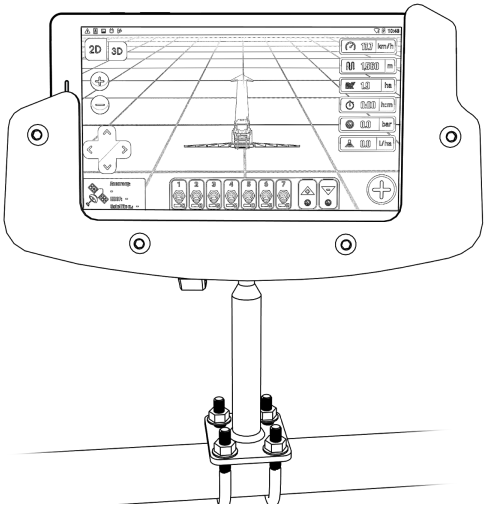
User Manual

MachineryGuide GPS Guidance System



Read the whole manual before using the product
and keep it for later reference

UK ENG

MachineryGuide
for precision agriculture

English

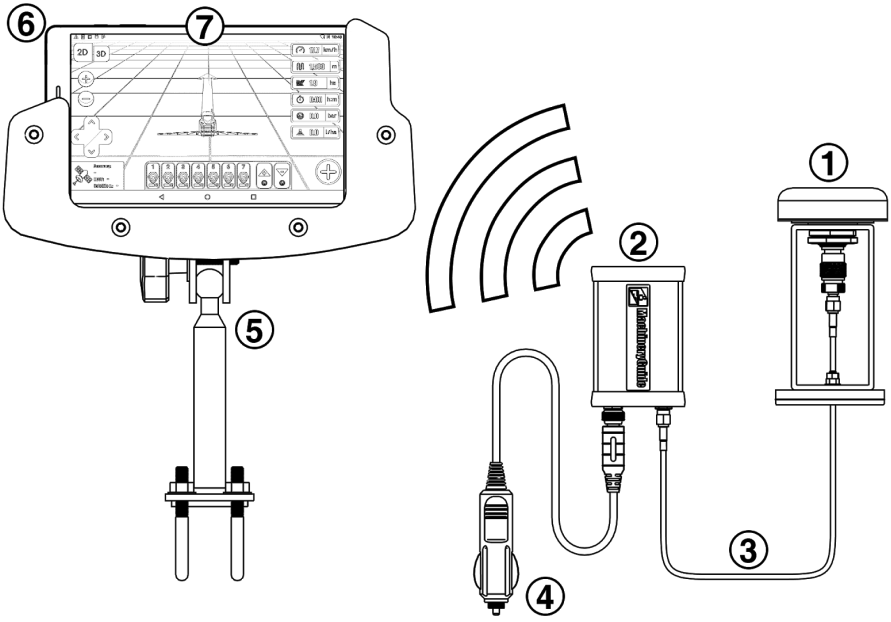
English

Table of Contents

English

English

Parts of the guidance system



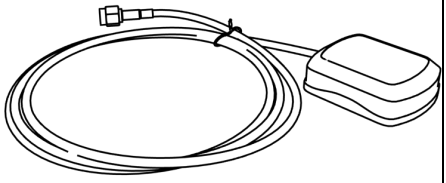
	Part name	Options
1	GPS/GLONASS antenna	SM1 or DM1 antenna
2	Bluetooth GNSS receiver	SM1 or DM1 receiver
3	Antenna cable	Only for DM1
4	DC-USB cable	Car charger, 3-points charger and 2-wire charger
5	Tablet mount	-
6	Android device	-
7	MachineryGuide Android application	-

GPS/GLONASS antenna

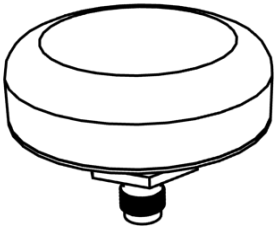
English

The antenna has to be mounted to the highest part of the agricultural machinery, and must not be obscured in order to achieve the best accuracy. There are two antenna options available for the MachineryGuide application:

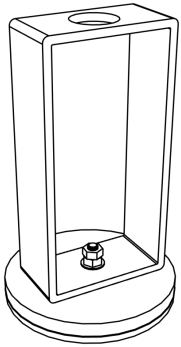
SM1 antenna

	Specifications: ● Frequency: 1575MHz ~ 1615MHz ● VSWR: 1.3 @ 1580MHz ● Bandwidth: 43MHz ● Polarization: RHCP ● Antenna gain: 27dB ● Size: 37.5mm x 34.5mm x 12.5mm ● Connection: SMA ● RF cable: RG174, 2.5m ● Magnetic bottom

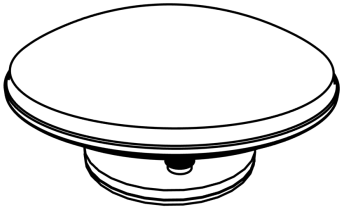
DM1 antenna

	The DM1 antenna has high gain (40 dB) and multipath error rejection. Specifications: ● Frequency: 1574 MHz +/- 10 MHz ● Bandwidth: 31 MHz (1dB) ● Polarization: RHCP ● Antenna gain: 40 dB ● Size: 66.5 mm x 66.5 mm x 49.8 mm ● Connector: TNC ● Manufacturer: Tallysman

DM1 Antenna Console

	The DM1 antenna can be installed with a magnetic console. The antenna goes to the top of the holder. The consol with the antenna should be installed to the top of the agricultural machine. It is very important to place it on the highest part of the vehicle, and to ensure that it is not covered, because this is indispensable to achieve the correct pass-to-pass accuracy.

