

# User guide Makin' Survey

Version 2.22



**MAKIN' 3D**  
**MACHINE CONTROL**

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# 1. Introduction

## 1.1. Congratulations on your new product

You are now ready to work more efficiently and keep the precision at an optimum level. Besides that, you will be more eco-friendly by doing the same amount of work in less time.

The system is designed to show you the information you need on the screen with the greatest accuracy.

At the construction site, you are the expert - Makin' 3D is the best work companion the excavator operator can get.

We at Team Makin wish you all the best with the use of your new system.

## 1.2. Maintenance

It is recommended to check the system's accuracy regularly. We recommend that the operator of the machine frequently checks the machine's positioning against a known point on every job site.

## 1.3. Storage

Keep the equipment safe when it's not installed in the machine. Use of a protective case is recommended if the tablet and antennas are removed from the machine to secure the devices from external stresses such as knocks and bumps.

## 1.4. Cleaning

The equipment must be cleaned regularly to ensure full functionality over time.

Cleaning is done by blowing to remove dust, you can also choose to use a damp cloth to wipe the tablet.

Under no circumstances should the equipment be high-pressure washed - neither inside nor outside the engine compartment.

## 2. Responsibility

### 2.1. Installation

All installation and main calibration of the system must be carried out by Makin approved technical personnel. Failure caused by unauthorized installation or repair could cause a void of warranty.

It is important to follow the machine manufacturer's instructions for installing the Makin machine control system to avoid violating any machine supplier's warranty regulations.

The user is responsible for using the product in accordance with the given instructions. The user is also responsible for ensuring that the reference models used are correct and that the bucket is properly calibrated and controlled.

Broken cables on the system may cause short circuits, system errors, and defective components. Ensure that no cables have external damage; damage must be repaired immediately before further use.

Errors in measurement results may occur if the equipment has been subjected to impact, abuse, modification, or transport damage. Control of the system after such events is important to ensure an optimum result.

Warranty: For further details, visit [www.Makin3D.com](http://www.Makin3D.com) for more information.

### 2.2. Limitations

The product is intended as a control tool for machine operators, and any use beyond this is not permitted. The supplier or manufacturer cannot be held responsible for any use that goes beyond the given limits.

### 2.3. End-user license agreement

License: The system is preloaded with software, which can also be downloaded with permission from Makin. The software is protected by copyright and other laws. The use of the software is governed by the license agreement entered into the Makin' 3D system when purchasing the product.

For further legal terms and conditions, including but not limited to the applicable End User License Agreement between you and Makin, we refer you to visit Makin's website, [www.Makin3D.com](http://www.Makin3D.com).

## 2.4. Warranty disclaimer

Makin provides this documentation without warranty, term, or condition of any kind, either implied or expressed, including, but not limited to, the implied warranties, terms, or conditions of merchantability, satisfactory quality, and fitness for a particular purpose.

Makin, its employees, and agents will not be responsible for any loss, however arising, from the use of, or reliance on this information.

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## 2.5. Software update

Software will be automatically and frequently updated, and users will get a notification on the screen. Software updates require a valid maintenance license. To start downloading an updated software version, users will be asked to agree before the download starts.

## **3. Compliance information**

### **3.1. EU/Compliance**

Makin hereby declares that the system and its components comply with the essential requirements and other relevant regulations of the Directives below.

### **3.2. 2014/30/EU**

The EMC Directive limits the electromagnetic emissions of equipment in order to ensure that, when used as intended, such equipment does not disturb radio and telecommunications as well as other equipment.

The directive also governs the immunity of such equipment to interference and seeks to ensure that this equipment is not disturbed by radio emissions when used as intended.

### **3.4. 2011/65/EU**

Directive 2011/65/EU of the European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

### **3.5. 2006/42/EC**

Machinery safety (MD)

### **3.6. ISO-13766-2006**

The system has been tested and passed the EMC test. Earthmoving machinery.

