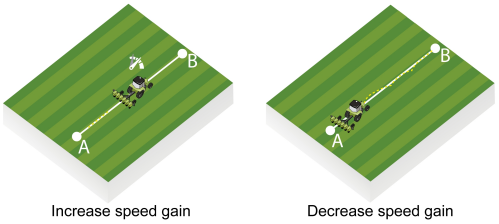


Figure - Speed gain

Curve aggressiveness

This option adjusts the gain increase and loss on the curves.

- When, for example, the farming vehicle opens on the curve (larger radius), it is necessary to increase curve gain;
- When the farming vehicle is closing the curve (smaller radius), it is necessary to reduce the curve gain.

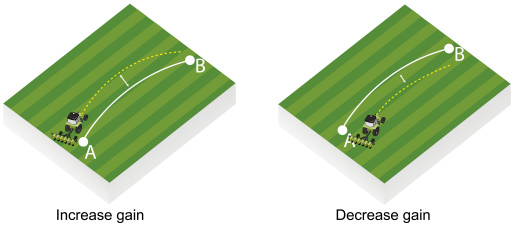


Figure - Curve aggressiveness

Adjustment recommendations

Follow the steps below as control adjustment suggestions:

1. **Observe the entry (linear guide)**

Activate the pilot after it is properly calibrated with the factory gain values:

- Aggressiveness: 100
- Sensitivity: 100
- Overshoot: 0

Warning	Perform the adjustment close to the working speed.

Field response	Description

If the response oscillates with a zigzag trajectory, the response is aggressive (quick wheel movement) or exceeds the line (<30cm).	Reduce the **Aggressiveness** and the **Sensitivity** together until you have a stable and secure response.
If the response is slow, slowly converges to zero error, and the alignment is away from the reference line.	Increase the **Aggressiveness** and **Sensitivity** together until you have a stable and secure response.

2. **Aggressiveness and Sensitivity Adjustment**

After obtaining a stable and secure entry response, adjust the Aggressiveness and the Sensibility separately to obtain the best performance possible:

- Increase the aggressiveness for a larger “attack” on the line during entry. In case the pilot is too aggressive or presents large overpass, reduce the parameter value;
- During operation over the line, in case the pilot is acting too much on the wheels with a tendency to zigzag, reduce the sensitivity value;
- If it takes too long to respond to land slopes or tends to go parallel with the line with an error over 1cm, increase the sensitivity.

3. **Overshoot Adjustment**

If it is difficult to reconcile a good entry time with a good response time over the line and in case the pilot still presents overshoot upon entry:

- Alter the overshoot value from 0 to 100;
- In case the overshoot is still high, reduce the value;
- In case the pilot is away from the line, increase the value.

4. **Curve Gain Adjustment**

Firstly, aggressiveness and sensitivity must be adjusted during operation of a linear guide:

- If the trajectory is always more open than the reference, increase the gain;
- If the trajectory is always more closed than the reference, reduce the gain.

Warning	The **Maximum saturation**, **Minimum saturation**, and **Maximum delta** values (available in the **General settings** option) directly affect the curve gain response. Low values for these parameters tend to make the response slow. Increasing curve gain, in this case, will not improve performance.

12.6.2.2 Calibration

Important	Only authorized technical personnel with an advanced visualization password can perform this step.
Important	Before starting the calibration procedure, ensure the vehicle dimensions are properly set (**Wheelbase, Antenna height**, and **Antenna offset)**.

To perform the calibration, proceed as follows:

1. In the **Configuration menu**, press the **System settings** option;
2. Select the **Advanced** option and enter the password. Press **OK**;
3. Confirm to return to the **Configuration menu**, then press **Auto steering**;

4. Select the **Calibration** option;
5. Perform the calibration step by step according to the descriptions in the following topics.

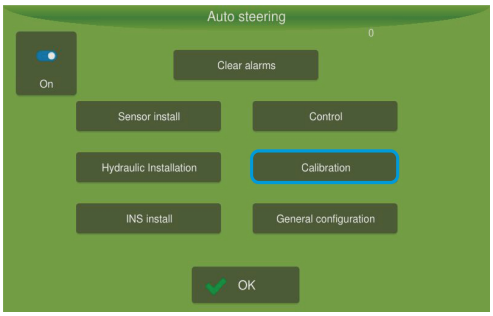


Figure - Calibration

On the calibration screen, it is possible to configure the following device parameters:

- Control driver position (ATCD);
- Accelerometer/Gyro calibration – relative position between the control driver and the vehicle;
- Gyroscope;
- Operating parameters;
- Clockwise and counterclockwise;
- Geometric parameters;
- Wheel sensor test;
- Dead zone.

Calibrating the driver position

1. Choose the correct driver installation position and press **Next.**

Warning	• Install the driver on a flat surface; • Install the driver on the same structure and, if possible, close to the antenna; • Never install the driver on a hard surface or the antenna on a dampened surface; • Always screw the driver onto the vehicle's frame.

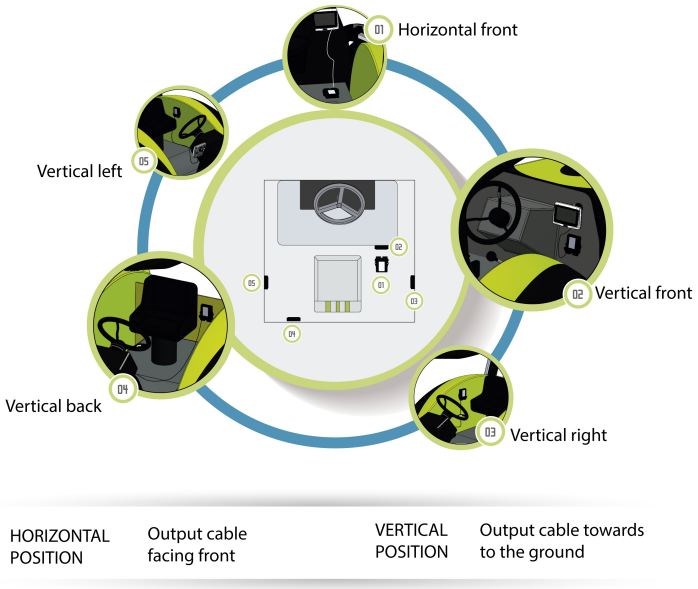


Figure - Driver position

Figure - Driver position

Calibrating the accelerometer

Determines the relative position (rolling and pitching angles) between the vehicle and the drive installation position.

Warning	Before starting calibration, consider the following: • Perform the tests with the motor in work rotation; • Do not swing the vehicle during this step; • This step is performed in two parts and the vehicle will be moved and should return to the same location, thus it is recommended to mark the ground where the vehicle wheels are positioned; • Perform the tests at a flat location; • Whenever the driver is removed from its position (for cleaning or any other purpose), the accelerometer calibration must be re-done, even if the device has been placed in the same location.

Figure – Accelerometer

To perform the calibration, proceed as follows:

1. Increase the motor rotation for working rotation (1500-2000rpm);
2. Press the vehicle image to the left and wait ten seconds;
3. Wait until the vehicle image to the right is green;
4. Position the vehicle in the same place, however in the opposite direction (for example, if the vehicle is facing north, it must now face south);
5. Press the vehicle image to the right and wait ten seconds;
6. As soon as both images are green, a window will be displayed showing the values found. Press **OK** to save and press **Next**.

Important	If the result shows some angle (rolling or pitching) larger than ten degrees, it is recommended to re-evaluate the installation position (the tilt compesation may not operate as expected).

Calibrating the gyroscope

The purpose is to estimate errors in the data provided by the gyroscopes.

Warning	• Do not move or swing the vehicle during the test; • This test is performed automatically whenever the vehicle is stopped;

To perform calibration, proceed as follows:

1. Press the **Calibrate Gyroscope** option;
2. After twenty seconds a window will show with the values found. Confirm with **OK** so that the data is saved.

Important	Values higher than 5 degrees/second may indicate component malfunctioning.

Figure - Gyroscope

Calibrating operating parameters

Important	Available only for PVED.

It allows to adjust the basic parameters that guarantee the valve operation.

Figure - Operating parameters

The following fields allows to adjust the following parameters:

Steering Wheel: Steering Wheel Angle Sensor, how it will report manual disarming.

Priority steering device (high or low): Refers to the valve configuration indicating the source of the signal to be controlled, analog wheel sensor connected to the PVED, CAN sensor or unmapped. It is compatible only with the setup using analog sensors (AD1 or AD2), and the interface on which the sensor is installed must be correctly mapped.

Primary steered wheel signal: Wheel angle sensor signal.

High priority set-point controller: Fixed information - the display will control the valve via CAN.

Redundant steered wheel sensor: Informs the valve if there is a redundant sensor to detect steering column movements (steering wheel).

Vehicle speed signal: Informs that there is a CAN speed sensor present in the vehicle installation.

OSP Signal: Orbitrol signal amplifier, works as a steering assistant.

Calibrating clockwise and counterclockwise

To perform the calibration, proceed as follows:

1. Set the vehicle in a circular clockwise motion and press **Start**;
2. Keep the same steering wheel position until the end of the test;
3. Once the second circle is completely green, press **Stop**;
4. Press **Next;**

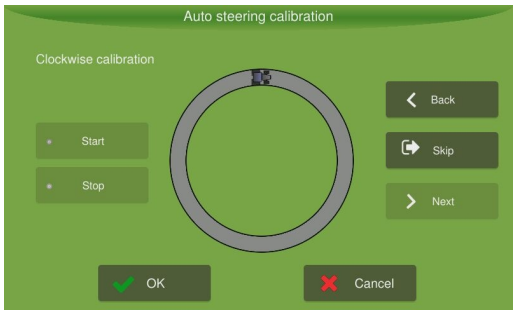


Figure - Clockwise calibration

5. Now set the vehicle in a circular counterclockwise motion and press **Start**;
6. Keep the same steering wheel position until the end of the test;
7. Once the second circle is completely green, press **Stop**;
8. A window will be displaced with the values calculated during calibration. Press **OK** to save the data.

Calibrating geometric parameters

Important	Available only for PVED.

It allows specifying dimensions and geometric parameters for correct valve configuration:

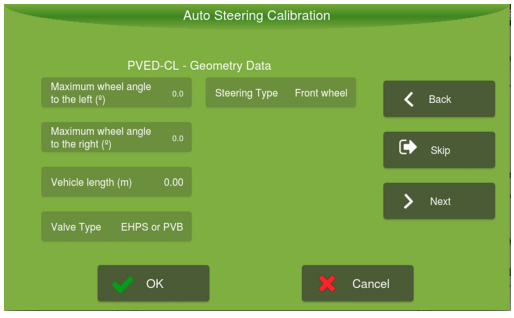


Figure - Geometric parameters

The following fields allow you to adjust the following parameters:

Maximum wheel angle (right/left): Information resulting from the previous calibration.

Vehicle length: Wheelbase, must conform to vehicle configuration.

Valve type: Valve type PVED.

Steering type: Vehicle pivot point, front, back, middle and idle.

Calibrating the wheel sensor test

To perform the calibration, proceed as follows:

1. Position the wheels in the central position and press **Save Reading Center**;
2. Position the wheels all the way to the left and press **Save Reading Left**;
3. Position the wheels all the way to the right and press **Sava Reading Right**;

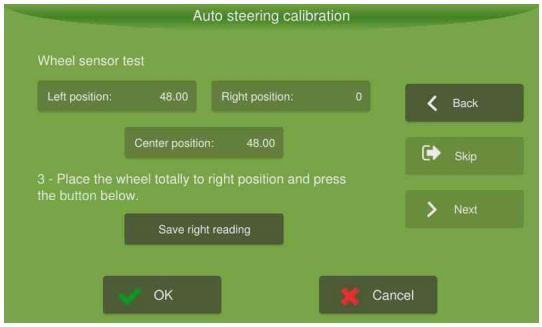


Figure - Wheel position

4. Position the wheel in the central position to enable the test commands;
5. Make sure there are no obstacles near the wheels and that the vehicle is stopped;
6. Press **Test** starting;
7. A test confirmation screen will show.

Calibrating dead zone

Important	Available only for PVED.

Performs the automatic test. The valve will automatically raise the dead zone parameters. To do this, the valve must be in the calibration mode, and must be turned off/on for the calibration mode to be activated again. The following calibration steps are:

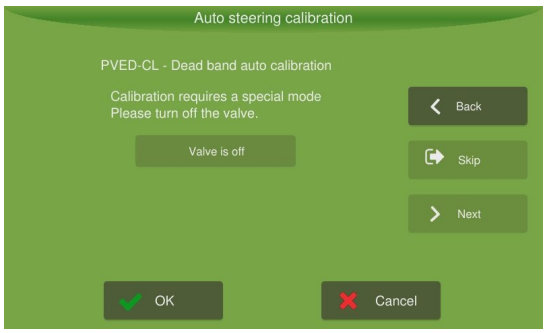


Figure - Calibrating dead zone Step 1

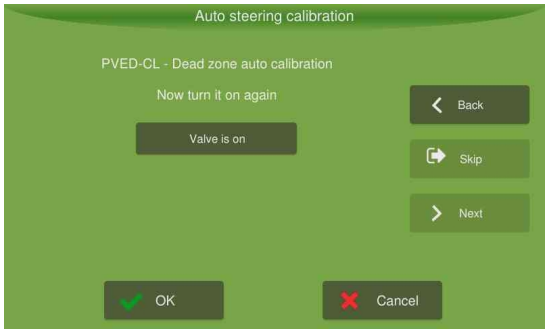


Figure - Calibrating dead zone Step 2

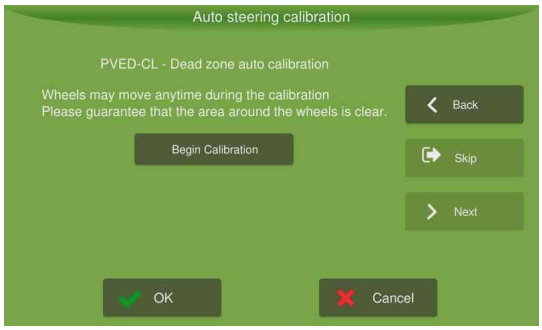


Figure - Calibrating dead zone Step 3

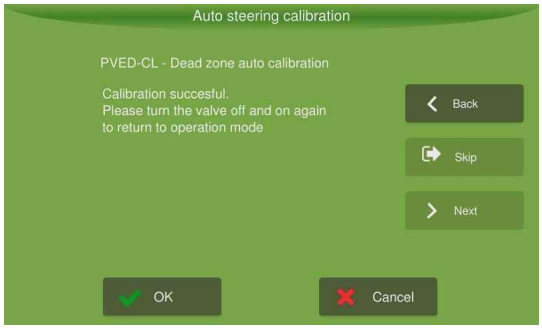


Figure - Calibrating dead zone Step 4

12.6.3 General configuration

To adjust the general settings, proceed as follows:

1. In the **Configuration Menu**, press the **Settings** option;
2. Select the **Advanced** option and enter the password. Press **Ok**;
3. Confirm to return to the Settings Menu and then press **Auto steering**;
4. Select the **General configuration** option (image 01);
5. Change the parameters as required (image 02);
6. Confirm the operation.