CM1 antenna

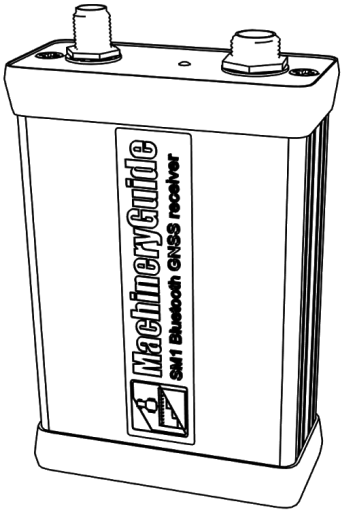
	The DM1 antenna has high gain (40 dB) and multipath error rejection. Specifications: ● Frequency: 1574 MHz ~ 1606 MHz ● Bandwidth: 31 MHz (1dB) ● Polarization: RHCP ● Antenna gain: 40 dB ● Size:152 mm x 152 mm x 94 mm ● Connector: TNC ● Manufacturer: Harxon

Bluetooth GNSS Receiver

The receiver unit gets the 12 V supply via DC cable. The communication with the tablet is done via Bluetooth interface. The external GPS antenna can be connected to the receiver via an SMA-connector. The data connection is in the form of serial NMEA messages.Two GNSS Receiver options available for the MachineryGuide application:

English

SM1 Bluetooth GNSS Receiver

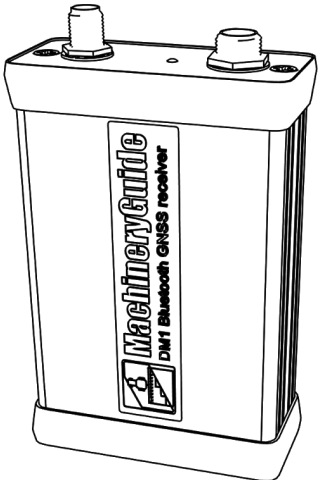


Specifications:

- GPS-, GLONASS-, SBAS-, QZSS-signals
- 10 Hz update rate
- Absolute accuracy: 2.5 m CEP
- Absolute accuracy with SBAS correction: 2.0 m
- Absolute accuracy with SBAS + PPP correction: < 1 m
- Pass-to-pass accuracy with SBAS+PPP correction:10-20 cm
- Speed accuracy: 0.1m/s
- Hot start TTFF open sky: 29 mp
- Col start TTFF open sky:30 mp
- Sensitivity: -161 dBm
- Bluetooth device name: MachineryGuide BT-REC-V2.3 DM1

When the Receiver is turned on, after two-three minutes of initialization time (depends on the satellite coverage) the Receiver starts to provide submeter level pass-to-pass accurate position data.

DM1 Bluetooth GNSS Receiver



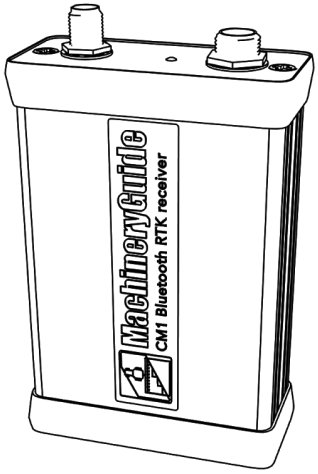
Specifications:

- Uses GPS, GLONASS, SBAS, QZSS signals
- 10 Hz update rate
- Absolute position accuracy 2.5 m CEP
- Relative (pass-to-pass) accuracy: 30-40 cm
- Velocity accuracy 0.1m/sec
- Warm start TTFF under open sky 29 sec average
- Cold start TTFF under open sky 30 sec average
- Tracking sensitivity -165 dBm
- Bluetooth device name: MG BT-REC-V2.3

When the Receiver is turned on, after ten minutes of initialization time (depends on the satellite coverage) the Receiver starts to provide decimeter level pass-to-pass accurate position data.

English

CM1 Bluetooth GNSS Receiver

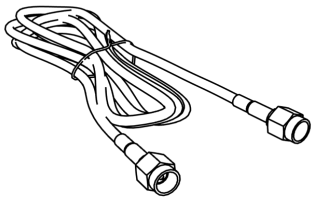


Specifications:

- Uses GPS, GLONASS, SBAS, QZSS signals
- 10 Hz update rate
- Absolute position accuracy 1 cm CEP
- Relative (pass-to-pass) accuracy: 2 cm
- Velocity accuracy 0.1m/sec
- Warm start TTFF under open sky 29 sec average
- Cold start TTFF under open sky 30 sec average
- Tracking sensitivity -165 dBm
- Bluetooth version: 2.0
- Bluetooth device name:
- MG BT-REC-V2.3

When the Receiver is turned on, after ten minutes of initialization time (depends on the satellite coverage) the Receiver starts to provide centimeter level pass-to-pass accurate position data.

Antenna Cable

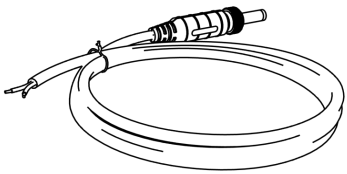
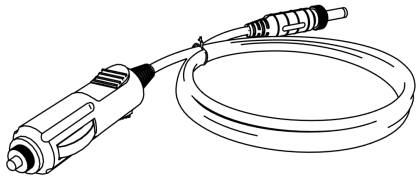
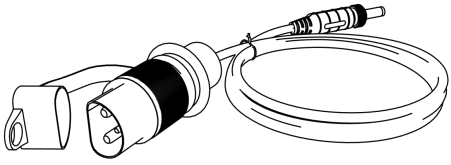


DM1 and CM1 antennas could be connected to the Bluetooth GNSS Receiver via an RF cable.