## 4. Product overview

### 4.1. Tablet buttons and light indicators



#### 1. On/Off button

#### 2. Power indicator

- *No light:* System is off
- *Green light:* System is on
- *Blinking green light:* Tablet in sleep mode

#### 3. Charging indicator

- *No light:* External power source not connected
- *Red light:* Battery power is critically low. External power source not connected.
- *Orange light:* Tablet is currently charging
- *Green light:* Tablet fully charged

4. Auto-rotate screen. The button can be programmed (more info below).

#### 5. Volume up

#### 6. Volume down

7. Not in use. Button can be programmed (more info below).

8. Not in use. Button can be programmed (more info below).

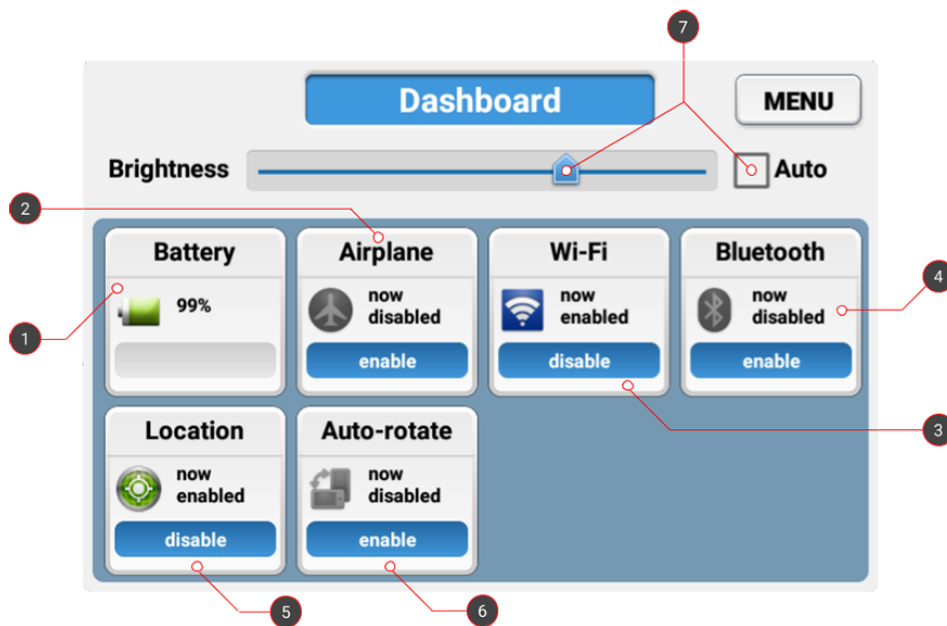
9. Basic tablet functionality via the 'Dashboard' app. Button can be programmed (more info below).



Additionally, screenshots can be taken by pressing the **'On/Off button'** and **'Volume down'** (simultaneously holding down buttons 1 and 6 for about two seconds). This can be useful in the unfortunate case that assistance is required. Find the screenshots via the **'Photos'** app.

## 4.2. Controlling basic tablet functionality

On the tablet, press the physical button labeled A1 to bring up the 'Dashboard' app, from which you can control the basic functionality of the tablet's hardware.