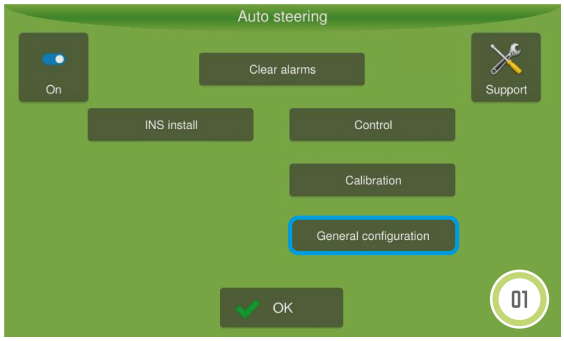


Figure - General configuration

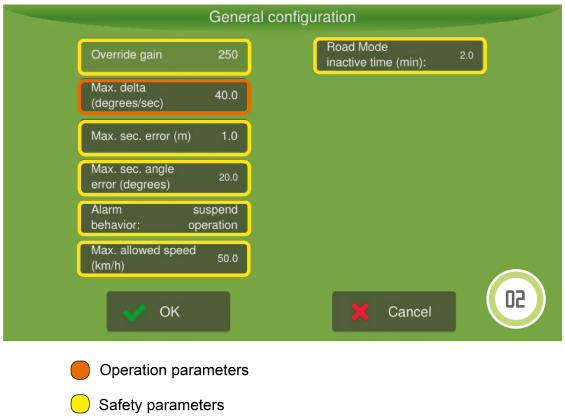


Figure - Parameteres

Security parameters

- **Override gain**

  Adjusts the effort needed by the operator to resume steering the vehicle from the automatic pilot. The larger the value, the more difficult it is. The smaller, the more easy (0-1000).

- **Max. sec. error (meters)**
  Blocks the automatic pilot use in case the vehicle positioning error is above the configured value, thus avoiding abrupt maneuvers.

- **Angle sec. (degrees)**

  Blocks the automatic pilot use in case the vehicle positioning error is above the configured value, thus avoiding abrupt maneuvers.

- **Alarm behavior**

  Indicates if the automatic pilot alarms will turn the operation off or not (section cut, fertilizing, etc).

- **Maximum allowed speed**

  Corresponds to the value that the user uses as cutting speed in the operation. If the equipment is operating above the set maximum speed, the autopilot can not be switched on. If the equipment exceeds the maximum speed set with the autopilot on, it will be disarmed.

- **Road mode inactive time (min)**

  It corresponds to the time configurable by the operator so that the pop up warning appears. This warning relates to autopilot downtime.

Operation parameters

- **Maximum delta (degrees)**

  Maximum speed for changing wheel direction.

12.7 Caterpillar pilot

12.7.1 Valve install

This option assists in checking the operation and installation of valve.

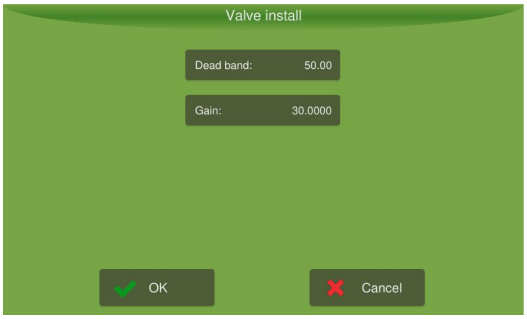


Figure - Valve install

Warning	Before performing the dead band, ensure the valve start cable (item 03548) is properly installed and is not inverted. To do so, in the HV controller test, press **Start** and enter a reference of 25 degrees. The wheel should go right, if it goes left, the cable is inverted.

12.7.2 INS install

The values shown on the following screen depend on the current vehicle position.

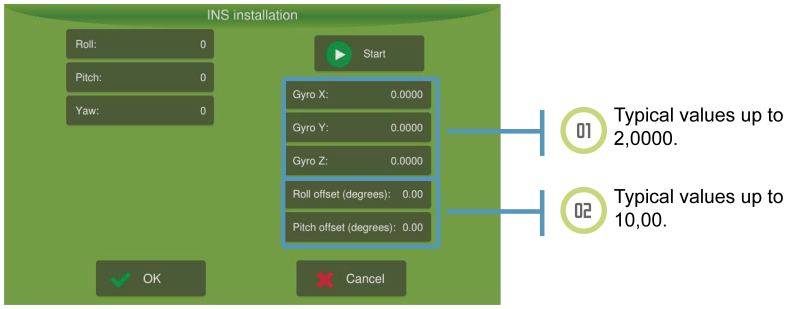


Figure - INS installation

To perform the installation, proceed as follows:

1. Position the vehicle horizontally and press **Start**;
2. Tilt the vehicle to the right. The **Roll** reading must be positive. By tilting the vehicle to the left, the **Roll** must be negative;

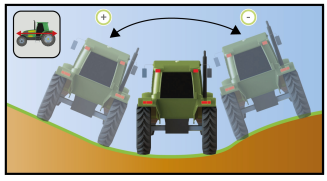


Figure - Roll

3. Position the vehicle on sloping ground. With the front of the vehicle tilted down, the **Pitch** reading must be negative. With the front tilted up, the **Pitch** must be positive;

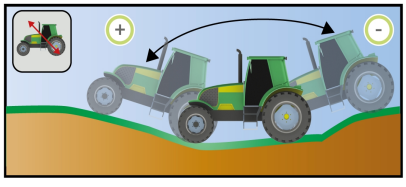


Figure - Pitch

4. The **Yaw** reading will only be different than zero with the vehicle in motion.

Figure - Yaw

Warning	Check if the Yaw, Pitch and Roll readings stabilize quickly after stopping the vehicle. In case this does not occur or there are inconsistencies with the read values, check if there is a problem with mounting the driver or any defective components.

12.7.3 Support mode activation

12.7.3.1 Control

Overshoot

Overshoot controls the rate in which the vehicle will drive on the guide line and the rate in which the vehicle will end as it approaches the line. The default value is zero and must only be altered if you cannot eliminate the overshoot through **Aggressiveness** and **Sensitivity**.

- Overshoot can be defined between 0 and 200%. By default it has a zero value, which means it is disabled.
- Increasing the value, the pilot converges more aggressively to the line. There is a tendency to increase overpass.
- Decreasing the value, the pilot converges more gently to the line, reducing overpass.

As an adjustment orientation, it is recommended to modify the value from zero to 100. If the system still presents overshoot, the value must be reduced. In case it aligns without overshooting but away from the line, increase the value.

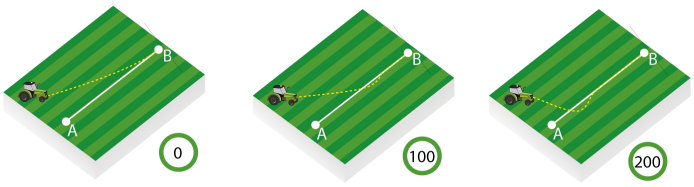


Figure - Overshoot

Aggressiveness

Aggressiveness controls the rate in which the vehicle attacks the guide line and how it keeps itself on the line. It can be defined between zero and 200. The default setting is 100.

- When, for example, the farming vehicle exceeds the guide line, it is necessary to reduce the aggressiveness. High values tend to make the vehicle zigzag;
- When the vehicle takes time to reach the guide line, it is necessary to increase aggressiveness. A value too low tends to make the pilot align faster and thus take more time to converge on the guide line.

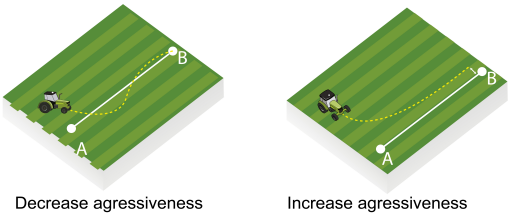


Figure - Agressiveness

Sensitivity

Sensitivity controls the rate in which the vehicle turns and its sensitivity when it is on the line. It mainly acts over the line.

- When, for example, the vehicle oscillates over the application line, it is necessary to reduce sensitivity. A high value tends to make the vehicle respond more quickly to small ground variations, possibly causing a zigzag trajectory.
- When the farming vehicle does not follow the application line, it is necessary to increase sensitivity. A value too low tends to make the vehicle take longer to respond to error variations.

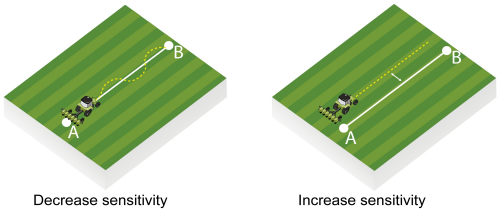


Figure - Sensitivity

Speed gain

Speed gain adjusts the gains (**Aggressiveness, Sensitivity,** and **Overshoot**) automatically based on vehicle speed.

- In case the application has great speed variations during the operation, adjust the gain to 100% and adjust the aggressiveness, sensitivity, and overshoot options when operating at 7km/h to the values that best adapt to your needs. After this initial adjustment, use the pilot on a different speed range and observe the response;
- In case the pilot is slowly converging to a zero error, increase the speed gain;
- In case the pilot is oscillating, reduce the speed gain. When the speed gain is set to zero, the system will alter the gains automatically based on vehicle speed (ideal for applications with low speed variations of around 3km/h).

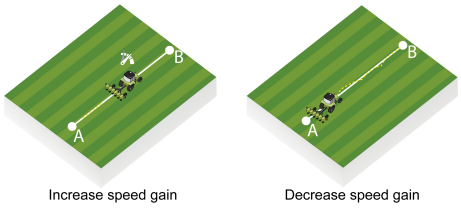


Figure - Speed gain

Curve aggressiveness

This option adjusts the gain increase and loss on the curves.

- When, for example, the farming vehicle opens on the curve (larger radius), it is necessary to increase curve gain;
- When the farming vehicle is closing the curve (smaller radius), it is necessary to reduce the curve gain.

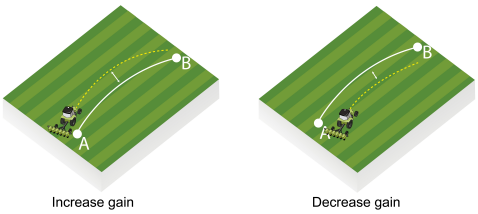


Figure - Curve aggressiveness

Adjustment recommendations

Follow the steps below as control adjustment suggestions:

1. **Observe the entry (linear guide)**

Activate the pilot after it is properly calibrated with the factory gain values:

- Aggressiveness: 100
- Sensitivity: 100
- Overshoot: 0

Warning	Perform the adjustment close to the working speed.

Field response	Description
If the response oscillates with a zigzag trajectory, the response is aggressive (quick wheel movement) or exceeds the line (<30cm).	Reduce the **Aggressiveness** and the **Sensitivity** together until you have a stable and secure response.
If the response is slow, slowly converges to zero error, and the alignment is away from the reference line.	Increase the **Aggressiveness** and **Sensitivity** together until you have a stable and secure response.

2. **Aggressiveness and Sensitivity Adjustment**

After obtaining a stable and secure entry response, adjust the Aggressiveness and the Sensibility separately to obtain the best performance possible:

- Increase the aggressiveness for a larger “attack” on the line during entry. In case the pilot is too aggressive or presents large overpass, reduce the parameter value;
- During operation over the line, in case the pilot is acting too much on the wheels with a tendency to zigzag, reduce the sensitivity value;
- If it takes too long to respond to land slopes or tends to go parallel with the line with an error over 1cm, increase the sensitivity.

3. **Overshoot Adjustment**

If it is difficult to reconcile a good entry time with a good response time over the line and in case the pilot still presents overshoot upon entry:

- Alter the overshoot value from 0 to 100;
- In case the overshoot is still high, reduce the value;
- In case the pilot is away from the line, increase the value.

4. **Curve Gain Adjustment**

Firstly, aggressiveness and sensitivity must be adjusted during operation of a linear guide:

- If the trajectory is always more open than the reference, increase the gain;
- If the trajectory is always more closed than the reference, reduce the gain.

Warning	The **Maximum saturation**, **Minimum saturation**, and **Maximum delta** values (available in the **General settings** option) directly affect the curve gain response. Low values for these parameters tend to make the response slow. Increasing curve gain, in this case, will not improve performance.

12.7.3.2 Calibration

Important	Only authorized technical personnel with an advanced visualization password can perform this step.
Important	Before starting the calibration procedure, ensure the vehicle dimensions are properly set (**Wheelbase, Antenna height**, and **Antenna offset)**.

To perform the calibration, proceed as follows:

1. In the **Configuration menu**, press the **System settings** option;
2. Select the **Advanced** option and enter the password. Press **OK**;
3. Confirm to return to the **Configuration menu**, then press **Auto steering**;
4. Select the **Calibration** option;
5. Perform the calibration step by step according to the descriptions in the following topics.

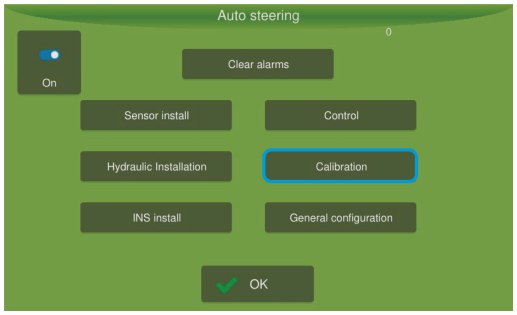


Figure - Calibration

On the calibration screen, it is possible to configure the following device parameters:

- Control driver position (ATCD);
- Accelerometer/Gyro calibration – relative position between the control driver and the vehicle;
- Gyroscope;
- Joystick setup;
- Joystick deadzone.

Calibrating the driver position

1. Choose the correct driver installation position and press **Next.**

Warning	• Install the driver on a flat surface; • Install the driver on the same structure and, if possible, close to the antenna; • Never install the driver on a hard surface or the antenna on a dampened surface; • Always screw the driver onto the vehicle's frame.

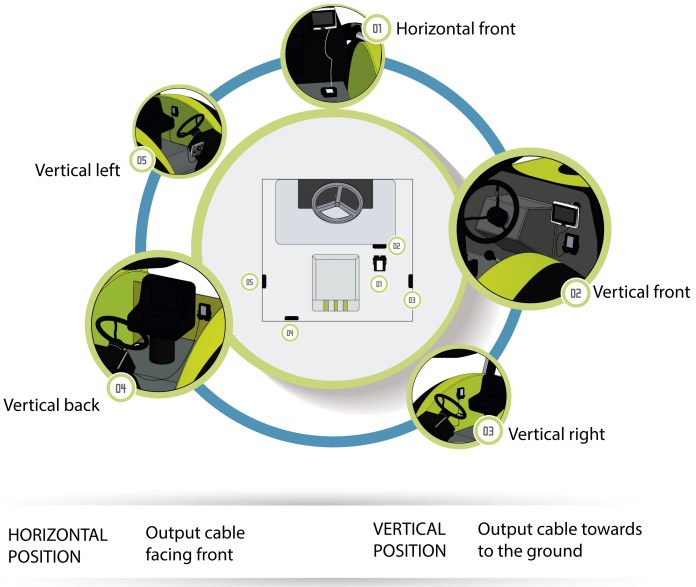


Figure - Driver position

Figure - Driver position

Calibrating the accelerometer

Determines the relative position (rolling and pitching angles) between the vehicle and the drive installation position.

Warning	Before starting calibration, consider the following: • Perform the tests with the motor in work rotation; • Do not swing the vehicle during this step; • This step is performed in two parts and the vehicle will be moved and should return to the same location, thus it is recommended to mark the ground where the vehicle wheels are positioned; • Perform the tests at a flat location; • Whenever the driver is removed from its position (for cleaning or any other purpose), the accelerometer calibration must be re-done, even if the device has been placed in the same location.