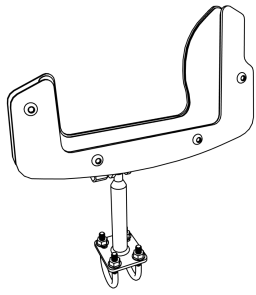
- Length: 2.5 m

DC-USB Cable

The DC-to-USB cable provides power to the Bluetooth GNSS Receiver. There are three types of cables available for the Receiver:

	A DC-to-USB cable with DC plug only on one end for the Bluetooth GNSS Receiver. Specifications: ● Length: 2 m ● Plug type: 2.1 mm DC plug
	A DC-to-USB cable with a DC plug for the Bluetooth GNSS Receiver and a standard car charger plug. Specifications: ● Length: 2 m ● Plug type: 2.1 mm DC plug
	A DC-to-USB cable with a DC plug for the Bluetooth GNSS Receiver and a 3-point charger plug. Specifications: ● Length: 2 m ● Plug type: 2.1 mm DC plug

Tablet Mount

	Tube mount for tablet with display size 7”. ● Easy to install ● Stable mount ● Flexible at two spherical joint

Software Installation

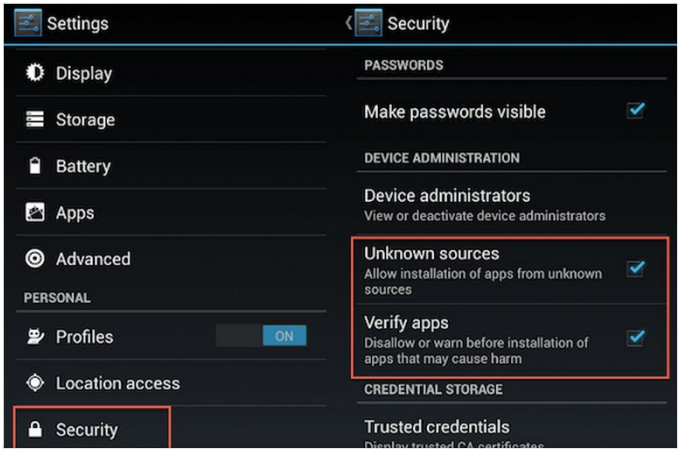
English

	Internet connection is required for downloading and activating the application.

Installation steps

1. The software (APK file) can be downloaded from website machineryguideapp.com, from the following link: machineryguideapp.com/en/releases
    a. It is recommended to reach the website directly from your tablet/smartphone, since this way the APK file is installed right away when tapping the download link.
    b. When the installer file (APK file) is downloaded to your computer, copy the file to your Android device. For this, connect your device to the computer as a media device with a USB-cable.

	Since MachineryGuide app is outside of official Android marketplace, to install the APK first go to Settings, scroll down to Security, and select Unknown sources.



2. After installation, activate your software. Click on ”*Licence*” button, then write in your 8 character long code given by your distributor. (In case you bought only the software, you will receive it in an e-mail, otherwise the code is found in the product box.)
3. After entering the code, the ”*Licence*” button on the main window will change to ”*Start*” button and you will be able to use the software without any restrictions.

Software Updates

Software updates are available on this link: machineryguideapp.com/en/releases. Installing a software update is very similar to the installation of the original software, the main difference is that Activation is not required this time.

In case of a new release, each user will be notified via e-mail. (The e-mail will be sent to the e-mail address that was assigned to the registration).

First Steps

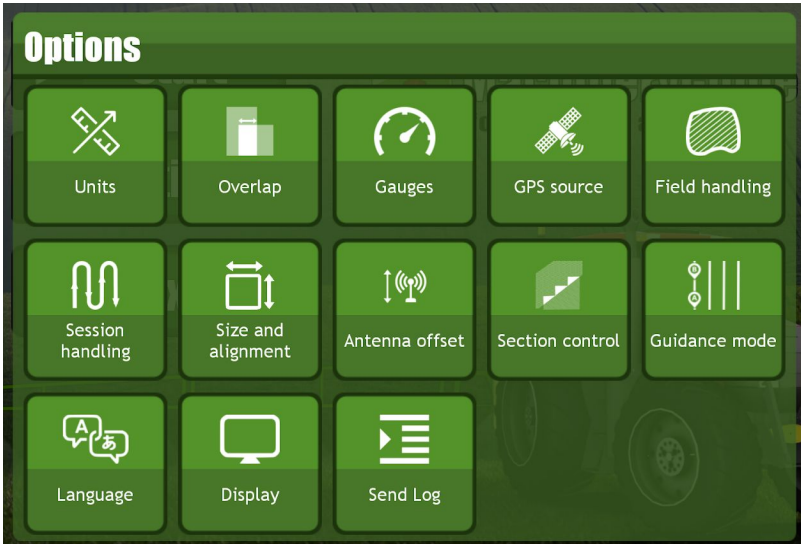
English

Instructions for using MachineryGuide guidance application.

Main Screen

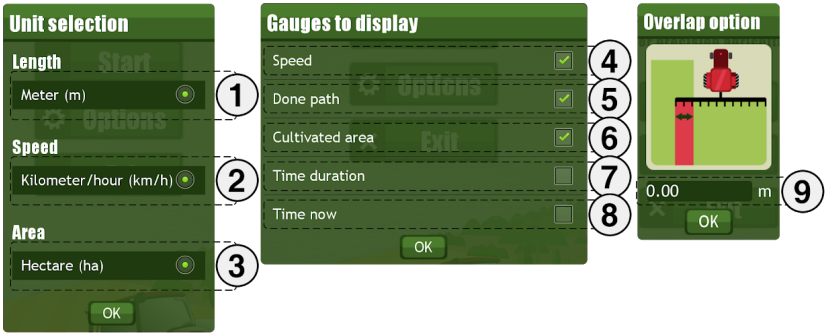
	Function
1	If the program has not been activated, instead of the ”*Start*” button the ”*Licence*” button appears. (you can read above about the activation)
2	The software can be configured in the “*Options*” menu
3	By tapping the ”*Exit*” button you can close the application. If you have started a job session, the program will ask if you want to save the data of the session before closing.

Options menu



The application can be customized through several settings. Each setting is saved automatically, so you do not have to set the desired parameters every time you start the application.

Units, Gauges to display and Overlap option menu



	Function
1	Unit for length can be set here. Supported formats are Meter, Feet, Inch and Yard
2	Unit for speed can be set here. Options are Kilometer/hour or Mile/hour.
3	Unit for area measurement can be set here. Options are Hectare, Acre and Square miles
4	Set Speed gauge to be displayed on the Navigation screen. Displays the actual speed of the agricultural machinery.
5	Set Done path gauge to be displayed on the Navigation screen. Displays the covered distance since the start of the session.
6	Set Cultivated area gauge to be displayed on the Navigation screen. Displays the area of the cultivated field since the start of the session.
7	Set Time duration gauge to be displayed on the Navigation screen. Displays the elapsed time since the start of the session.
8	Set Time now gauge to be displayed on the Navigation screen. Displays the actual time.
9	You can set the width of the allowed overlap. The distance between the navigation lines are calculated based on the values given here.