1. The battery indicator shows the remaining battery power of the tablet

2. Turn on/turn off Airplane mode

3. Turn on/turn off WiFi radio

4. Turn on/turn off Bluetooth radio

5. Turn on/turn off the location service

6. Turn on/turn off automatic screen rotation

7. Screen brightness adjustments

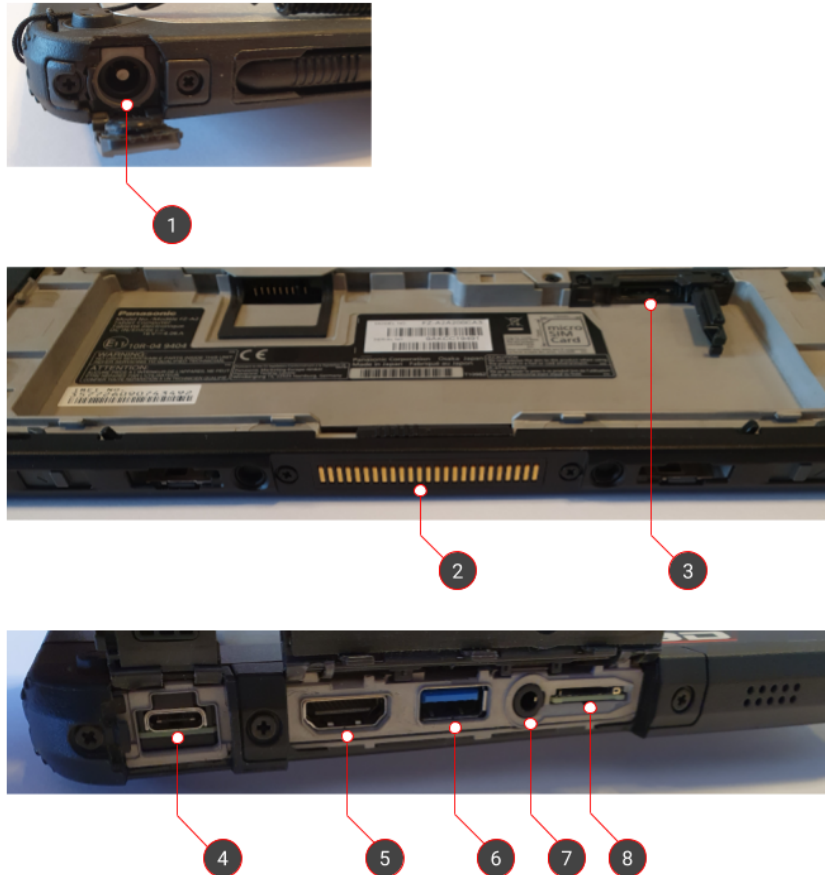
## 4.3. Programming the physical tablet buttons

Through an app called 'UserButtonManager', some of the physical buttons of the tablet can be easily programmed. These are called A1, A2, A3 and Rotate Lock in the app and correspond respectively to buttons 9, 8, 7, and 4 mentioned above.

By default, A1 launches the 'Dashboard' app and Rotate Lock toggles 'Auto-rotate'.

## 4.4. Tablet Panasonic FZ-A3 connections

The Panasonic FZ-A3 has connectors on the top, on the side, inside the battery compartment, and at the bottom.