Figure – Accelerometer

To perform the calibration, proceed as follows:

1. Increase the motor rotation for working rotation (1500-2000rpm);
2. Press the vehicle image to the left and wait ten seconds;
3. Wait until the vehicle image to the right is green;
4. Position the vehicle in the same place, however in the opposite direction (for example, if the vehicle is facing north, it must now face south);
5. Press the vehicle image to the right and wait ten seconds;
6. As soon as both images are green, a window will be displayed showing the values found. Press **OK** to save and press **Next**.

Important	If the result shows some angle (rolling or pitching) larger than ten degrees, it is recommended to re-evaluate the installation position (the tilt compesation may not operate as expected).

Calibrating the gyroscope

The purpose is to estimate errors in the data provided by the gyroscopes.

Warning	• Do not move or swing the vehicle during the test; • This test is performed automatically whenever the vehicle is stopped;

To perform calibration, proceed as follows:

1. Press the **Calibrate Gyroscope** option;
2. After twenty seconds a window will show with the values found. Confirm with **OK** so that the data is saved.

Important	Values higher than 5 degrees/second may indicate component malfunctioning.

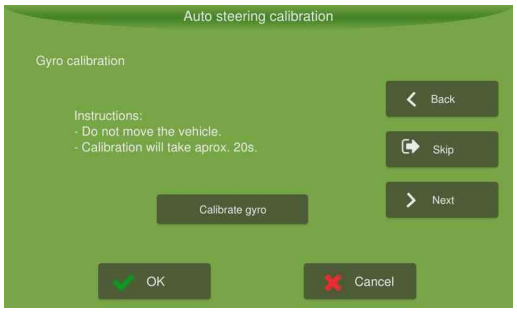


Figure - Gyroscope

Calibrating the joystick setup

Important	Available only to the Caterpillar pilot.

In the Calibration screen, with the Joystick switch selected, you can set up the joystick positions (front and back) as well as lateral movement (the reading should increase if the joystick is moved to the right). The reverse detection pattern selected must be that of the auto stering (Guidance > Reverse detector.)

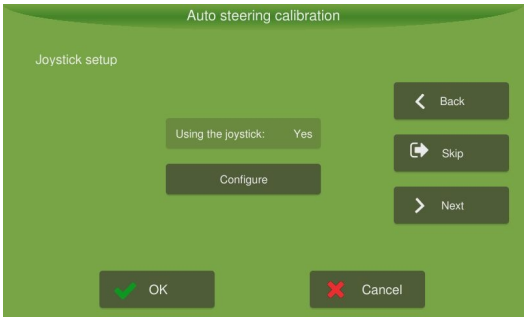


Figure - Joystick calibration settings

Calibrating the joystick deadzone

Calibration of the dead zone should only be done if the machine stops moving sideways. When starting, the machine will move laterally. The value 0.11 indicates the minimum rotation / movement speed of the machine for the calibration to be completed. If the machine does not move sideways stopped, this value should be adjusted directly on the hydraulic calibration screen, empirically (0.6 is recommended, if the driver is very aggressive on the line, it should be reduced in steps of 0.05, otherwise increase in steps of 0.05).

Figure - Joystick dead zone calibration

12.7.3.3 General configuration

Important	Only authorized technical personnel with an advanced visualization password can perform this step.

To adjust the general settings, proceed as follows:

1. In the **Configuration menu**, press option **Settings**;
2. Select the **Advanced** option and enter the password. Press **OK**;
3. Confirm to return to the **Configuration menu** and then press **Auto steering**;
4. Select the **General configuration** option (image 01);
5. Alter the parameters as desired (image 02);
6. Confirm the operation.

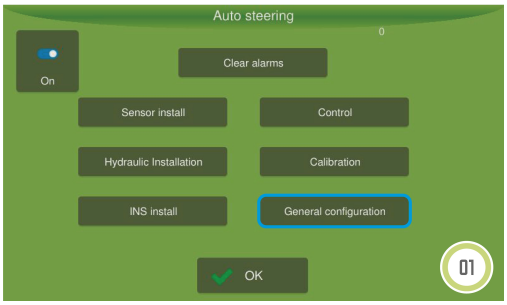


Figure - General configuration

Figure - General configuration

Security parameters

- **Override gain**

  Adjusts the effort needed by the operator to resume steering the vehicle from the automatic pilot. The larger the value, the more difficult it is. The smaller, the more easy (0-1000).

- **Error sec. (meters)**

  Blocks the automatic pilot use in case the vehicle positioning error is above the configured value, thus avoiding abrupt maneuvers.

- **Angle sec. (degrees)**

  Blocks the automatic pilot use in case the vehicle positioning error is above the configured value, thus avoiding abrupt maneuvers.

- **Wheel alarm (degrees)**

  Checks the wheel sensor operation and, in case of anomaly, disables the auto steering.

- **Alarm behavior**

  Indicates if the automatic pilot alarms will turn the operation off or not (section cut, fertilizing, etc).

- **Maximum speed allowed**

  Corresponds to the value that the user uses as cutting speed in the operation. If the equipment is operating above the set maximum speed, the autopilot can not be switched on. If the equipment exceeds the maximum speed set with the autopilot on, it will be disarmed.

- **Road mode inactive time**

  It corresponds to the time configurable by the operator so that the pop up warning appears. This warning relates to autopilot downtime.

Operation parameters

- **Maximum saturation (degrees)**

  Maximum steering angle at low speeds.

- **Minimum saturation (degrees)**

  Maximum steering angle at high speeds (25km/h).

- **Maximum delta (degrees)**

  Maximum speed for changing wheel direction.

Important	Low values for these parameters tend to harm entry and the pilot response on a curved guide (slowness to perform maneuvers).
Warning	High **Minimum saturation** and **Maximum delta** values may cause abrupt vehicle movement, which impairs operation safety on high speeds.

- **PWM C control logic**

  Configuration of the third output of the steering driver. It is possible to configure the MOTOR C output when using hydraulic auto steering.

12.8 Operation

On the operation screen, check if the automatic pilot icon shows and is active:

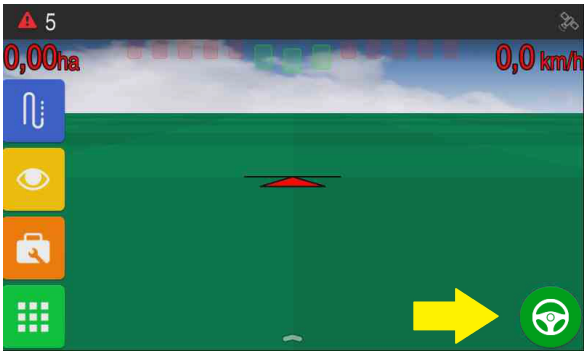


Figure - Operating auto steering pilot

Icon	Description
	Auto steering pilot activated - the device is on and controlling the wheel.
	Auto steering pilot enabled - the devices is enabled to operate.
	Auto steering pilot blocked - the device cannot be activated. Critical alarm occurence (makes operation impossible). High error and angle in regards to the guide.
	Auto steering pilot unavailable - no communication with the ATCD control driver.

Important	In case the icon is disabled, select **Settings menu** - **Auto steering pilot** and check if the **On** icon shows.

To turn the electric or hydraulic automatic pilot on or off:

- Press the **Auto steering pilot** icon on the operation screen;
- Simultaneously touch the operation screen with three fingers, or

- Use an on/off pedal, in case one has been installed to the pilot.

Warning	It is also possible to turn the automatic pilot off by manually forcing the steering wheel.

In order for the auto steering pilot to start driving the vehicle, it is necessary that it is over a guide line. When active, the automatic pilot will drive the vehicle over this guide line. For guide line creation, see topic Creating a guide line.

Important	The operator must manually drive the vehicle between guide lines.
Warning	The operator must always be aware of the vehicle's trajectory, observing potential obstacles or regions unfit for the vehicle's movement.

With an upwards dragging motion on the operation screen, the pilot bar is shown where it is possible to set the **Aggressiveness**, **Sensitivity,** and **Overshoot** parameters.

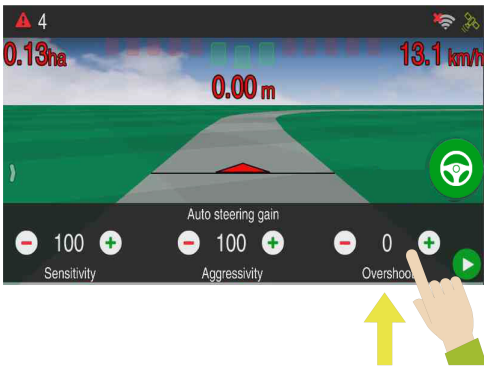


Figure - Pilot operation

13. Fertilisation control

Important	Feature available only after product activation.

The rate application process aims to equalize soil nutrients, thus optimizing the application of the resources.

13.1 Settings

Important	It is only possible to access these settings when implements Fertilizer Applicator/Limestone Applicator or Seed Applicator/Fertilizer Applicator are selected.

To configure the **Fertilisation control**, proceed as follows:

1. Select option **Fertilisation control** from the **Configuration menu**;
2. Select the input you wish to configure (if more than one exists);
3. Select the option which configures the **Input dosage rate**;
4. Configure and press **OK** to confirm dosage setting;
5. Select the option to configure the **input calibration**;
6. Configure and press **OK** to confirm calibration setting.

Details on setting **Dosage rate** and **Input calibration** are in the subsequent topics.

Warning	Dosage values are in Kg/ha.

Figure - Fertilisation control

13.1.1 Dosage rates

The **Dosage rate** corresponds to the amount of input that will be applied by that specific input container in one hectare. Three types of dosage rates can be used:

- Fixed rate;
- Variable rate;
- Fixed rate with map.

For each input, two rate values may be preconfigured. They can be used alternately during the operation at the operator's discretion.

13.1.1.1 Fixed rate

Two fixed values must be set for the **Fixed rate** which may be used during operation and will be available on the panel for quick access by the operator. They are called dispenser. Seeing that for this type of rate a boundary map is not used, the fixed rate is applied throughout the traversed trajectory.

To set the **Fixed rate** values, proceed as follows:

1. Select option **Fertilisation control** from the **Configuration menu**;
2. Select option **Dosage type**;
3. Select option **Fixed rate**;

4. Select option **Primary dosage**;
5. Enter the desired value in Kg/ha and press **OK**;
6. Select option **Secondary dosage**;
7. Enter the desired value in Kg/ha and press **OK**;
8. Press **OK** to confirm the operation.

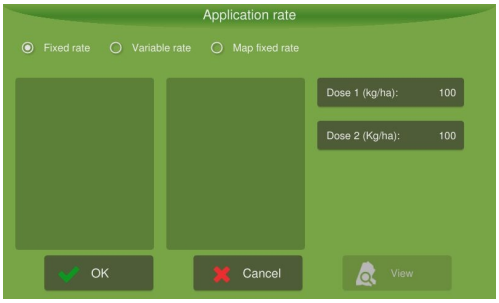


Figure - Fixed rate

13.1.1.2 Fixed rate with map

For the **Fixed rate with map** two fixed values must be set, the **Primary dosage** and the **Secondary dosage**, which may be used during operation and will be available on the panel for quick access by the operator. They are called dispensers.

Important	Since a map is used for this type of rate, the map will serve as a boundary for input application. Nothing will be applied outside the map.

To view the selected map with its total area, use option **View**. To configure the values for the fixed rate with map, proceed as follows:

1. Select option **Fixed rate with map**;
2. Select the desired map among those listed;
3. Select option **Primary dosage**;
4. Enter the desired value in Kg/ha and press **OK**;
5. Select option **Secondary dosage**;
6. Enter the desired value in Kg/ha and press **OK**;
7. Press **OK** to confirm the operation.

13.1.1.3 Variable rate

For the **Variable rate**, two fixed values must be set that may be used during operation and will be available on the panel for quick access by the operator. They are called dispensers. For the variable rate, a map is used. However, in this case the **Primary dosage** and **Secondary dosage** set in the system will be used outside the map boundaries. Inside the map boundaries, the values previously set on the map will be used.

Important	In order not to apply the input outside the map, simply set the **Primary dosage** and **Secondary dosage** values to zero

To view the selected map as well as its total area and set dosage, use option **View.**

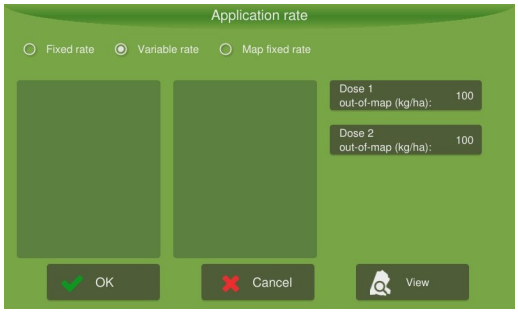


Figure - Variable rate

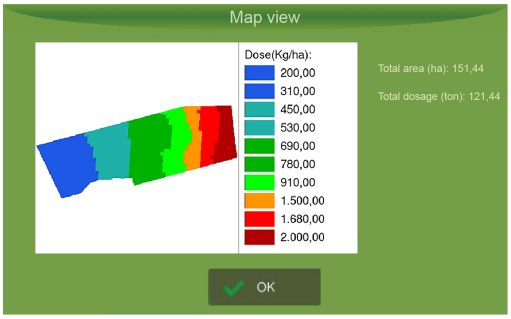


Figure - Map view - Variable rate

To configure the **Variable rate** values, proceed as follows:

1. Select option **Variable rate**;
2. Select the desired map among those available;
3. Among the attribute options available, select the recommendation to be used;
4. Select option **Primary dosage** for outside the map boundaries;
5. Enter the desired value in kg/ha and press **OK**;
6. Select option **Secondary dosage** for outside the map boundaries;
7. Enter the desired value in kg/ha and press **OK**;
8. Press **OK** to confirm the operation.

13.1.2 Calibration

Since input density and/or grain sizes may vary, a calibration must be performed whenever possible for any operation mode, either **Fixed rate** or **Variable rate.** To perform the **Calibration** for an input, proceed as follows:

1. Select option **Fertilisation** from the **Configuration menu**;
2. Select option **Input**;
3. Select the input you wish to calibrate;
4. Select option **Calibration**.

Important	Check the calibration step-by-step in the following topics.

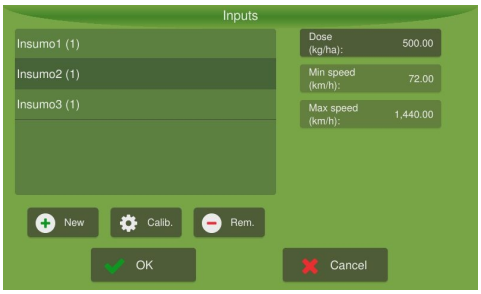


Figure - Input calibration

On the input screen, other than calibration you can also create a new input item or remove an existing input.

Important	You need to be on the **Advanced** visualization mode to be able to **Add** or **Remove** an input from the list.

When an input is selected, information on **Dosage**, **Minimum speed**, and **Maximum speed** indicated for operating that input are presented. There are two types of calibration, namely **Fixed gate calibration** and **Multiple or two-stage gate calibration.**

Important	To view the Multiple or two-stage gate calibration option this feature must be activated on the display, otherwise only the Fixed gate will be available.

13.1.2.1 Fixed gate calibration

To perform the calibration, proceed as follows:

1. Adjust the time using the right and left arrows;

Warning	Never use a time smaller than 40 seconds.

2. With the vehicle in work rotation and the hydraulic command activated, press the option to **Start** the test;
3. The countdown will start and automatically stop when the time is up;
4. Inform the weight of the material collected during this time using an appropriate scale.