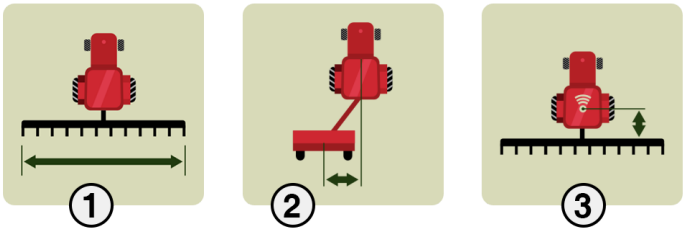
Session handling, GPS source and Display menu

	Function
1	For each job session several parameters can be set, which can checked anytime later on. Address of the field, type of actual agriculture, description of the job and the name of the employee can be set here.
2	Previously saved Fields with their parameters can be loaded by tapping here.
3	Previously saved Sessions can be loaded by tapping here. Tap to *“Continue former session”* to simply load and continue a saved session.
4	G-sensor control, Button control and Archive session can be set for demo or testing purposes.
5	External Bluetooth antenna or Built-in GPS module can be set as actual GPS data source.

English

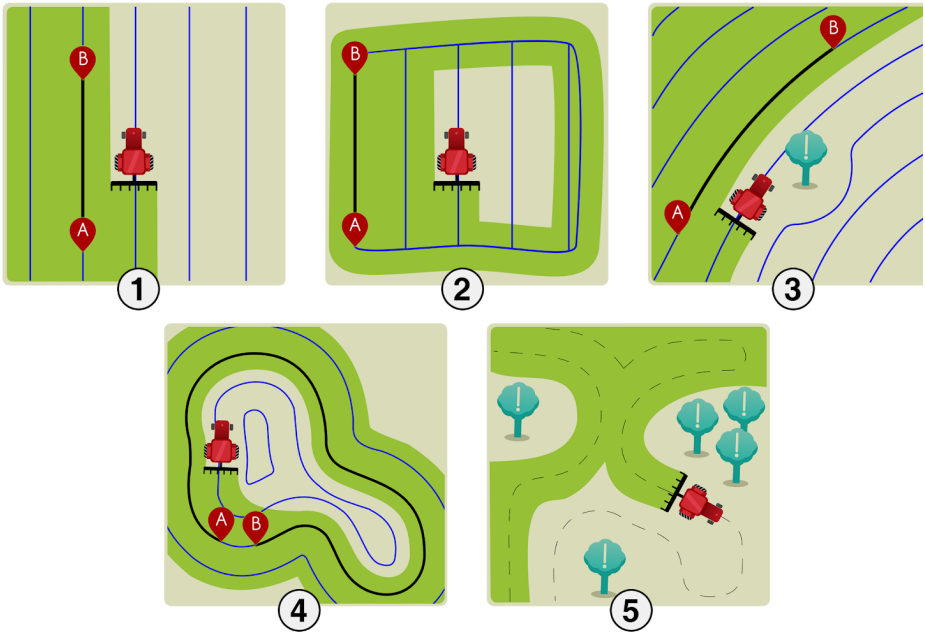
6	Visualization of the agricultural machinery displayed on the Navigation screen can be set here. A tractor model with sprayer, a tractor sprayer, a harvester and a simple arrow are the available options.
7	The color for the cultivated area.
8	Two camera modes are available: (1) Camera moves along with the tractor (follows the moving tractor) and (2) Camera is fixed, looks only in one direction.
9	Option for Navigation: (1) Navigation bar, (2) Navigation arrow and (3) arrow with navigation bar.

Size and alignment menu



	Function	Options
1	Setting the width of the work	- The workwidth of the agricultural machine can be set with the parameter given here. (The software sets the width of the line (stripe), which indicates the cultivated area. The navigation distances are also calculated based on this data.) - Negative number cannot be given.
2	Setting the center-offset	- The outline of the cultivated area can be moved to the left of the agricultural machine with negative values. It can move to the right of the agricultural machine with positive values. - center-offset is not considered when calculating the navigation path (not supported when guidancing)
3	Setting the distance of the antenna from the machinery	The software does not support towed machines with joint.

Guidance mode menu



	Function
1	A-B straight mode
2	A-B surrounding mode
3	A-B curve mode
4	A-B round curve mode
5	Tracking only mode

English

Language settings

You can set the language of the operating system. The chosen language will be the language of the program as well.

Supported languages:

- Chinese, English, German, Hungarian, Polish, Portuguese, Russian, Spanish

Font size settings

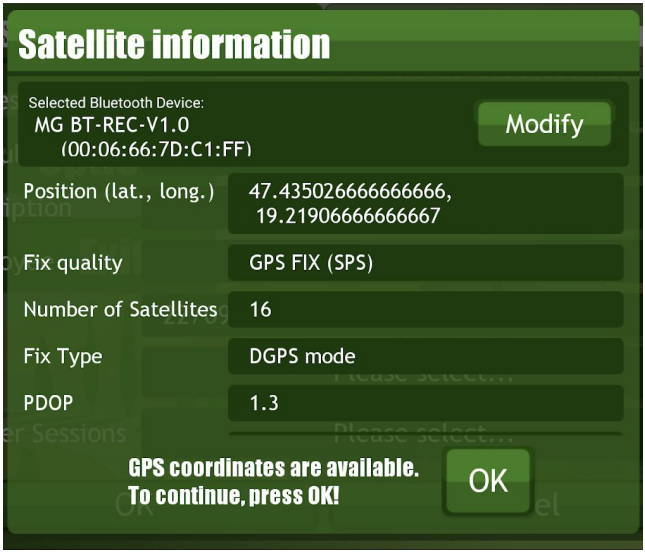
You can choose the font size of the operating system. The chosen size will be the font size of the application as well.