**1.** 16 V DC input power for external charger

**2.** Docking station connector for data and power transmission

**3.** Micro SIM card for broadband internet on both tablet and GNSS receiver

**4.** USB-C

**5.** HDMI output to external screen

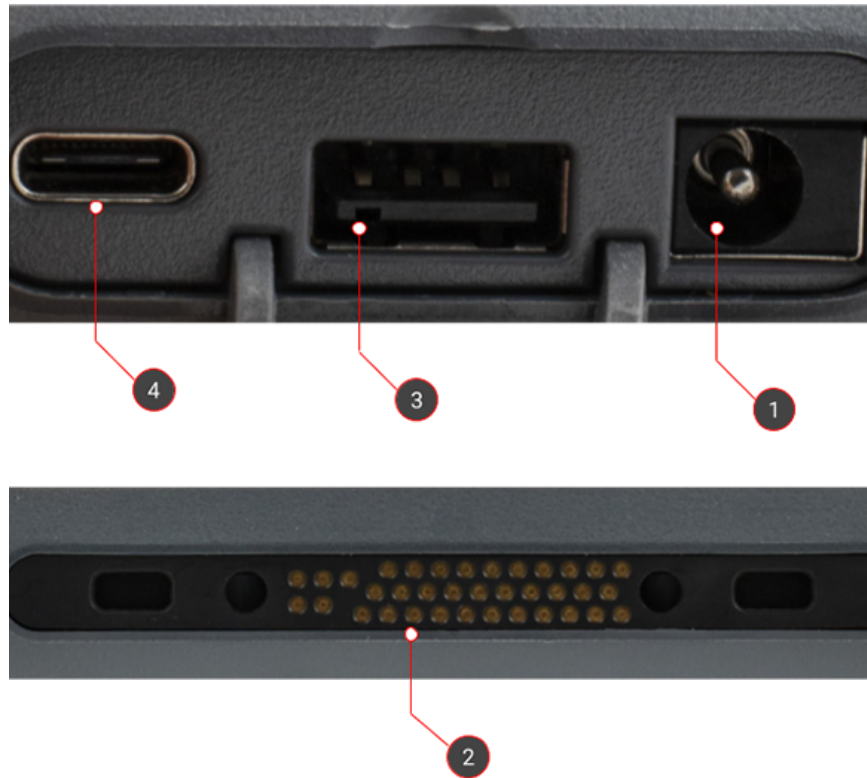
**6.** SuperSpeed USB-A 3.0

**7.** Mini-jack audio output

**8.** Micro SD for extended storage

## 4.5. Tablet Juniper Mesa3 connections

The tablet Juniper Mesa3 has connectors on the side and at the bottom.



1. 12 V DC input power for external charger

3. SuperSpeed USB-A 3.0

2. Docking station connector for data and power transmission

4. USB-C

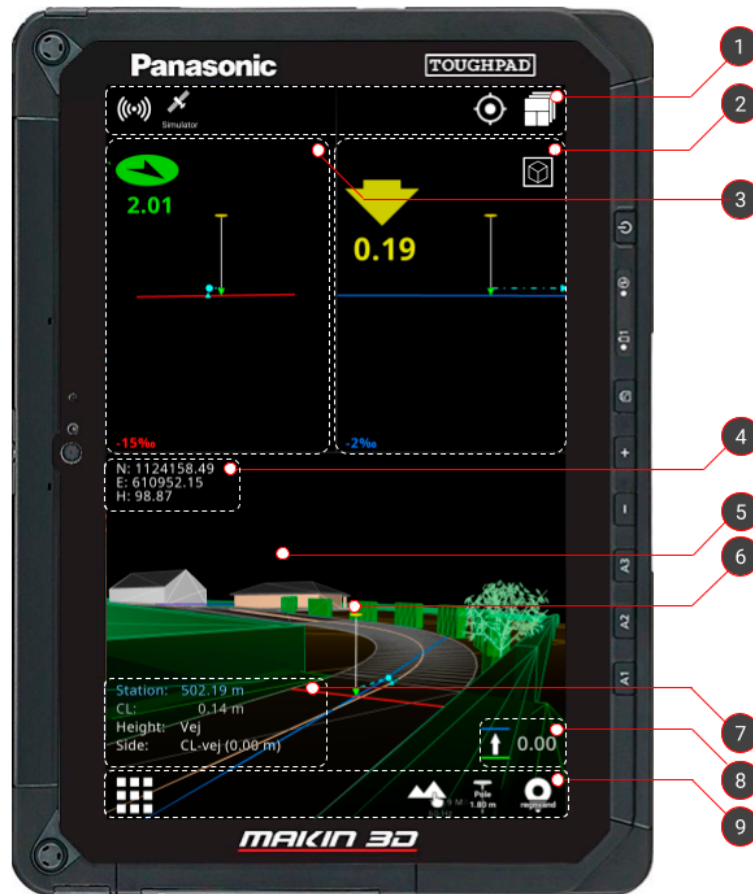
## 4.6. Software

### 4.6.1. How to turn the system on

- Turn on your Makin' 3D system by pressing the on/off button on the tablet. Android will start up and present the '**Lock screen**'.
- Swipe upwards with one finger on the touchscreen to access Makin' 3D.
- If no project has been previously loaded, you will be prompted to do so. See 5.1. under '**Open or create a project**'.

## 4.6.2. Elements of the runscreen

Makin' 3D has many different screens to choose between. Below is an explanation of one that contains most of the visual features available.



1. Top bar with status indicators for connectivity. It also contains features for resetting the pan and zoom level as well as changing between screens.

2. Indication of the slope in the main direction of the tool point. The arrow indicates the vertical distance to the selected height reference. The arrow will change color depending on the distance to the target. Tap the indicator to change the height tolerances.

6. Tap the bucket/pole/tablet (also in the static views) to change or calibrate the machine's bucket or change pole/tablet height.

7. *Station*: Indicate where on the centerline you are located. To the right of the Station, you can see the slope along the road

*CL*: Distance to centerline. To the right of the CL, you can see the slope across the road.