Warning	Normally, fertilizer applicators have a single line, while seed applicators have multiple lines. In this case, indicate the input weight collected in a single line.
Important	Ensure that the hydraulic motor speed is close to the reference speed. Factory setting is usually 150RPM, with little variation.

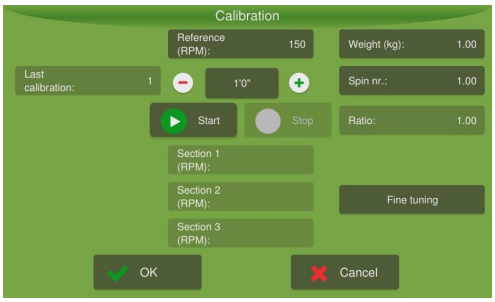


Figure - Fixed gate calibration

13.1.2.2 Multiple or two-stage gate calibration

To perform the calibration, proceed as follows:

1. Mark the **Multicalibration** option with a **V**;
2. Select the **Low** gate and enter the desired collection time;
3. With the vehicle in work rotation and the hydraulic command activated, press the option to **Start** the test;;
4. The countdown will begin and will automatically stop when the time is up;
5. Enter the weight of the material collected in this time using an appropriate scale;
6. Select the **High** gate and repeat the previous steps;
7. Press **OK** to confirm and check the minimum and maximum speeds for the map recommendations.

Calibration fine tuning

To fine tune the performed calibrations, proceed as follows:

1. On the operation screen, select option **View**;
2. Select option **Clear**;
3. Confirm clearing the trail, the total input, and the applied area;
4. Apply a known amount of the input whose calibration you wish to fine tune;
5. In the calibration settings, select option **Fine tuning**;
6. Enter the input weight applied (**Actual weight**);
7. Enter the **Read weight** by the monitor (visible on the operation screen).

To verify, reapply a known amount of fertilizer and check if the applied weight (actual weight) is close to the weight read by the monitor (there may be a variation of around 5%). If it still is not close, redo the **Fine tuning** procedure. After calibrating and fine tuning, enter the **Dosage** to check the speed range (minimum and maximum) in which the system can operate.

Figure - Fine tuning

13.2 Operation

13.2.1 Start operation

The operation is started by selection the suspended operation option in the center of the operation screen.

Important	Application will only start once the implement moves and exceeds the minimum speed set for the GNSS.

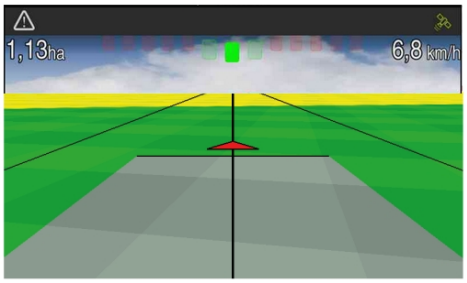


Figure - Operation

13.2.2 Monitor operation

The features available for the **Fertilisation** implement are detailed below:

Figure - Fertilisation features

01 - Speedometer (km/h)
The green area represents the speed range indicated for the operation. The red ends represent the maximum and minimum values and the indicator shows the current speed.

02 – Tank level
The user indicates in liters or kilograms how much he put in the tank and the system discounts what is being applied, indicating the current tank level (in percentage). When the tank level goes below 10%, it turns red as an alert for the operator. To indicate a new supply, just press the tank icon.

03 – Input application statement
The number that shows is the recommended dosage for input application. This value may be altered in real time using the plus and minus options. The increase or decrease is of 5kg/h for each touch. The strip below shows the amount of input being applied: the middle of the strip equals the recommended value indicated above. If the marker is to the left, there is less than the recommended amount of input being applied, and if it is to the right, there is more than the recommended being applied.

04 – Dosing clocks
The clock values may be set through the Fertilization menu and give access to predefined doses for input application. It is possible to alternate between the two dosages whenever necessary by simply pressing the desired clock icon.

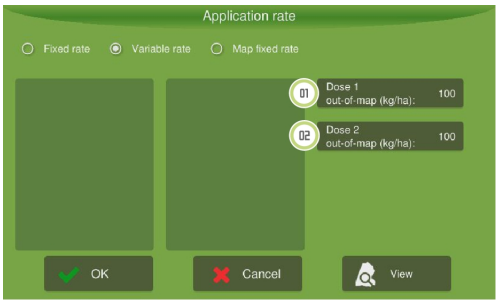


Figure - Dispensers

05 – Section demonstrator
A fertilizer applicator has no selection cut, but a controller. Pressing osahdyasgydn a section, you can turn it on or off automatically, but the operation can also automatically control the on/off when necessary.

The sections may show on the operation screen with the following situations:

Icon	Description
	Manually turned off
	Manually turned on
	Automatically turned on
	Automatically turned off

13.2.3 Suspend application

Press the center of the screen to suspend the operation. An image indicating that the operation is suspended is shown in the middle of the screen. During the period in which the operation is suspended, the trail is not drawn on the map.

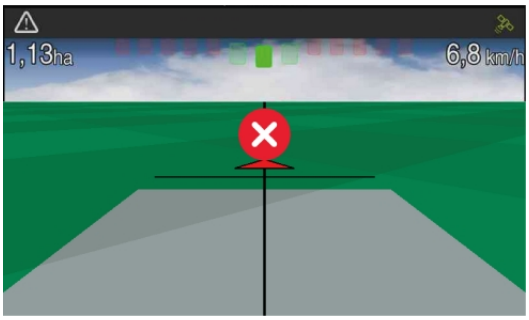


Figure – Suspend application

Important	It is possible to suspend the operation using a button or a pedal.

14. Sprayer control

Important	Feature available only upon product activation.

The **Sprayer** performs the automatic activation and shutdown of the spraying sections, minimizing overlap in input application and avoiding excessive spraying, thus ensuring the recommended doses even with speed variations when operating the machines.

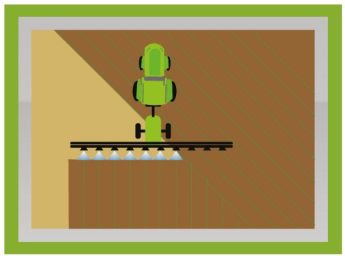


Figure - Sprayer

14.1 Settings

To configure the **Sprayer control**, proceed as follows:

1. Select option **Sprayer control** from the **Configuration menu**;
2. Select the tank you wish to configure (if there is more than one);
3. Select the option to configure the input dosage rate;
4. Configure and press **OK** to confirm the dosage setting;
5. Select the option that configures the nozzle;
6. Configure and press **OK** to confirm the nozzle setting;
7. After setting the dosage and the nozzle, confirm the operation pressing **OK**.

The configuration details for the **Fixed rate** and the **Nozzle configuration** are presented in the subsequent topics.

Important	It is only possible to enter these settings by selecting the Sprayer or Planter that applied liquid pesticides.

Figure - Sprayer screen

14.1.1 Fixed rate

The **Fixed rate** corresponds to the amount of input that will be applied for that specific input container in one hectare. Three types of dosage rates may be used:

- Fixed rate;
- Variable rate;
- Fixed rate with map.

For each input, two rate values may be preconfigured which can be used alternately during operation at the operator's discretion.

14.1.2 Nozzle configuration

To configure the **Nozzle configuration**, proceed as follows:

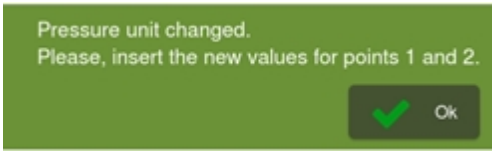
1. Select the tank you wish to configure;
2. Select option **Nozzle configuration**;
3. Enter the color and the minimum and maximum flow rate (manufacturer's specifications);
4. Check the maximum and minimum speeds calculated automatically;
5. Press **OK** to confirm nozzle settings.

Figure - Nozzle configuration

14.1.3 Sprayer pressure calibration

To perform pressure reading calibration, proceed as follows:

1. Select the **Pressure unit** option to change the current pressure unit. The following message appears asking you to change the scale:



2. Adjust the values of the pressure points in the **Pressure point 1** and **Pressure point 2** fields;
3. Select Voltage Point 1 (v) to adjust the value of the expected voltage corresponding to the pressure;
4. Select Voltage Point 2 (v) to adjust the value of the expected voltage corresponding to the pressure. This point must be different from point 1;

Important	According to the reading the voltage sensor curve will be drawn a line relating voltage and pressure. To calibrate, use the values from the data sheet of the pressure sensor used or read them manually.

5. Select **Input filter samples** to adjust the number of samples used to calculate pressure through a moving average filter.

14.2 Operation

14.2.1 Start operation

The operation is started by selecting the suspended operation in the center of the operation screen.

Important	The application will only begin when the implement moves and exceeds the minimum speed configured for the GNSS.

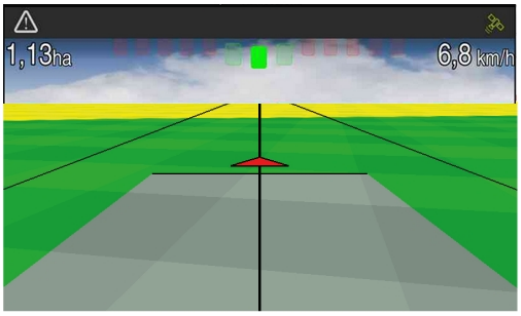


Figure - Operation

14.2.2 Monitor operation

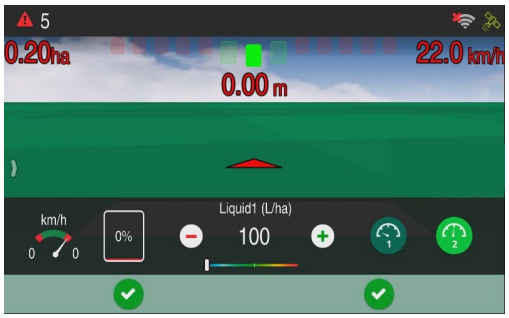


Figure - Sprayer operation

To learn the bar feature details, check topic Monitor operation on the Fertilisation control topic.

14.2.3 Suspend application

Press the center of the screen to suspend the operation. An image indicating that the operation is suspended will be presented in the middle of the screen. While the operation is suspended. The trail will not be drawn on the map.

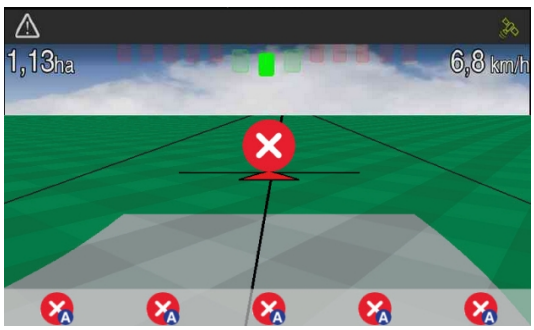


Figure - Suspend sprayer

Important	It is possible to suspend the operation using a button or a pedal.

14.2.4 Session cut

Important	For this implement, the section cut is already configured.

The section cut presents both manual and automatic section control. For the manual section control, the operator determines which sections to close. It is possible to open or close the sections at any time, regardless of the state of other sections. For example, close one section between two open sections.

Icon	Description
	Manually closed
	Manually opened
	Automatically opened
	Automatically closed

To manually control the sections, press the red icon to close a section or press the green icon to open it.

Important	The trail on the screen between sections is not shown when a section is closed between two open sections.

For the automatic section control, the automatic opening and closing of sections is done as the planter enters in applied or not applied areas. The corresponding icons for open or closed section are presented with letter A (automatic) on the right.

- **Automatic closing:** the section overlaps more than the configured percentage;
- **Automatic opening:** the section does not overlap.

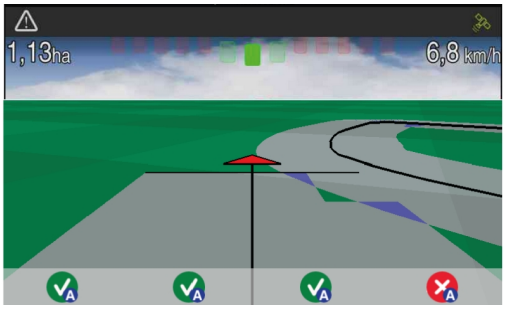


Figure - Sprayer selection cut

15. Bait control

Important	Feature available only upon product activation.

The application of bait control allows intermittent dosing as well as the setting of an extra dosage to be applied by the operator upon sighting anthills. The continuous dosage application is performed using the configured spacing, and the dosage calibration is done by product weight, ensuring correct dosages.

- Allows three manual dosages to be configured, besides setting the continuous dosage;
- The doses are by weight, not by time;
- Performs electronic calibration;
- Automatically calculates the distance between doses;
- Generates operation maps and calculates productive yields and times, and can be integrated with a forestry management system.

15.1 Settings

Important	It is only possible to enter the **Bait control** when the product is selected.

To configure the bait control, select option **Bait control** from the **Configuration menu**. The following options are available:

- **Recommendation (Kg/ha)**
  Enter the amount of anticide that will be applied per hectare.
- **Quantity per application**
  Total amount of anticide that will be applied in each discharge adding all the continuous applicators.

Warning	In case there are two applicators, the amount applied for each nozzle will be this value divided by two.

- **Spacing between applications (m)**
  Distance in meters between applications.

Important	The three settings above are related to each other and are automatically altered when a value is changes, always using the Recommendation field value as main reference. For example, if the user changes the Spacing between applications, the system automatically alters the value for Quantity per application so that the recommendation is reached. The same logic applied when the used alters the Quantity per application field, automatically altering the Spacing between applications to meet the recommendation.

- **Continuous dosage calibration**
  Opens the calibration screen for the continuous applicators.
- **Small dosage (g)**
  Small predefined dosage for applying the anticide.
- **Medium dosage (g)**
  Medium predefined dosage for applying the anticide.
- **Large dosage (g)**
  Large predefined dosage for applying the anticide.
- **Manual dosage calibration**
  Opens the calibration screen for the manual applicator.

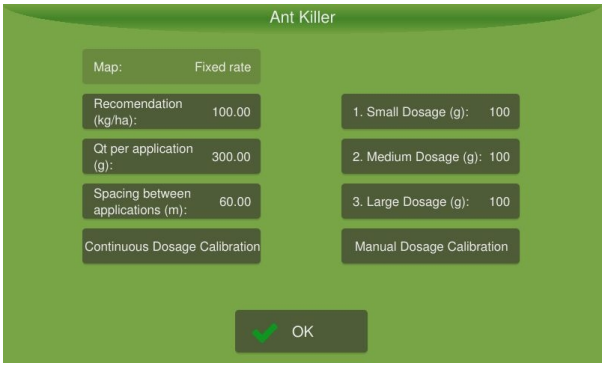


Figure - Bait control configuration

15.1.1 Calibration

The calibration for the continuous and manual applications is performed following the same steps. To calibrate the anticide, proceed as follows:

1. Insert a collection bag on the continuous applicators or manual applicator exists in case of manual calibration;
2. Press **Start** to start collecting. Wait until the collection time ends. The system will stop automatically;
3. Weigh the collected anticide with a precision scale. Inform the on-board computer of the weight in grams;
4. In **Calculated calibration**, the amount applied in grams per meter will be shown;
5. Select **OK**.