Starting a new job session (with Bluetooth-receiver)

English

Steps of starting a job session:

1. Start the program
2. Set the parameters in the "*Options*" menu that are necessary to start guidancing.
    a. set workwidth
    b. set center-offset
    c. Set distance of the antenna
    d. Set guidance mode
    e. Set allowed overlap
3. Select the Bluetooth-antenna as GPS-source in the "*Localization source*" menu.
4. Tap "*Start*".
5. To start the job session, the Bluetooth-device needs power supply.
6. After tapping "*Start*" button the "*Satellite Information*" window appears on the screen. If the Bluetooth device had been not selected yet, click on the "*Modify*" button and select the "*BT-REC-V2.3*" receiver. If the mentioned device is not listed on the screen, please click on the "*SCAN FOR DEVICES*" button.
7. The following window appears after clicking "*Start*":



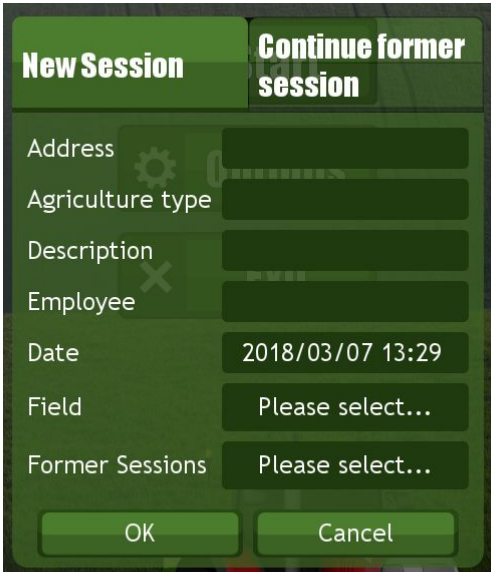
On the Navigation screen the job session can be immediately started, as soon as position data is available, independently from its accuracy.

On the Navigation screen a small icon and caption gives information about the accuracy, so the User can choose the accuracy they want to work with.

Accuracy levels:

- Bad (Red sign)
- Weak (Orange sign)
- Good (Yellow sign)
- Excellent (Green sign)

8. The following window appears after clicking "*Ok*":



Information about the new job session could be added here. It is not necessary to fill any of the fields here, but it makes easier to find a session later.

9. A summary of the given data appears after clicking "*Ok*".

Error messages and notifications when using the Bluetooth-antenna

English

The Application send notifications in case of any error that occurs while using the Bluetooth GPS-receiver.With these notifications the User can solve issues in connection with the guidance system quickly. If the accuracy of the received position data decreases below the minimum level, a notification shows up, so the User can stop the job until the signal becomes accurate enough to continue with the desired accuracy. The Application also gives notifications if the connection with the antenna is lost or not stable.

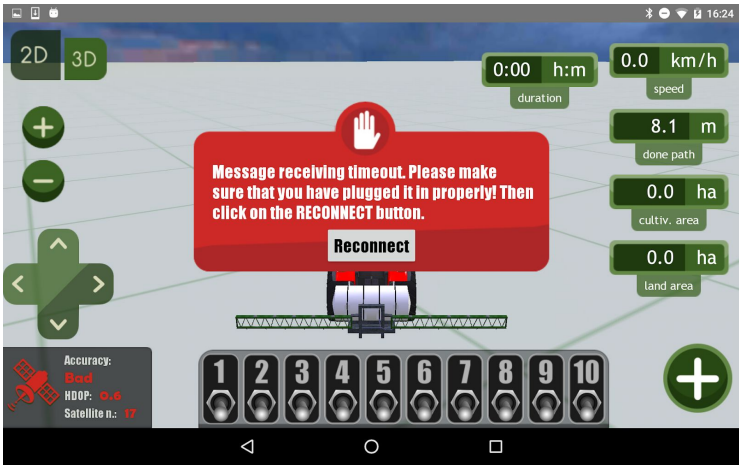
Sources of error messages:

1. Bluetooth connection had been cut-off (possible cause: the power supply of the Bluetooth-receiver is unavailable, that is, the USB-cable or the car charger is unplugged)
2. There has been no new information about the position within a certain amount of time.

Alarm notification in Main menu

English

Alarm notification on the Navigation screen



⚠	Check if the cables of the receiver are properly connected to the Bluetooth-receiver, then tap ”*Reconnect*” button to start again the connection between the device and the Application if Bluetooth-connection is interrupted and the automatic reconnection has failed.

Starting a new job session (with built-in GPS-module)

English

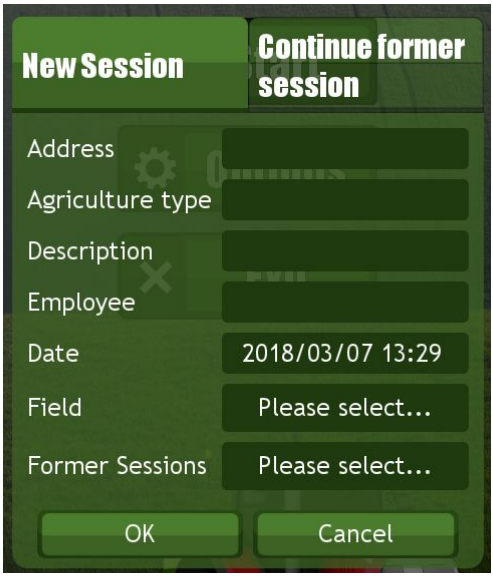
Steps of starting a job session:

1. Start the program
2. Set the parameters in the "*Options*" menu that are necessary to start guidancing.
    a. set workwidth
    b. set center-offset
    c. Set distance of the antenna
    d. Set guidance mode
    e. Set allowed overlap
3. Select the built-in GPS-module as the GPS-source in the *"Localization source*" menu.
4. Tap "*Start*".
5. To start a job session, the Built-in GPS-module has to be turned on.
6. After tapping "*Start*" the following window appears. Wait until the pop-up window disappears.

While waiting for GPS-reception all functions of the program are blocked. The program behind the dialogue window indicating waiting is darkened. You can interrupt the progress anytime by tapping the tablet's/phone's "*Back*" button.

7. At the following window data of the job session could be added for easier access later on

English



Information about the new job session could be added here. It is not necessary to fill any of the fields here, but it makes easier to find a session later.