**3.** Indication of the slope in the cross direction of the tool point. The arrow indicates the horizontal distance to the selected side reference. The arrow will change color depending on the distance to the target. Tap the indicator to change the side distance tolerances.

**4.** Info bar for Easting, Northing and Height coordinates.

**5.** Tap any element in the loaded 3D model to bring up the References dialog.

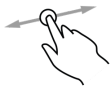
*Height:* Name of current Height Reference

*Side:* Name of the current Side Reference.

**8.** Change the height offset according to the current reference - e.g. the specified plane or the loaded model file.

**9.** Quick keys are shortcuts to features found in the menu.

### 4.6.3 Touch gestures



Use one finger to rotate a 3D View.



Use two fingers to pan a Top View or 3D View.



Spread or pinch two fingers to respectively zoom in or out a Top View or 3D View.



Tap to select.



Sometimes it is possible to long-hold for further options.

#### 4.6.4. Symbols in the top bar



Indicating connection to the internet. The symbol appears white when connection is established and grey if no connection.



Indicates the number of visible satellites. hRMS (Horizontal Root Mean Square) and vRMS (Vertical Root Mean Square) indicate the current GNSS accuracy. Tapping the icon will bring you to the GNSS status menu.



Indication of synchronization of data between server and machine.



An indication that you have remote support from Makin.

This will usually be in connection to a remote support case where you will be notified.



Bring your machine back to the center of your screen after zooming and panning.



Placed in the upper right corner. Tap for change of screen, depending on the work you are doing, and what you want to have in focus.



Toggles between 2D (top view) and 3D view. This button is always placed in the runscreen that it toggles.



Indicating project offset. The symbol appears when a project offset is applied to the active project.



#### 4.6.5. Shortcuts in the quick keys menu



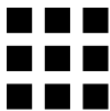
Tap to access the 'References' dialog. Another way to access this dialog is to select an element in the 3D model. Long hold to access the 'Project' menu.



The name of the current point code is shown on the icon's label. Tap to quickly log a point, which will be stored alongside general as-built data. Long hold to access 'Point codes'. You need to select a point code before logging a point.



Both the width and name of the bucket are shown on the icon's label. Tap to access the 'Bucket' dialog.



Menu from where you can access all features of the system.



Copies a point that you are then allowed to edit.



Stakeout for both points, lines, and line points.



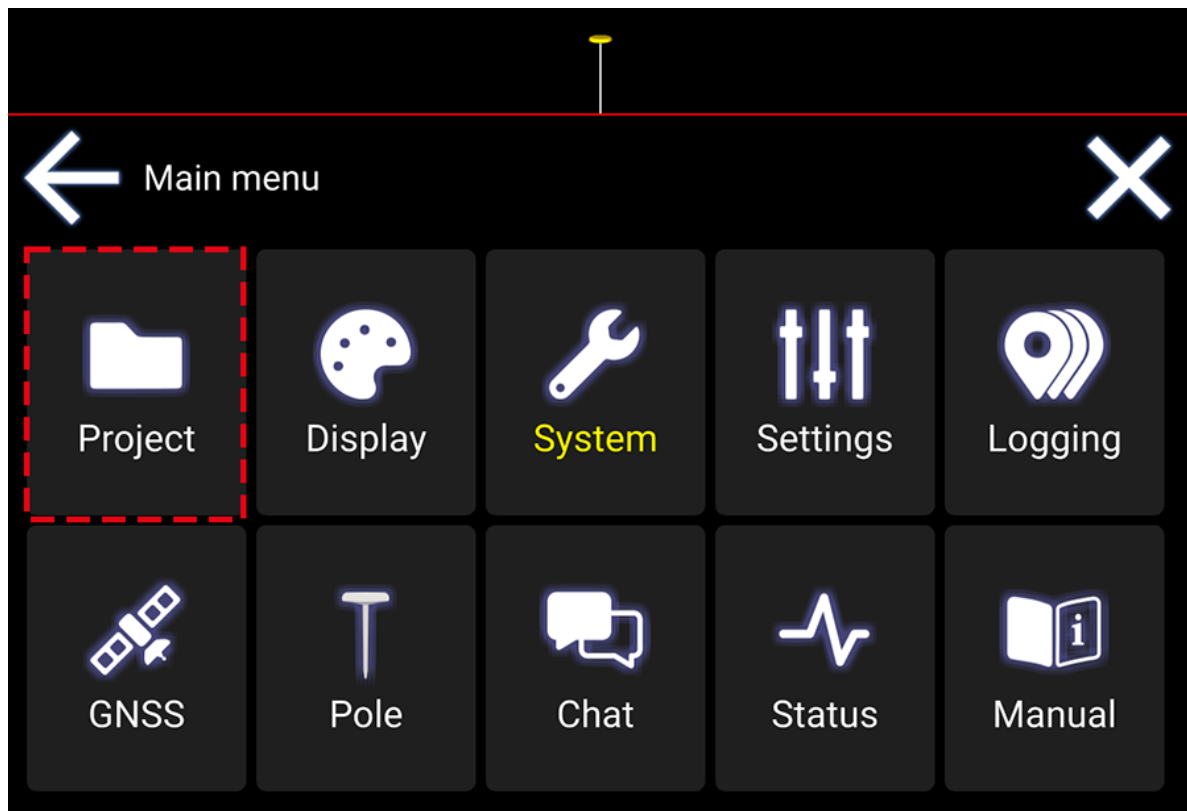
Makin' Surfaces is active. The name of the layer will be shown here.