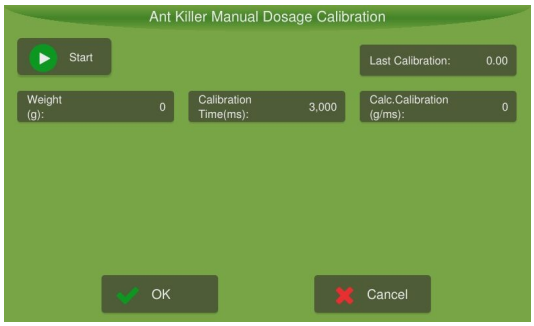


Figure - Bait control dosage calibration

15.2 Operation

15.2.1 Start operation

The operation is started by selecting the suspended operation option in the center of the operation screen.

Important	Application will only begin once the implement moves and exceeds the minimum speed set for the GNSS.

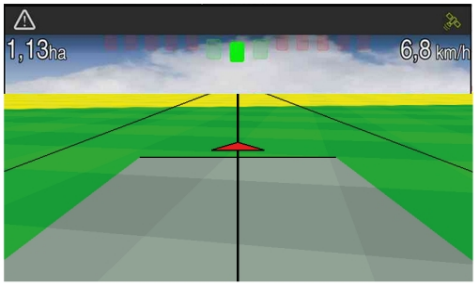


Figure - Operation

15.2.2 Monitor operation

The operation is started by selecting the suspended operation option in the center of the operation screen.

Important	Application will only begin once the implement moves and exceeds the minimum speed set for the GNSS.

To view the lower part of the screen, drag it from the bottom to the top.

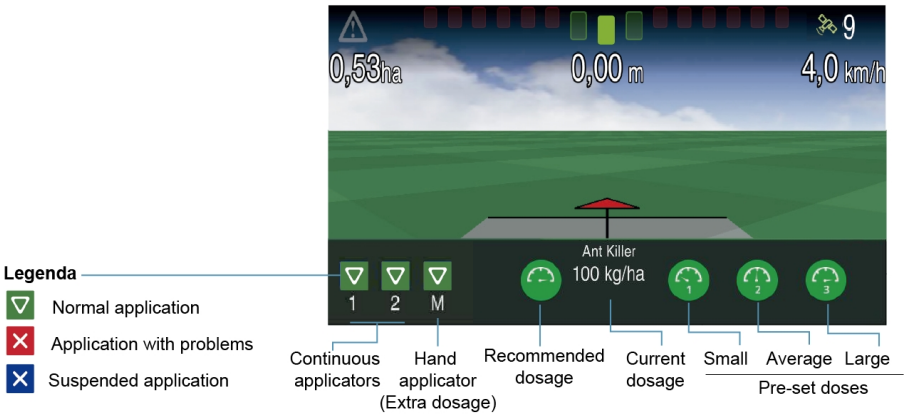


Figure - Bait control operation

On the lower bar there are the following options:

- View of the anticide sensor bar for continuous and/or manual application

This option is available only for implements with installed sensors. If the sensor is not enabled, this bar will not show. The icons represented by numbers 1 and 2 represent the continuous dispensers, while M represents the manual dispenser. Three options are available: normal application, problematic application, and suspended application, as shown by the caption in the figure.

- Recommended dosage

The recommended dosage applied the same amount used in automatic application. The number that shows on the central part of the menu indicates the amount of anticide that is being applied.

- Dosing clocks

The values for dosing clocks are set through the Bait control menu and give access to predefined dosages for applying anticide upon sighting anthills. It is possible to alternate among the three dosages whenever necessary simply pressing the desired clock icon. Indicator 1 refers to the small dosage, indicator 2, to the medium dosage, and indicator 3 to the large dosage. For implements with manual dispensers, the dosing clocks use this exit. For implements without this applicator, the predefined dosages are applied through the continuous applicators.

15.2.3 Suspend operation

Press the center of the screen to suspend the operation. A figure of an X indicating that the operation is suspended will be presented in the middle of the screen. While the operation is suspended, the trail will not be drawn on the map.

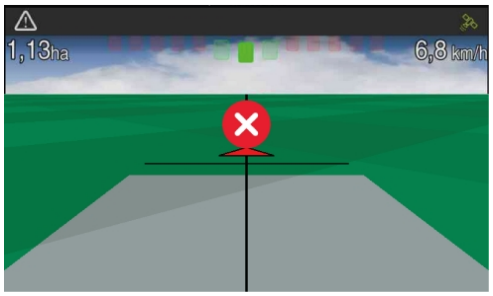


Figure - Suspend operation

Important	It is possible to suspend the operation using a button or a pedal.

16. Planting control

16.1 Settings

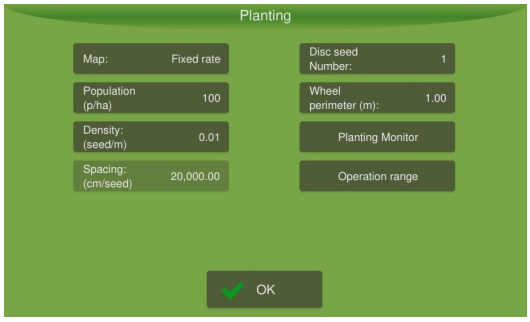


Figure - Planting control

To configure the planting, proceed as follows:

1. Select option **Planting control** from the **Configuration menu**;
2. Select the option that configures the **Fixed rate** for the input;
3. Enter the **Seed population**;
4. Enter the **Seed density**;
5. Enter the **Disc seed number**;
6. Enter the **Wheel perimeter**;
7. Configure the **Planting monitor**;
8. Configure the **Operating range**;
9. Press **OK**.

The following parameters are available for setting:

- **Map**
  Instructions in topic Dosage rate.

- **Population**
  When the fixed rate is activated, the population may be entered directly (p/ha) or through the **Density** field (seeds/m), with the **Spacing** (cm/seed) calculated automatically.

- **Disc seed number**
  This value refers to the amount of seeds needed to fill the holes in the dispenser disc.

- **Wheel perimeter (m)**
  This value is used in case the speed is calculated through the vehicle's or the implement's wheel instead of the GNSS.

- **Operating range**
  Enter the minimum and maximum population values recommended for the selected map and check if the minimum and maximum operation speeds. When in operation, it will only be applied when in the given range.

Figure - Operating range

16.2 Operation

16.2.1 Start operation

The operation is started by selecting the suspended operation option in the center of the operation screen.

Important	Application will only begin once the implement is moving and exceeds the minimum speed set for the GNSS.

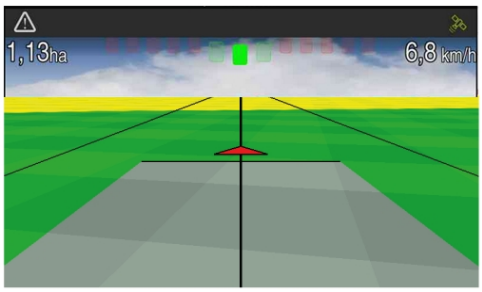


Figure - Operation

16.2.2 Monitor operation

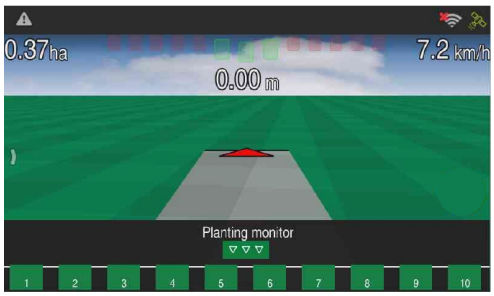


Figure - Operation

During the operation, the user my follow the seed flow on the monitor. To learn the feature details, check topic Planting monitor below.

16.2.3 Suspend operation

Press the center of the screen to suspend the operation. An image indicating that the operation is suspended will be shown in the middle of the screen. While the operation is suspended, the trail will not be drawn on the map.

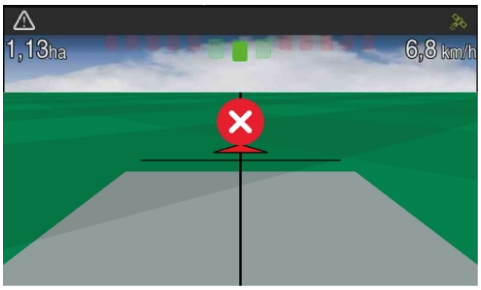


Figure - Suspended planting operation

Important	It is possible to suspend the operation using a button or a pedal.

16.2.4 Section cut

Warning	This option is available for seed and fertilizer controllers. This feature cannot be used for planting monitoring.

Icon	Description
	Manually closed
	Manually opened

The section cut has a manual and an automatic section control.

For manual section control, the operator determines which sections to close. It is possible to open or close the sections at any time, regardless of the state of other sections. For example, you can close a section between to open sections. To manually control the sections, press the close icon manually to close a section or press the open icon manually to open the section and leave it open.

Important	The trail on the screen is not shown when a section is closed between two open sections.

For automatic section control, the sections are automatically opened or closed as the planter enters applied or not applied areas. Icons corresponding to open or closed sections are presented with letter A (automatic) on the right.

- **Automatic closing:** the section overlaps exceeding the set percentage;
- **Automatic opening:** the section does not overlap.

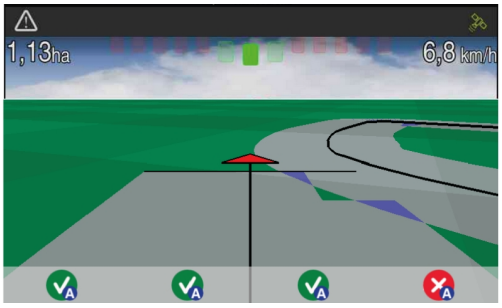


Figure - Planting section cut

16.2.5 Planting monitor

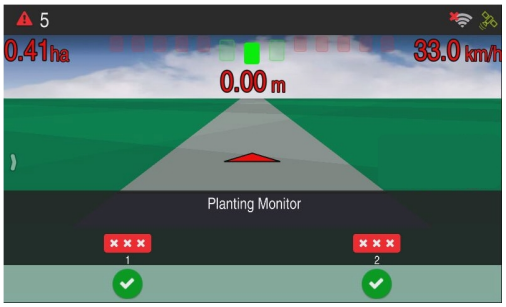


Figure - Planting monitor

Sensor adjustment

To adjust the sensor, check the procedure in topic Seed sensors.

Visualization

In option **Planting control – Planting monitor**, it is possible to choose which planting monitor visualization mode will be used: **Standard** or **Advanced.** In **Standard** mode, when you drag your finger from the bottom of the screen to the center, a planting monitor bar will be shown offering three visualization options:

- Visualization of the seed sensor bar;
- Visualization of the fertilizer sensor and the seed sensor bar.

Important	Consult with a specialized technician to configure the implement and the bar visualizations.

Important	If the implement has more than one type of fertilizer, the fertilizer sensor bar will present the two fertilizers in the same bar.

Each section is indicated by its number and icons, whose meanings are described in topic Monitor operation.

Type	Description
	Rectangle with rounded corners - Fertilizer
	Rectangle with rounded corners - Seeds

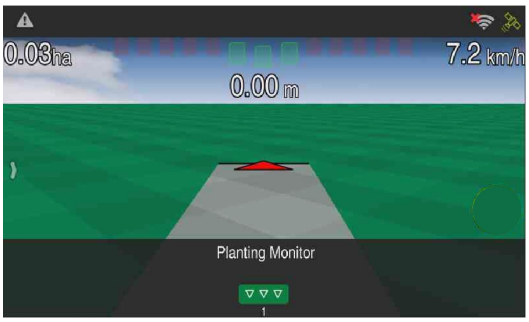


Figure - Panting monitor bar - standard mode

These may contain the following color fills:

- Red - No application - problems;
- Blue - Operation suspended;
- Green - Normal application.

For indicating the state of each line, the following items may be viewed:

Type	Description
	All lines are applying normally.
	All lines are not applying.
	One or more lines are not applying. For more information, press the icon. To exit this detailed visualization mode, move the bar downwards.

In **advanced** mode, the bars may be seed to increase or decrease according to the density that is being applied in each line as a function of the recommended density. Green indicates the population is within the recommended, and red indicates it is below the recommended.

Important	The advanced visualization mode is only available for the seed monitor.

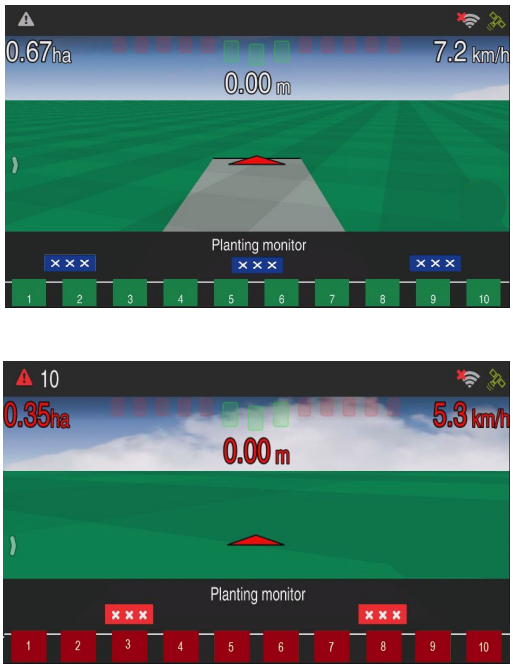


Figure - Planting monitor in advanced mode - density

The lower bar shows all the planter lines. In case the planter has many lines, it is possible to zoom in for better visualization of the desired line.

Figure - Zoom of the lines

To do so, press the area of the required line and a bar with seven lines from this region will show, as illustrated in the figure below. To return to viewing all bars, move the zoom bar downwards. When there is a fault in the seed or fertilizer flow, the system will warn the user visually and soundly.

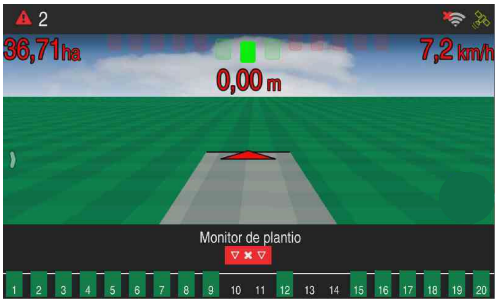


Figure - Density failure

Tolerance

In option **Planting – Planting monitor**, enter the desired tolerance values. In **standard** visualization mode, the tolerances are considered at 30% regardless of the set values. In **advanced** visualization mode, the tolerances are considered according to this information.

16.2.5.1 Doubles and skips

Important	The planter must be configured to view this feature.
Important	Prerequisite for operation: seed sensor.

Double and skips lines are considered planting errors. Doubles occur when more seeds than required are applied in a region, while skips occur when seeds cease to be applied in a region.

Important	How to enable: Doubles and skips can only be enabled by a technician.
Important	Only in Advanced mode you can modify the detection sensitivity of doubles and skips.

Doubles

Occurs when a number of seeds falls above the required.

The percentage of doubles defines the tolerance in relation to the distance that the system considers a double.

Example: With a spacing of 1 meter between seeds, a second seed fell 50 cm earlier than expected. If the tolerance percentage is 40%, this second seed is considered a double, but if the percentage is at 60%, it will not be considered a double.

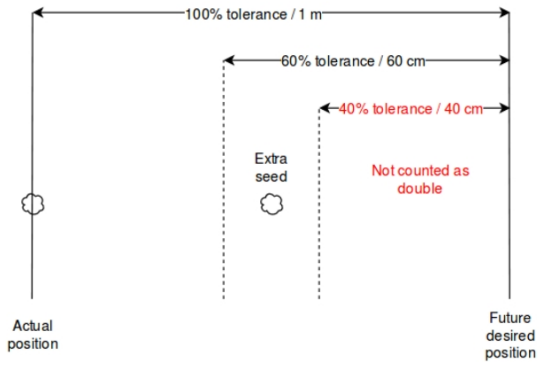


Figure - Diagram of double lines

Skips

Occurs when the expected seed is not cleared.