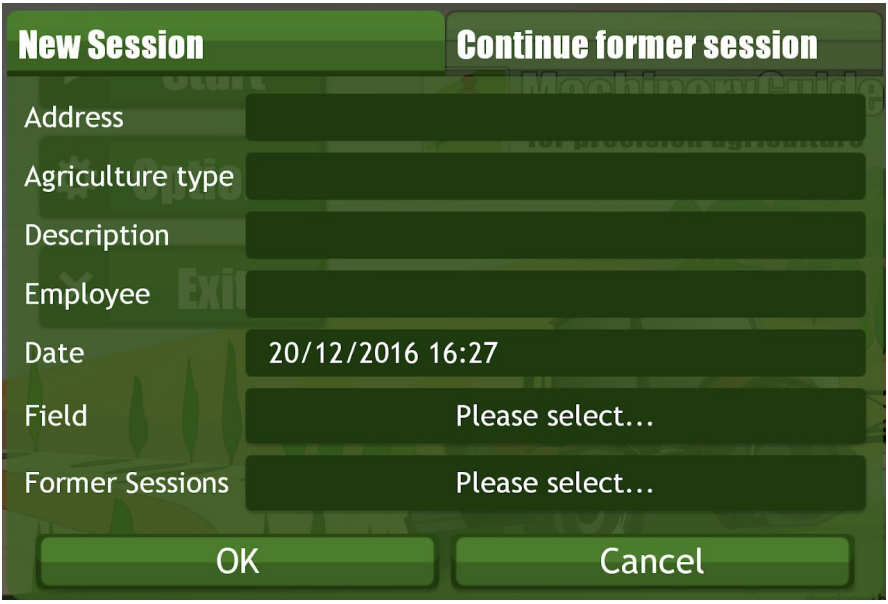
8. Press "*Ok*" to start the session

Loading previously saved sessions and continue former job

English

1. Reload former session data

When starting a new job, data from previously saved jobs could be added. Former field data (area, perimeter etc.) and former session data (path) could be added by tapping the “Please select…” buttons.



If any former data had been selected, the guidance will be created as an individual job session, thus it can be retrieved with its individual date and session name.

2. Continue former job

User can also load and continue previously started jobs. In this case the selected job will be continued instead of an individual new job.

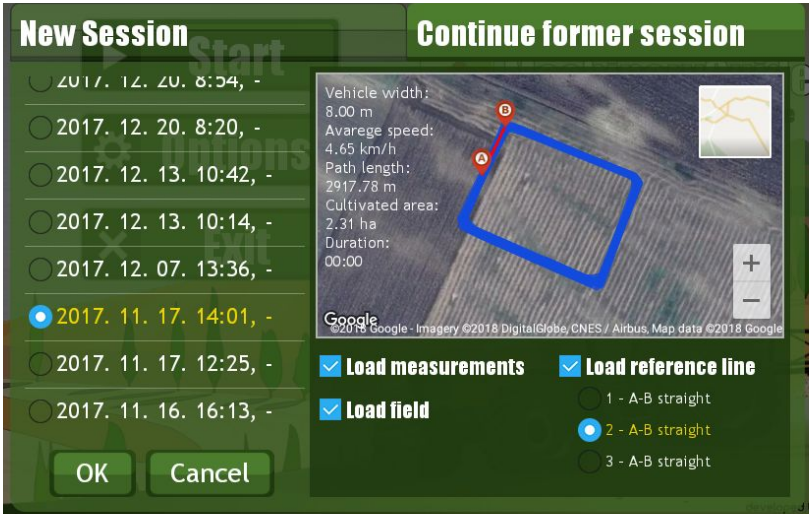
	Warning! Due to the fact that the positional data given by free corrections have low absolute accuracy, there might be a difference between the loaded and the actual positions.

English

Steps to continue a job session:

1. Start the program.
2. In the main menu tap ”*Start*”.
3. As soon as the initialization of the GPS’s position reception is done, the following window disappears:

4. Tap ”Continue former session” tab.



5. Select the session from the list that you want to continue. Newer items listed first.
6. Click “*Ok*” to start loading the job.

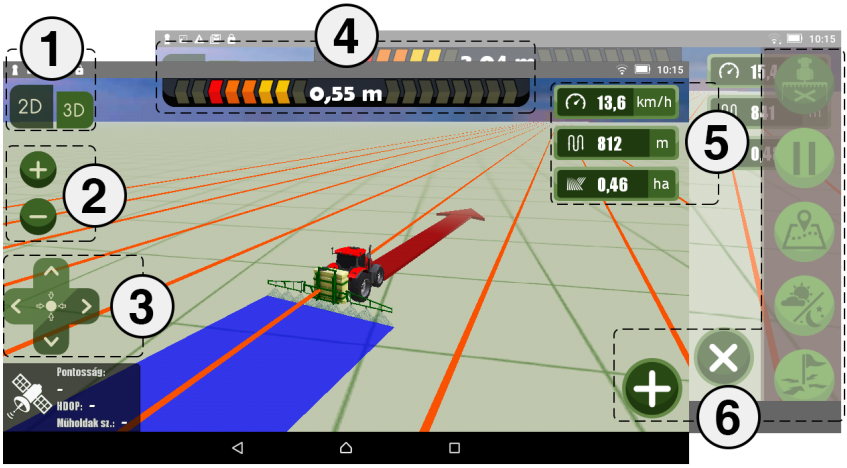
Managing former paths

Former paths can be managed in the “*Session handling*” sub-menu in the “*Settings*” menu. All statistical data of the saved paths and former jobs can be viewed here, with area of the field (if it has been assigned to the actual job) and reference lines. Route of the previously done fieldwork also appears here.