# 5. Menu

## 5.1. Project

Menu > Project

Working according to any kind of design is considered a project, whether it is a simple relative plane or referencing lines and surfaces in more complex 3D models.

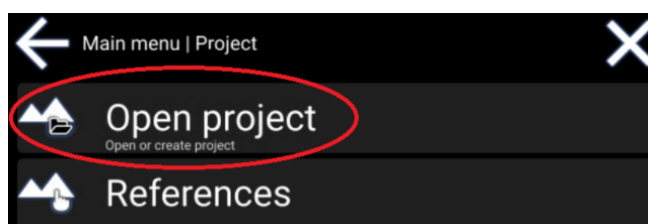


### 5.1.1. Open or create a project

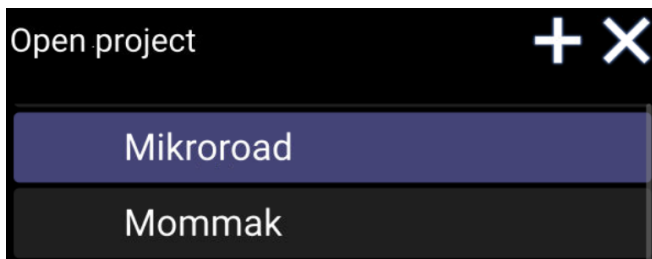
Menu > Project > Open project

To open an existing project:

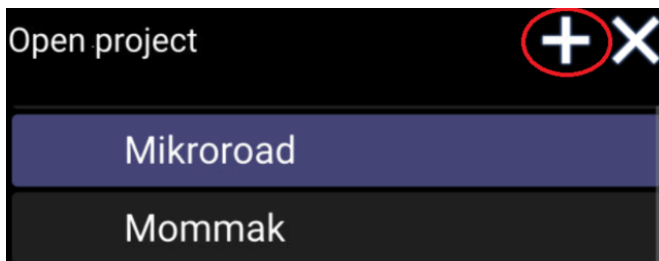
- In 'Project' tap 'Open project' to see all the projects stored. This dialog is automatically opened if no project is loaded.



- Tap the project to open and the download starts



If you want to create your own local project, tap the '+' icon.



### 5.1.2 Supported file types

When creating a project, the following file types are supported:

- LandXML Roadrunner format (XML)
- Drawing eXchange Format (DXF)
- Norwegian coordinate and observation format (KOF)

New projects are stored in LandXML format.