The percentage of failures defines the tolerance in relation to the distance that the system considers a skips.

Example: With a spacing of 1 meter between the seeds, a second seed fell 50 cm later than expected. If the tolerance percentage is 40% is considered a failure, however, if the percentage is at 60%, it will not be considered a failure.

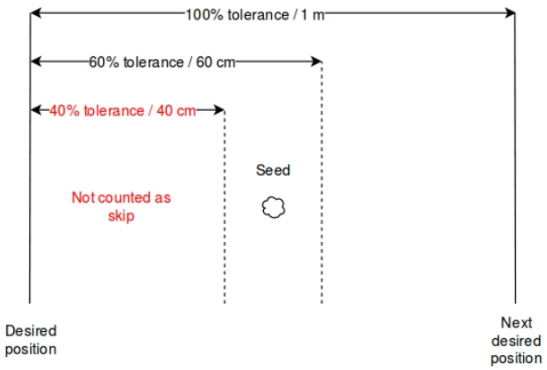


Figure - Diagram of skips lines

There is a visual indicator in the operation screen with yellow and red lines. The upper yellow refers to the double lines. The lower red refers to skips lines.

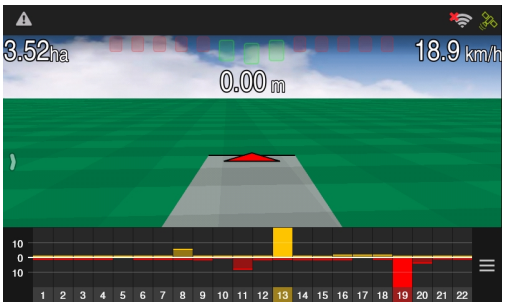


Figure - Visual indicator of doubles and skips lines

Both the red and yellow lines will appear when they exceed the limit of the graph. When the line is totally yellow, it will indicate the number of double lines. When the line is completely red, it will indicate the number of skips lines.

17. Files

The display allows data transfer from or to a pendrive. This is useful to import or export data from/to your on-board computer to/from other display units. The following options are available for transfer:

- **Operation maps**

  Maps that contain information collected by the display such as seed sensors per line, GPS date and time, vehicle error relative to the guide, seed, fertilizer, and liquids application, application width, tractor speed, alarms, among others.

- **Prescription maps**

  Maps with application recommendations

- **Waylines**

  Maps of operation lines in shape format with the purpose of using the same planned and standardized application trajectory.

- **Markers**

  Marcadores criados para indicação de pedras, buracos, formigueiros, áreas molhadas entre outros.

- **Settings**

  Settings to the display such as vehicle, implement, curve, GNSS, system, and interface settings.

Data transfer between the display and a pendrive is done in the **Configuration menu – Files**.

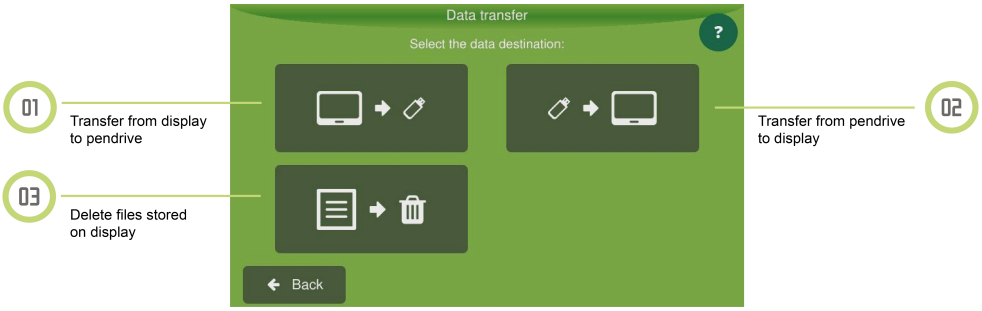


Figure - Data transfer

17.1 Exporting data

Insert a compatible pendrive into the USB porton the back of the display.

Warning	The display exports shape files in operations with covered area polygons.

17.1.1 Exporting an operation map

To export an application map, proceed as follows:

1. Select the **Files** option from the **Configuration menu**;
2. Select option **Export to USB**;
3. Select option **Operation map**;
4. Choose the items to be transfered.

Figure - Data transfer

5. Press **OK**;
6. Select the format to which you wish to export:
   - Display files (SAIG);
   - Google Earth kml files;
   - Shapefile (shp, dbf, prj e shx).

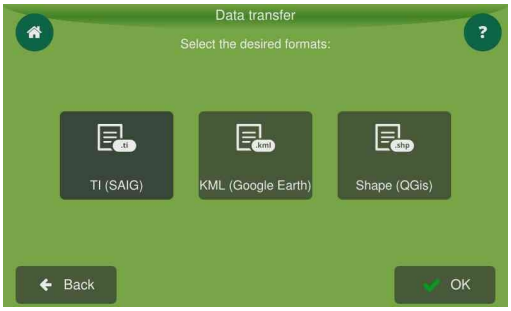


Figure - Data transfer - Formats

7. Press **OK**;
8. When the transfer is finished, press **OK**.

17.1.2 Exporting a prescription map

To export a recommendation map or line map, proceed as follows:

1. Select option **Files** from the **Configuration menu**;
2. Select option **Export to USB**;
3. Select option **Prescription map** or **Line map**;
4. Select the items you wish to export among those listed;
5. Press **OK**;
6. When the transfer is finished, press **OK**.

Warning	It is possible to select more than one file to export.

Figure - Data transfer - Items

17.1.3 Exporting guides

To export a guide or a line map, proceed as follows:

1. Select option **Files** from the **Settings menu**;
2. Select option **Export to USB**;
3. Select option Waylines;
4. Select the desired option: **Original guide (proprietary)** or **Line map (generic)**;
5. If **Original guide** is selected, wait for exporting on the next screen;
6. If option **Parallel guides** is selected, delimit the number of lines to the right and to the left and press **OK**;
7. Wait for the file transfer.

Warning	It is possible to select more than one file to export.

Figure - Data transfer - Items

Warning	To learn more about the Original guide or Line map formats, see topic Export guide.

17.1.4 Exporting markers

To export markers, proceed as follows:

1. Select option **Files** from the **Configuration menu**;
2. Select option **Export to USB**;
3. Select option **Markers**;
4. Select the markers you wish to export among those listed;
5. Press **OK**;
6. When the transfer is finished, press **OK**.

Warning	You can select more than one file for export.

Figure - Exporting markers

17.1.5 Settings

To export settings, proceed as follows:

1. Select **Files** from the **Configuration menu**;

2. Select option **Export to USB**;
3. Select option **Settings**;
4. Select the settings you wish to export among those listed;
5. Press **OK**;
6. When the transfer is finished, press **OK**.

Warning	It is possible to select more than one file to export.

Figure – Exporting settings

17.1.6 Exporting pending files

Warning	This field will only be enabled when the **Send files to cloud automatically** option is automatically selected.

To export pending files, proceed as follows:

1. Select **Files** from the **Configuration menu**;
2. Select option **Export to USB**;
3. Select option **Exporting files**;
4. Select the settings you wish to export among those listed;
5. Press **OK**;
6. When the transfer is finished, press **OK**.

Warning	It is possible to select more than one file to export.

17.2 Importing data

To import data, proceed as follows:

1. Insert a compatible pendrive into the USB port on the back of the display;
2. Select option **Files** from the **Configuration menu**;
3. Select option **Import from USB**;
4. Select the type of data you wish to import:
   - Operation map;
   - Prescription map;

- Guides;
- Markers;
- Settings.

5. Select the desired option and press **OK**;
6. When the transfer is finished, press **OK**.

Warning	To learn more about importing guides, see topic Import guide.

17.3 Deleting data

To delete data stored in the display, proceed as follows:

1. Select option **Files** from the **Configuration menu**;
2. Select option **Delete data**;
3. Select option **Operation map** or **Prescription map**;
4. Select the items you wish to delete among those listed;
5. Press **OK**;
6. When the transfer is finished, press **OK**.

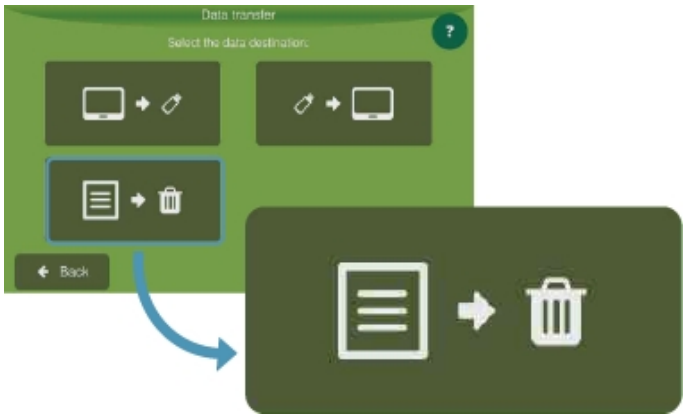


Figure - Delete data

18. System settings

The general system settings are available in **Configuration menu - Settings.**

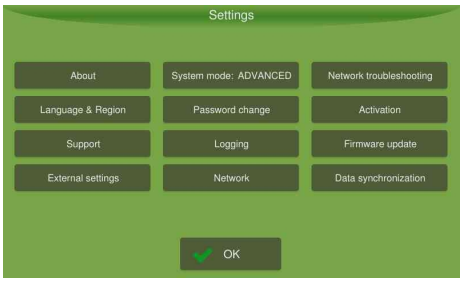


Figure - System settings

18.1 About

Shows the software version for the display, the processor (CPU) and screen (LCD) temperatures, the serial number, as well as shows information on the GNSS data, among others.

Figure - About

18.1.1 Version

Information about the system is composed of the following item set:

- Version;
- Revision;
- Serial number;
- Application version.

18.1.2 System manager

To access the system manager, proceed as follows:

1. Select option **Settings** from the **Configuration menu**;
2. Select option **About**;
3. Press the **System manager** button.

Figure - System manager

18.1.2.1 Update

Installing software update

Important	To update the system manually it is possible to download the file to the pendrive through the website of Hexagon Agriculture, in the part of Support.

In **Software update** the updates that have been automatically downloaded by the system and/or updates available through a pendrive are shown.

To perform the software update, proceed as follows:

1. Select **Update** on the **System manager** screen;
2. Select **Installing software update**;
3. Select the update you wish to install and select **Yes**;
4. The progress bar will be displayed;
5. Wait for the installation until the progress bar is complete.

Uninstalling software update

In **Uninstall software update** it is possible to uninstall the latest installed version.

Installing config update

In **Install config update** it is possible to install system settings.

Important	This option is only available for displays in monitoring mode.

Uninstalling config update

In **Uninstalling config update** it is possible to uninstall the latest installed settings.

18.1.2.2 Backup

It is possible to create data and settings backup from your display, restore backed-up settings, and delete backups. Furthermore, you can import or export a backup, thus passing information from one display to another.

Figure - Backup

Creating a backup

1. Select option **Create backup** to create a backup of the current display settings;
2. Confirm the operation by selecting **Yes**;
3. Wait for the process to finish and press **OK**.

Restoring a backup

1. Select option **Restore backup** to restore a backup;
2. Select the desired backup from the list;
3. Confirm the operation by selecting **Yes**;
4. Wait for the process to finish and press **OK**.

Removing a backup

1. Select option **Remove backup** to delete a backup;
2. Select the backup you wish to delete from the list. It is possible to select more than one backup;
3. Select option **Remove** in the upper right corner;
4. Wait for the process to finish and press **OK**.

Exporting a backup

1. Select option **Export backup** to export a backup to a pendrive;
2. Insert the pendrive into the display USB port;
3. Select the backup you wish to export from the list. It is possible to select more than one backup;
4. Select option **Export** in the upper right corner;
5. Wait for the process to finish and press **OK**.

Importing a backup

1. Select option **Import backup** to import a backup from a pendrive to the display;
2. Insert the pendrive into the display USB port;
3. Select the backup you wish to import. It is possible to select more than one backup;
4. Select option **Import** in the upper right corner;
5. Wait for the process to finish and press **OK.**

18.1.2.3 Collecting diagnostic information

When an error occurs and the display can no longer operate, the recovery mode will show on your screen. The diagnostic information obtained from the display must be sent to **Hexagon Agriculture**'s technical support when requested. To collect the data, proceed as follows:

1. Insert a pendrive into the display USB port;
2. Select option **Collect diagnostics**;
3. Confirm the operation.

18.1.2.4 Factory reset

Factory reset may solve problems and system crashes. With this procedure, the display settings and all adjustments will return to the factory default values. Before performing a factory restore, however, it is important to collect diagnostic information for **Hexagon Agriculture**'s technical support evaluation.

18.1.2.5 About this system

Press this option to obtain version and revision information for the system manager and the operating system version. This information is useful for technical support.

18.1.2.6 Power off

Press this option to shut the display off. It is not possible to exit the system manager without pressing the **Power off** option.

18.1.3 CPU information

Indicates CPU temperature.

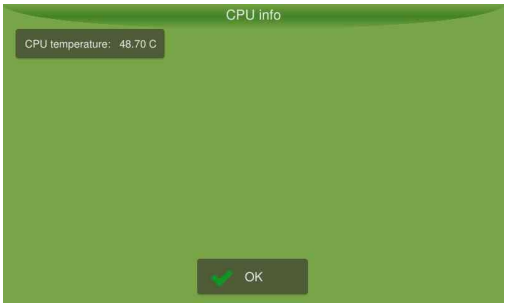


Figure - CPU temperature

18.1.4 Network information

This screen indicates the state of the device's network: **offline** or **online**.

When the device is **online**, the following information is also presented:

- Ethernet interface;
- MAC address;
- IP address.

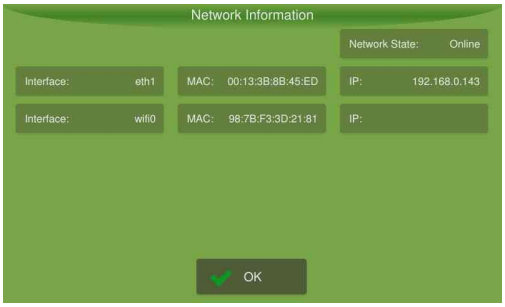


Figure - Network state

18.1.5 Remote access

Here it is possible to turn remote access on or off. When off, the display will not be viewed nor operated remotely.

Important	See further information on remote access in this manual's specific topic Support mode.

18.1.6 Show activations

Shows the list of features that are activated on the display.

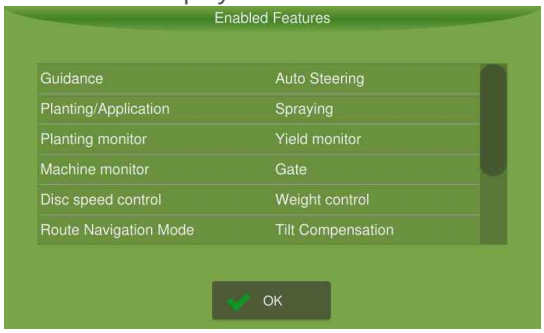


Figure - List of activations

18.1.7 GNSS information

Shows a list of information regarding the GNSS.

Figure - GNSS information

18.1.8 Legal information

Shows information on use licenses.

18.2 Language and region

In this option it is possible to select the visualization **Language**, to set the **Time zone**, and to select the color **Theme** for the display.