Former sessions screen:

	Function
1	List of former jobs
2	Export selected session to a KML file. The exported file can be found in the “MachineryGuide” folder at the root of the file system and can be opened in any free KML-viewer application (such as GPX Viewer, Google Earth) In the opened KML file various information about the job can be displayed.
3	Export selected session to a PDF file.
4	Edit data of the selected job
5	Delete selected job

Layout of the Navigation screen



	Name	Function
1	Change view	Swapping between bird's-eye view and 3D-view.
2	Zoom	Zoom in or out of the machinery
3	Changing point of view	Bird's eye view: moving the camera around 3D view: rotate the camera around
4	Navigation	Navigation arrow, navigation distance and field border notification are the parts of the navigation. The navigation arrow turns in proportion to distance, visually indicating to the user how to correct the direction of the machinery.
5	Measuring gauges	Gauges to display information about the actual job.
6	Function buttons	Function buttons are hidden by default. They can be revealed by tapping the button in the right bottom corner, or by pulling them from the right side of the screen.

Function buttons

English

	Name	Function
	Start button	Guidancing starts after tapping this button. If not activated, the path of the machinery is a thin line, the normal path appears after activation
	Pause button	Stops the gaudicing. A flag will be placed at the position of the machinery, so later on the User can continue the work from the exact position.
	“A” reference point	With this button the "A” reference point can be set (placed on the field).
	“B” reference point	With this button the "B” reference point can be set (placed on the field). There must be minimum 50 m distance between “A” and “B” points. The section between “A” and “B” point will be the reference line of the actual session, the navigation trajectory calculation is based on this section.
	Hide/show cultivated area	Hides or shows the whole cultivated area.
	Hide/show navigation arrow	Hides or shows the navigation arrow (plus the navigation distance and the field border alarm)
	Satellite information	Information about the satellite connection by tapping this button. This function is only available with the Bluetooth GPS antenna.

English

	Options	The Options menu is available from Navigation screen as well, but preferences are limited here, because when a session is started, for instance the "allowed overlap", "center offset", "guidance mode" are no longer changeable.
	Exit job	Exit the application. The software asks whether the User want to save the session or not before closing the application.
	New A-B line	It is possible to add several “A” and “B” points for consecutive guidances.
	Position correction	This option helps the User to correct the actual position of the machinery relative to the done path, or loaded coordinates of previous jobs.
	Night mode	Agricultural activities often continues after dark. With the help of Night mode, MachineryGuide can be used comfortably under such circumstances as well.
	Snapshot view	A snapshot of the full session can be viewed at any phase of the job on Google Maps in 2D, 3D, normal and satellite mode.

Starting navigation (with A-B straight guidance mode)

English

Steps of starting navigation:

1. Go through the steps of ”Starting a new job session”.
2. Drive the agricultural machine to the right position, if the machinery is not yet at the area to be cultivated
3. Tap “Start” to start the job. 

In case of A-B guidancing, User has to select a reference section, to which the navigation path (parallel lines) will be calculated. For setting the reference line, “A” and “B” points have to be placed.

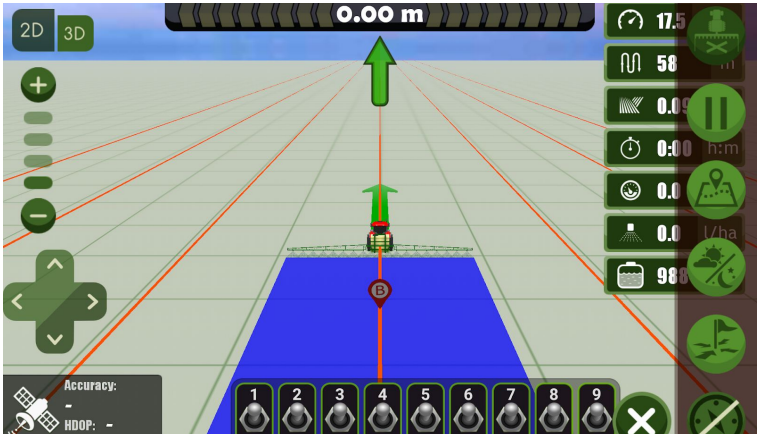
4. Set point “A” to set the first reference point 

5. Drive forward. To place ”B” reference point the machinery need to be at least 20 metres away from point ”A”. Until then, ”B” button is inactive.
6. Set point “B” to set the second reference point 

7. Guidancing now has started. It can be interrupted any time by tapping the  button, and be continued by tapping the button. 
8. Go by the outlined navigation lines, follow the directions of the navigation arrow.

English

Navigation screen after placing the reference points



Starting navigation (AB with surrounding guidance mode)

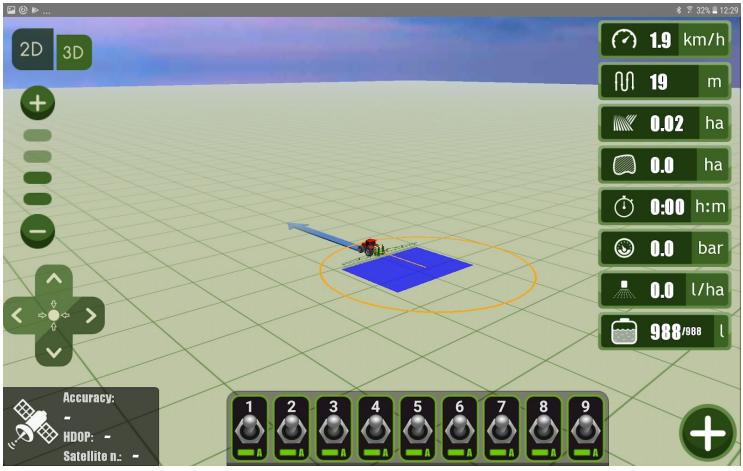
English

Steps of starting navigation:

1. Choose “A-B with surrounding” mode in *Settings*, under *Guidance mode* sub-menu
2. Go through the steps of ”Starting a new job session”.
3. Drive the agricultural machine to the right position, if the machinery is not yet at the area to be cultivated
4. Tap “Start” to start the job.

In case of AB with surrounding guidancing, first drive around the field area and point out the ”A” and “B” reference points, the so-called reference section, to which the navigation path (parallel lines) will be calculated. You should follow these lines during guidancing.

5. A circle appears at the starting point of the job, indicating the place where the machinery have to return after surrounding the field:

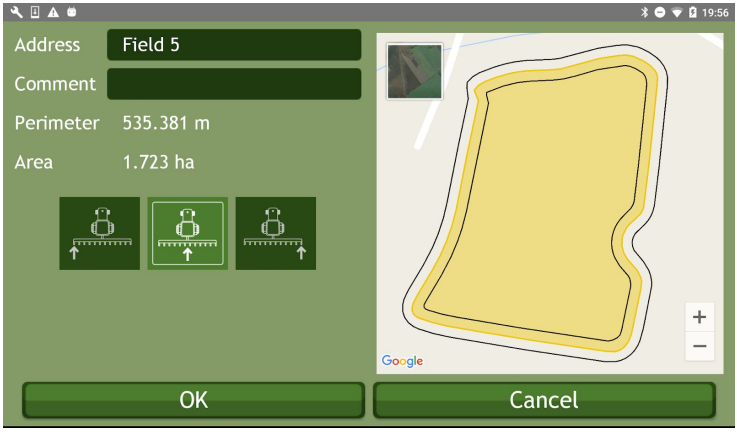


6. Start to go around the field, and set point “A” as the first reference point

7. Drive forward. To place ”B” reference point the machinery need to be at least 50 metres away from point ”A”. Until then, ”B” button is inactive.

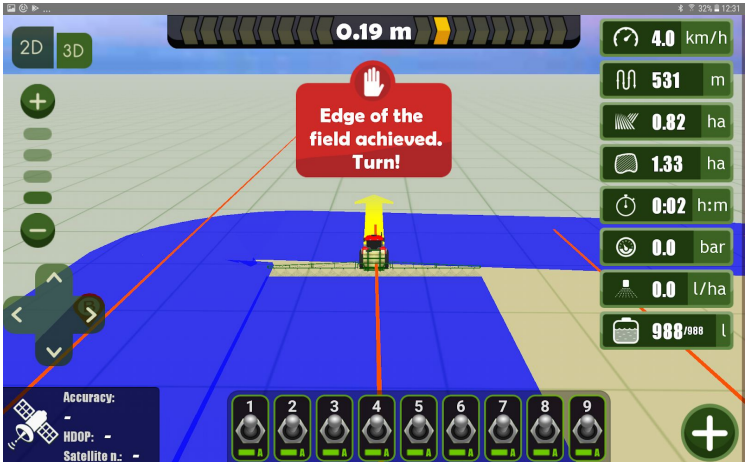
9. Set point “B”  to set the second reference point

10. After returning to the starting point circle, the software automatically closes the field and opens the window below to save the field:



10. Guidancing now has started. It can be interrupted any time by tapping the  button, and be continued by tapping the  button.

11. Go by the outlined navigation lines, follow the directions of the navigation arrow. If you reach the edge of the field the following notification will appear on the screen:



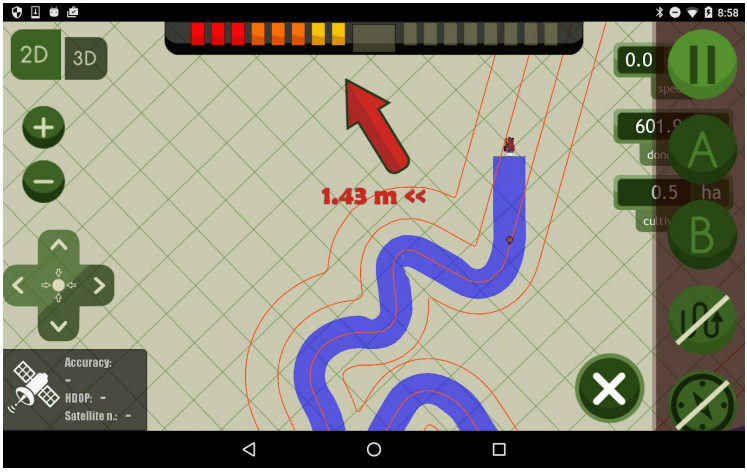
English

Starting navigation (AB curve guidance mode)

Steps of starting navigation:

1. Choose “AB curve” mode in *Settings*, under *Guidance mode* sub-menu. The following steps are the same as described at the chapter “**AB straight guidance mode**”.

2. After placing the “A” and “B” reference points the navigation lines will be calculated regarding to the shape of the A-B section, for example:



Starting navigation (AB round curve guidance mode)

English

Steps of starting navigation

1. Choose “AB round curve” mode in *Settings*, under *Guidance mode* sub-menu.

2. Go through the steps of ”Starting a new job session”.

3. Drive the agricultural machine to the right position, if the machinery is not yet at the area to be cultivated

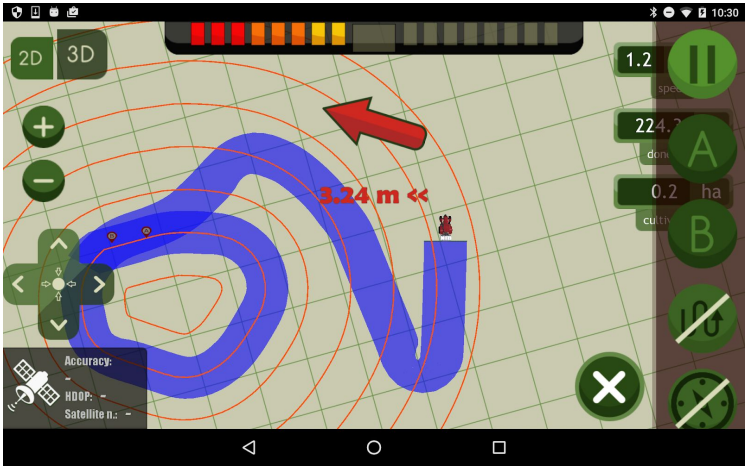
4. Tap “Start” to start the  job.

5. Start to go around the field, and set point “A”  as the first reference point

6. Drive forward. After surrounding the field, return to the ”A” reference point and place ”B” reference point by tapping the following button: 

7. Guidancing now has started. It can be interrupted any time by tapping the  button, and be continued by tapping the  button.

8. Go by the outlined navigation lines, follow the directions of the navigation arrow:



English

English