Figure - Language and region

- **Language**
  Select the desired language and confirm.
- **Time zone**
  Press + and - to inform the local time. Each touch will alter time in 15 minuts from the UTC (Coordinated Universal Time).
- **Theme**
  Select the default or night theme for the operation screen and confirm.

18.3 System mode

This option allows alternating between **Normal** and **Advanced** mode. This operation may only be performed by entering a password.

To alter the **System mode**, proceed as follows:

1. Select option **Settings** from the **Configuration menu**;
2. Select option **System mode**;
3. Enter the password and press **OK**.

Normal mode

In this mode, the user only has access to basic features of the on-board computer. Used mainly by operators.

The following features are enabled in normal mode:

- About;
- Language and region;

- Support;
- External settings;
- System mode;
- Network troubleshooting.

Advanced mode

In this mode, other than the basic features in normal mode, the user has access to advanced features of the on-board computer. Used mainly by technicians.
The following features are enabled in advanced mode:

- Change password;
- Logging;
- Network;
- Activation;
- Firmware update;
- Access to the GNSS option in the Settings menu;
- Data synchronization;
- PLC;
- Add, edit, and remove vehicle;
- Add, edit, and remove implement.

18.4 Support mode

This option gives specialized technicians access to installation settings and advanced tests. This operation can only be performed entering a password.

To access the assistance options, proceed as follows:

1. Select option **Settings** from the **Configuration menu**;
2. Select option **Support**;
3. Enter the password and press **OK**.

The following features are enabled when **Support** is selected:

- Advanced file transfer;
- Implement motor test;
- **Firmware test** and **Firmware transfer**;
- Enable/disable **Monitoring mode**;
- Enable/disable **Navigation mode** with routes.

18.5 Network troubleshooting

Informs on the situations of the connections of the drivers connected to the CAN network and the display.

Commands	Description
OK	All function drivers are connected.
NC,X	Function driver number X is not on the network.
EX,X	Driver X is spare on the network.
Conflict	Two drivers with the same address.
Not installed	Implement does not require this type of driver.

The drivers that may be connected to the display are:

- Controller;
- Deep;
- Sprayer;
- Gate;
- Auto steering;
- Planting monitor;
- Transport;
- Machine monitor;
- Cutting section;
- Logic controller
- Ant killer controller.

Reset: clears the address for all the devices connected to the CAN.

Device info: shows the software version and the external power supply for the connected devices.

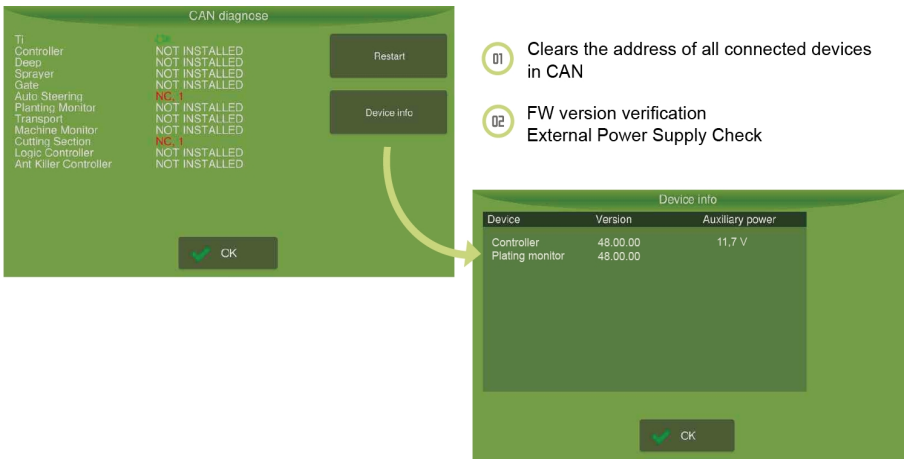


Figure - Network troubleshooting

18.6 External settings

On the external settings screen, it is possible to set the horn and the operation switches.

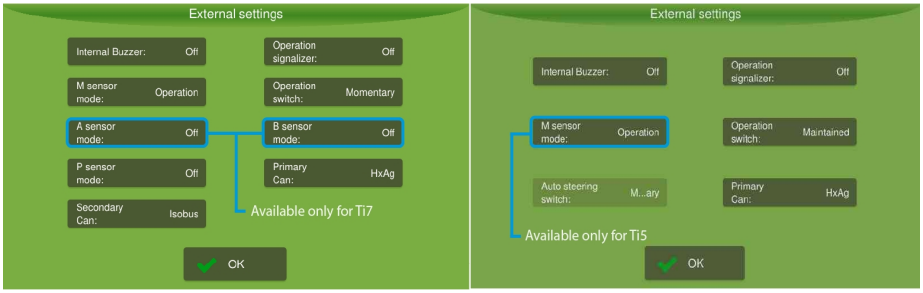


Figure - External settings - displays Ti7 and Ti5

- **Internal buzzer**

  Turns the sound alarm on and off. If it is On, some alarms will be notified with beeps. If it is Off, the horn will never beep.

- **M sensor mode**

  This is used to select if the Ti's external switch should be used to control the pilot or to control the operation. If the **Operation** option is selected, the **Operation switch** button is disabled. If the **Auto steering** option is

selected, the **Operation switch** is disabled.

Important	This option is only available for the display Ti5, since it only has one external switch. The display Ti7 always keeps the pilot and operation switches enabled.

- **Auto steering switch**

  The pilot switch is used to turn the automatic pilot on/off. It has the same states as the operation switch.

- **Operation signalizer**

  This option may be used when an output is required to connect with third-party equipment. When on, the output of the right external horn stops being a horn and starts to indicate the application status, i.e., twelve volts will be applied to the output if it is marking the trail, and zero volts when it is not marking the trail.

- **Operation switch**
  The operation switch is used to start/stop the operation. Select the **Momentary** option if your button is the kind that returns to the normal state after being pressed, and select option **Maintained** if your switch is the kind that maintains its state after being pressed.

Important	When buttons of type **Maintained** are used and the state of the button indicates that the operation is stopped or the automatic pilot is off, it will not be possible to turn them on through the screen. The button needs to be indicating the on state. The same occurs for **Momentary** buttons, because in this case the operator can always turn the operation or the pilot on/off either with the button or on the screen.
Warning	During device initialization, 12V pulses of short duration (less than 250ms) may be applied to this output.

- **Primary Can**
  This option you can select **Isobus** or **HxAg**.

- **Flag sensors A and B**
  This option enables two inputs to the device to mark indicators such as pits.

Important	The flag sensor buttons are only available for the display Ti7.

18.7 Change password

Important	Feature only available in **Advanced** mode.

This feature allows changing the password for accessing the **Advanced** mode. To change the password, proceed as follows:

1. Select option **Settings** from the **Configuration menu**;
2. Go to **Advanced mode**;
3. Select option **Change password**;
4. Enter the new password and confirm pressing **OK**.

18.8 Logging

Important	Feature only available in **Advanced** mode.

This feature allows the user to choose how the log file for the events that occurred during the operation is stored. To select how the log file is stored, proceed as follows:

1. Select option **Settings** from the **Configuration menu**;
2. Go to **Advanced mode**;

3. Select option **Logging**.

The file may be stored in the following ways:

- **Single file**

  This way the log is saved in a single application file separated by work session and by implement type.

- **Daily**

  This way the application file is created for each day of operation.

- **Periodic**

  This way the used must choose a desired period among the options, namely 12 hours, 1 hour, 30 minutes, or 15 minutes.

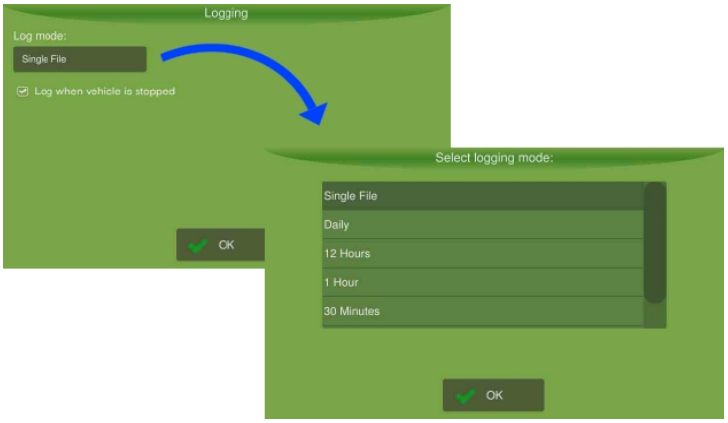


Figure - Storing the log

18.9 Activation

Important	Feature available only in the **Advanced mode**.

This feature allows new implements to be activated.

To perform the activation, proceed as follows:

1. Select option **Settings** from the **Configuration menu**;
2. Go to **Advanced mode**;
3. Select option **Activation**.

18.9.1 Pendrive procedure

To activate a feature using a pendrive, proceed as follows:

1. Insert the pendrive with file “ActivationCode.sig”;
2. Press **Import**;
3. Press **Activate**;
4. Check the success or failure message.

18.9.2 Manual procedure

To manually activate a feature, proceed as follows:

1. Fill in the **H0** through **H7** and **Fix** fields;
2. Press **Import**;;
3. Press **Activate**;
4. Check the success or the failure message.

Figure - Activation

18.10 Firmware update

Important	Feature available only in the **Advanced mode**.

This feature allows the user to update the driver firmware.

To update the firmware, proceed as follows:

1. Select option **Settings** from the **Configuration menu**;
2. Go to **Advanced mode**;
3. Select option **Firmware update**;
4. Select the desired device connected to the CAN network and press **Advance**;
5. On the following screen all the firmware valid for the selected driver will be listed;
6. Select the desired firmware and press **OK**.

Figure - Firmware update

18.11 Network

Important	Feature available only for the **Advanced mode**.

To enable your display for the 3G, Wi-Fi, and Virtual Vista networks, proceed as follows:

1. Select option **Settings** from the **Configuration menu**;
2. Go to **Advanced mode**;
3. Press **Network**;
4. Select the desired network.

Figure - Network

18.11.1 3G settings

By pressing the **3G** button, the connection screen is displayed.

Figure - 3G

To configure the 3G connection, proceed as follows:

1. Press the **Detect settings automatically** option so that the data indicated as number 02 in the figure above be automatically filled in. This option may not be available for all 3G SIM card models;
2. If the data were not detected automatically in the previous step, manually fill them with the information supplied by the mobile network service provider;
3. Set the network state as **active** to enable it.

On the upper bar of the operation screen, the Mobile network icon will become available and may present two states: **Active** and **Inactive**.

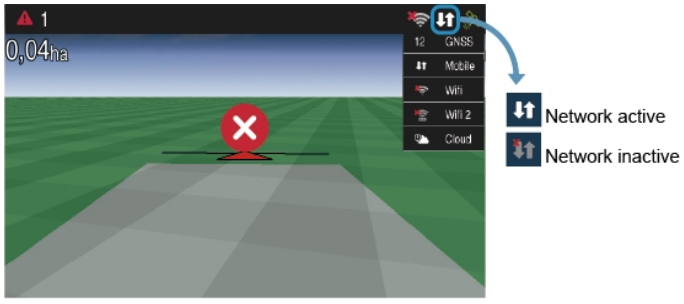


Figure - Mobile on the operation screen

18.11.2 Wi-Fi network settings

Important	Some displays have two Wi-Fi connections: internal and external Wi-Fi. The internal Wi-Fi may be requested when the display is purchased, while the external Wi-Fi may be acquired at a later time. In this case, the Wi-Fi USB adapter must be approved.

By pressing the **Wi-Fi** button, the connection screen is displayed.

Figure - Wi-Fi network

To configure the network, proceed as follows:

1. Select the Wi-Fi network;
2. Press **OK.**

Important	In case your Wi-Fi network is not listed, the Wi-Fi network access point can me manually enabled through button Enable access point. Enter the name if the network (SSID) and the password on the next screen.

On the upper bar of the operation screen, the Wi-Fi network icon will become available.

18.11.3 Virtual Vista settings

Important	To connect the display with Virtual Vista, you need to have a **Virtual Vista** account.

To configure **Virtual Vista**, proceed as follows:

1. Select option **Virtual Vista**;
2. Enter the **Username** (e-mail address), password, and login used to defined your Virtual Vista account;
3. Press **Enabled** to start Virtual Vista.

Figure - Virtual Vista

18.12 Data synchronization

Important	Feature available only in the **Advanced** mode.

On the data syncing screen it is possible to configure automatic software updates. The automatic update is only possible it the display is connected to the Internet.

To configure data syncing, proceed as follows:

1. Select option **Settings** from the **Configuration menu**;
2. Go to **Advanced mode**;
3. Select option **Data synchronization**;

4. Enter the hostname. This field is factory filled with the default hostname.

Important	This server is also used for the Routes feature.

5. Select option **On** so that the update is ready for installation through the system manager. In the **Off** state it is not possible to update the software because there is no communication with the server;

6. In the **Period** (minutes) option, select the time interval in which the display will check for new updates.

Important	In the **Software version** and **Config version** options, it is possible to check the last updated version.

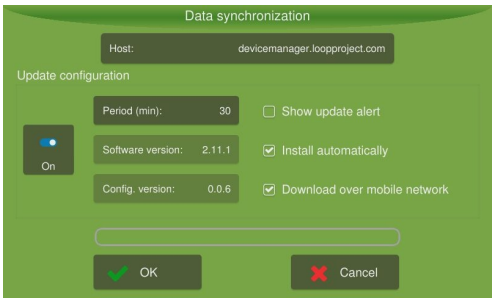


Figure - Data synchronization

On the right side the following options are available:

- **Show update alert**

  Asks the user if he wishes to download the new update.

- **Download over mobile network**

  Select this field if you want the Ti to use the mobile network if it is unable to connect to the Wi-Fi network for the download.

- **Install automatically**

  The display automatically installs the software updates without asking the user for permission on the device boot following the update download.

19. Assistance and remote control

To request remote assistance contact our technical assistance service. The technician will contact you to remotely operate your display. The technician can press buttons in your stead to perform the required actions or guide you to solve your problem.

Warning	The display is factory set with the remote access option enabled. If you wish for this option not to be available to Hexagon Agriculture, go to **Configuration menu – System settings – About – Remote access** and select **Off**.

The technician can give support in two ways:

- **Visualization mode**

  In this mode the technician guides the display operator to perform the assistance steps. The technician views your display screen, but cannot alter any data. Any click the technician makes is ignored and will not be sent to your device. Only the display user can operate the system.

- **Operation mode**
  In this mode the technician gives assistance by operating your display. In order for the technician to operate, a message will be sent through the display requesting operation access.

Important	The technician must have the display's serial number and it must be connected to a network to use remote assistance. Technical support access is done via Hexagon Agriculture's web support software.

19.1 Visualization mode

To have remote access in **Visualization mode**, the technician needs to have the device's serial number and access it through the web software that Hexagon Agriculture used to provide remote assistance. It is possible to identify that the Ti on-board computer is being visualized remotely by a technician through the visualization indicator icon on the bottom right corner of the screen.

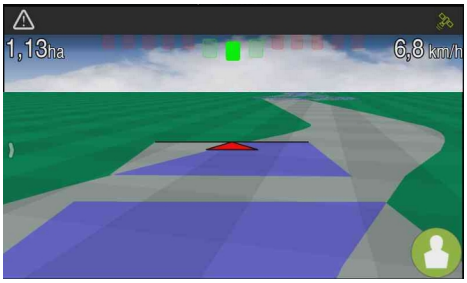


Figure - Visualization mode icon

Warning	The display is factory set with the remote access option enabled. If you wish for this option not to be available to Hexagon Agriculture, go to **Configuration menu** – **System settings** – **About** – **Remote access** and select **Off**.

If the remote access option is off, when a technician tries to visualize the device remotely, a message will be displayed on the display screen for the user to alter the remote access settings if he wants to allow visualization.

19.2 Operation mode

To allow remote access in **Operation mode**, proceed as follows:

1. The technician requests remote access authorization through a message on your display screen. The message informs the name and company of the user making the request;
2. Confirm the operation selecting **Yes** to authorized access;
3. Check if an operation icon such as the one on the figure is displayed in the bottom right corner of your operation screen.

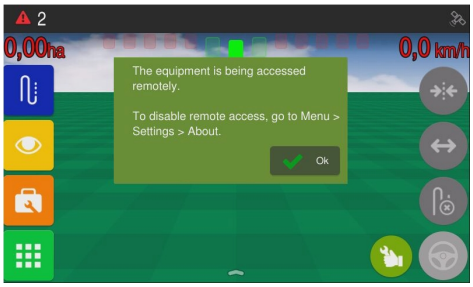


Figure - Operation mode icon

Important	Remote access may be interrupted at any time by pressing the access icon on the bottom right corner of the screen. The display will display a message for the user to confirm access interruption.

20. Technical features

20.1 Display Ti5 technical features

Monitor data

- Material: 5'' LCD, 800X480 pixel, 256k colors with touch interface;
- Dimensions: 125 (W) X162 (L) X45 (H) mm;
- Weight: 1000g;
- Power supply voltage: 12VDC;
- Light bar current: 0.6A.

Environmental specification

- Operating temperature: -20 to +60 [°C];
- Storage temperature: -30 to +80 [°C];
- Humidity: 95% maximum;
- Degree of protection: IP67.

Interfaces

- CAN: 1 x Back;
- USB: 1 x Back;
- RS-232: 1 x Back.

Models according to the GNSS module

Model		Display Ti5-H, Ti5-H+	Display Ti5	Display Ti5
GNSS module		u-blox MAX-7Q	Novatel OEMStar	Novatel OEM719
Settings	Channels	56 L1	14 L1	555 L1, L2, L3, L5, L6
	Constellations	GPS, GLONASS, SBAS, QZSS	GPS, GLONASS, SBAS	GPS, GLONASS, BeiDou, Galileo, NacIC, SBAS, QZSS, L-Band
Horizontal position precision	Simple point	2.50 m	1.50 m	1.20 m
	SBAS	2.00 m	0.70 m	0.60 m
	DGPS	-	0.50 m	0.40 m
	PPP	-	-	0.04 m
	RTK	-	-	0.01 m + 1 ppm
Startup time	Start in heat	1 s	35 s	19 s
	Start in cold	29 s	65 s	40 s
Data rate	Measurements	up to 10 Hz	up to 10 Hz	up to 100 Hz
	Position	up to 10 Hz	up to 10 Hz	up to 100 Hz
Temporal accuracy		30 ns	20 ns	20 ns
Speed accuracy		0.1 m/s	0.05 m/s	0.03 m/s

Data taken from the manufacturers' websites: https://www.u-blox.com and https://www.novatel.com.

4G module

Technology	Bands
LTE	• Band 1 (2100 MHz) • Band 3 (1800 MHz)

	• Band 7 (2600 MHz) • Band 8 (900 MHz)
UMTS (WCDMA) **HSDPA** **HSUPA**	• Band 1 (2100 MHz) • Band 2 (1900 MHz) • Band 5 (850 MHz) • Band 8 (900 MHz)
GPRS **EDGE**	• GSM 850 (850 MHz) • EGSM 900 (900 MHz) • DCS 1800 (1800 MHz) • PCS 1900 (1900 MHz)

Certifications

"This device has no right to be protected against harmful interference and cannot cause interference with duly authorized systems."

20.2 Display Ti7 technical features

Monitor data

- Material: 7'' LCD, 800X480 pixel, 256k colors with touch interface;
- Dimensions: 208 (W) X159 (L) X57 (H) mm;
- Weight: 1279g;
- Power supply voltage: 12VDC;
- Light bar current: 0.6A.

Environmental specification

- Operating temperature: -20 to +60 [°C];
- Storage temperature: -30 to +80 [°C];
- Humidity: 95% maximum.

Interfaces

- CAN: 2 x Back;
- USB: 1 x Back;
- RS-232: 2 x Back.

Models according to the GNSS module

Model		**Ti7-H, Ti7-H+ e Ti7-G**	**Ti7**	**Ti7-O**	**Ti7**
GNSS module		**u-blox MAX-7Q**	**Novatel OEMStar**	**Novatel OEM628**	**Novatel OEM719**
Settings	**Channels**	56 L1	14 L1	120 L1, L2, L5	555 L1, L2, L3, L5, L6
	Constellations	GPS, GLONASS, SBAS, QZSS	GPS, GLONASS, SBAS	GPS, GLONASS, BeiDou, Galileo, SBAS, QZSS, L-Band	GPS, GLONASS, BeiDou, Galileo, NacIC, SBAS, QZSS, L-Band
Horizontal position precision	**Simple point**	2.50 m	1.50 m	1.20 m	1.20 m
	SBAS	2.00 m	0.70 m	0.60 m	0.60 m
	DGPS	-	0.50 m	0.40 m	0.40 m

	PPP	-	-	0.04 m	0.04 m
	RTK	-	-	0.01 m + 1 ppm	0.01 m + 1 ppm
Startup time	**Start in heat**	1 s	35 s	35 s	19 s
	Start in cold	29 s	65 s	50 s	40 s
Data rate	**Measurements**	up to 10 Hz	up to 10 Hz	up to 100 Hz	up to 100 Hz
	Position	up to 10 Hz	up to 10 Hz	up to 100 Hz	up to 100 Hz
Temporal accuracy		30 ns	20 ns	20 ns	20 ns
Speed accuracy		0.1 m/s	0.05 m/s	0.03 m/s	0.03 m/s

Data taken from the manufacturers' websites: https://www.u-blox.com and https://www.novatel.com.

4G module

Technology	Bands
LTE	• Band 1 (2100 MHz) • Band 3 (1800 MHz) • Band 7 (2600 MHz) • Band 8 (900 MHz)
UMTS (WCDMA) **HSDPA** **HSUPA**	• Band 1 (2100 MHz) • Band 2 (1900 MHz) • Band 5 (850 MHz) • Band 8 (900 MHz)
GPRS **EDGE**	• GSM 850 (850 MHz) • EGSM 900 (900 MHz) • DCS 1800 (1800 MHz) • PCS 1900 (1900 MHz)

Certifications

"This device has no right to be protected against harmful interference and cannot cause interference with duly authorized systems."

21. FCC statement (applicable only in the USA)

Tests performed on the display have shown its compatibility with the limits for Class A digital devices, to the terms of Part 15 of the FCC rules. These limits are designed to offer reasonable protection against any harmful interference when the device is operated in a commercial environment.

This device generates, uses, and may radiate radiofrequency energy if it is not installed in accordance with the instruction manual supplied by the manufacturer, and may cause harmful interference to radio communications.

Operating this device in a residential area may cause harmful interference, in which case the user must correct the interference at his own expense.

 Warning	Functional alterations or modifications not expressly approved by Hexagon Agriculture may void the user's authority to use the display.

22. Compliance with European Directive 1999/5/EC (R&TTE)

By means of this term, **Hexagon Agriculture** declared that the display meets the basic requirements and other important provisions of Directive 1999/5/EC. The compliance declaration can be found at http://www.hexagonagriculture.com.

CE Class 1 device in accordance with European Directive 1999/5/EC (R&TTE). Can be marketed and put into operation without restriction in a Member State of the European Union.

Warning	Relative compliance to countries whose regulations are not covered by European Directive 1999/5/EC must be approved before use and operation.

Type	Frequency band [MHz]
GNSS Receptor	L1: 1368 +/- 43 MHz L2: 1236+/-18 MHz
CDMA	800/1900 MHz
HSDPA	850/900/1800/1900/2100 MHz

Output power:
CDMA +24 dBm
HSDPA +24 dBm

Type	Antenna	Gain	Connector	Frequency band
GNSS receptor	Pinwheel OEM	22 dBi	TNC JACK	L1: 1568.0 ± 43.0 MHz L2: 1236.0 ± 18.3 MHz L5, E5a: 1176.0 ± 12.0 MHz E5b: 1207.0 ± 12.0 MHz B2: 1191.8 ± 25.0 MHz
Cell phone	TEOGLAS	2,6 dBi	SMA JACK	824 - 960 1710 - 2170

23. Problems and solutions

Problem	Solution
Display will not turn on	Check the power supply; Check the fuse; Check if the connections are secure; Check if the cable is not broken (use a multimeter to test the voltage).
GNSS problem	Check if the GNSS is in an area with sky-bound view. In covered areas, the signal will become too low and may note locate properly; Check the antenna cabling; Measure the GNSS cable voltage (5v); Check if the GNSS Port and Model are correctly selected on the GNSS menu.
Motor will not move	Perform display tests and calibrations; Check if the hose connections are correct (pressure and tank); Check if the command is in the right direction; Check if the operation is not stopped in the display; Check if the encoder is blinking when it turns; Check if the vehicle is not below the operation speed range.
Map problems	Within the pendrive, the SHP, SHX, and DBF files must be in the same location; The ma name cannot contain special characters or spaces; The map name might be too long.
Sprayer problems	Perform calibration and simulation; Check the filter; Check the valve and flow meter cabling; Check if the vehicle is below the operation speed range.
Application failure when entering and exiting borders	Check if the antenna-pin and pin-implement distances are correct.
Nothing happens after starting the installation test for the pilot sensor	Check if the automatic pilot driver is recognized on the network (Settings menu – Network diagnosis). In case it is not found, check the power supply and cable continuity; Check the sensor's power cable for continuity and check that the voltage between pins "3" and "1" is of 12v.
Nothing happens after starting the HV control test	Check if the automatic pilot driver is recognized on the network (Configuration menu – Network diagnosis). In case it is not found, check the power supply and cable continuity; Check the wheel sensor and hydraulic valve cables; Check the hydraulic system (if there are no inverted connections, etc).
The wheel turned to the opposite side	Invert the connectors on the valve terminals. If the problem persists, check the instructions on the hydraulic pilot topic Sensor installation.
Pilot problems	Check the tank oil level; Check for possible leaks; Check the pilot diver's attachment; Check the steering sensor.

24. Glossary

CAN – The Controller Area Network is an internal communication network that intercommunicates components within the vehicle. It must ensure message delivery, the absence of message conflicts, minimum delivery times, low cost, and ability to operate reliably in an environment with electrical noise.

BEC – Sugarcane electronic newsletter.

DIFF – Method of correcting the GNSS positioning. Without it, the automatic pilot cannot operate properly.

GNSS – Name of the global positioning system. It is a satellite navigation system that provides a mobile receiving device its own position.

Latitude – Latitude is the angle between the equatorial plane and the reference surface. Latitude is measured in degrees North and South of the equatorial plane, between 90º South at the South Pole 90º North at the North Pole.

Longitude – Longitude is measure along the equatorial plane and represents the distance between a point and the Greenwich Meridian. It is measured in degrees, from 0º to 180º East or West.

Kg/ha – Kilograms per hectare.

L/min – Liters per minute.

Pl/ha – Plants per hectare.

PPL – Pulses per liter.

PPS – Pulses per second.

Pulse – Electrical information provided by the flow meter or encoder.

Relation – For inputs, this is the relation between the applied weight over the hydraulic motor's RPM. For sprayer, it is the number of pulses of the flow meter over liters.

RPM – Rotations per minute provided by the hydraulic motor's sensor.

Section – Set of nozzles for the sprayer bar or of planting/fertilizing lines that may be opened or closed simultaneously.

25. Warranty certificate

Product description

Hexagon Agriculture display precision farming system.

About the Warranty

1. Hexagon Agriculture guarantees the proper functioning of the product(s) indicated above and that it markets, and commits, for a twelve-month period* as of the data of issuance of the respective invoice, comprised of the three months of legal warranty and nine months of contractual warranty, to repair and replace the parts and materials that present verified manufacturing defects under normal use conditions and for the purposes for which they are intended, taking responsibility for the cost of the part(s) to replaced, as well as for the required manpower, although the purchaser shall bear the technician travel costs and/or the costs for shipping the part(s) for repair.
*Except for whips, sensors, and connectors, for which the warranty period is of three months.
1.1. The manufacturer must be immediately notified of any defect found on the product. Such notification must be formalized via electronic correspondence through addresses comercial@hexagonagriculture.com and suporte@hexagonagriculture.com.
1.2. This warranty certificate will only be valid for products marketed and used in Brazil, and must be presented along with the respective Invoice, which will integrate it for all purposes.

Warranty exclusions

2. Hexagon Agriculture's liability will be void when:

a) The product's serial number or identification label are removed/altered;
b) The product seal is removed;
c) The product is connected to a voltage other than that specified in the installation/operation manual;
d) The product is placed in an improper location, in disagreement with the rules set forth in the installation/operation manual;
e) The product is used in disagreement with the rules set forth in the installation/operation manual, or for purposes other than that for which it is intended; and/or
f) The product has suffered any type of accident, provided such accident was not due to the defect.

Warranty limitations

3. The warranty hereby granted shall not extend to damages and/or malfunction of the above identified product(s) when the following hypotheses are verified:

a) Use and/or operation in disagreement with the operation manual;
b) Risks, cracks, dents, deformations, and/or any other types of damages resulting from accidents during transportation or handling;
c) Failure to observe the cleaning and lubrication instructions in the instructions manual, including the use of materials and chemical products not recommended by Hexagon Agriculture;
d) Not sending the signed installation form to Hexagon Agriculture;
e) Operation with parts and materials of dubious origin or of low quality;
f) Modifications, repairs, assemblies/disassemblies, installations/uninstalling carried out by persons or technicians not accredited by Hexagon Agriculture;
g) Malfunctions or failures due to power supply problems;
h) Use of improper packaging when sending the product for repair; and/or
i) Fortuitous and force majeure events.

26. Change control

Changes made in the manual according to new released versions and detected adjustments, listed here in descending order.

Update for software version 2.19 and improvements (V300R004)

Location of changes	Change description
PVED Autosteering	New topics on PVED pilot, installation test, configuration and calibration.
Caterpillar pilot	Steering system: Caterpillar joystick support.
Doubles and skips	New seed sensor functionality, used to control planting errors.

Update for software version 2.18 and improvements (V300R003)

Location of changes	Change description
Connectivity information	When used Novatel models, shows the information on the GNSS position accuracy.

Update for software version 2.17 and improvements (V300R002)

Location of changes	Change description
Sprayer pressure calibration	You can set/calibrate the sprayer sensor and show its reading in the cloud. Added the image of the new sprayer pressure calibration screen and field description.
General configuration	You can now configure the output that will be applied to the output of the MOTOR C when using the power steering. The image of the General configuration screen has been updated according to the new descriptions of the PWM C Control logic field.
Antenna installation	The antenna installation of the Ti5 and Ti7 displays were updated.
Displays overview	Merge the topics of the Ti5 display and Ti7 display.
Equipment's installation	Merge the topics of the Ti5 display and Ti7 display.
Technical features	Merge the topics of the Ti5 display and Ti7 display.
NMEA output	The NMEA output for Ti7 display uses Serial 2 and a suitable cable.

Update for software version 2.16 and improvements (V300R001)

Location of changes	Change description
Deleting data	The delete data option is now visible only in Advanced mode.
External settings	The external settings option will now be visible only in Advanced mode.