*Note: When Makin' 3D reaches 170 MB data in size, a warning will pop up, informing you that the project is large. This can reduce performance.*

*The file size on the hard disk is not the same as the data size in memory, so it is difficult to say exactly how big the project file can be. This depends on how detailed or complex the model is.*

## 5.2. References

### Menu > Project > References

In the 'References' dialog, you can choose which part of the 3D model should be active/inactive and what should be selected as height references, side references, and alert references.

Height references can be points, lines, and surfaces.

Side- and alert references can be points and lines.



1. Tap one of the symbols to select all elements in the project

2. White means an element is visible and activated

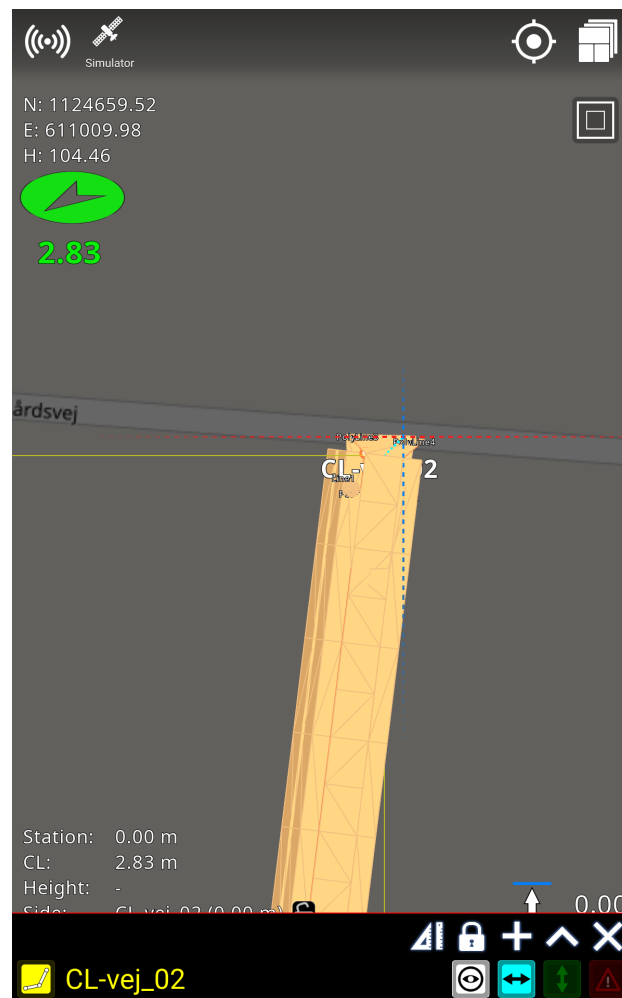
3. Blue indicates an element used as a side reference. Press to select as reference. Long press will deselect all other side references selected

4. Green is used for elements that may reference the height. Press to select as reference. Long press will deselect all other height references selected

5. Red is an alert reference, which gives a warning when the tool is too close to the element. Not applicable for surfaces.

6. Highlight element with yellow color in the 3D model

As an alternative to going via the menu, you can also find this feature in the **Quick Keys menu** or by selecting any element in the 3D model.



## 5.2.1. Folders

In the reference examples below, we see all the data that has been entered on a road parcel.



In this example, we have six folders:

- Road Models
- Water & drain
- Electricity
- Construction
- Landscaping
- User data

If you enable options (i.e., set visible, side reference, height reference, alert reference) for a folder, you enable the option for all models in the entire folder. For example, if you have many road models, you may want to open the folder with the small gray arrow to the left of the folder and only activate the road models that you actually need.





Folders are shown in blue text - model files are white. File and folder names are scrollable, indicated with a tiny yellow arrow to the right of their names. A star following a project name indicates the project is local.

In the above example, we have opened the folder for road models, which contains a number of individual files. You can turn on all elements of a folder, or turn on some details by expanding individual folders. Within the folders, you can select specific data to make visible and choose what to actively work against.

To get an indication of the different model files, side and/or height must be activated. As with viewing, you do this by tapping the respective blue and/or green boxes. By enabling visibility, side, and height in combinations, you can customize what information you want on the screen.

## 5.2.2. Visible reference

All geometries are visible by default and can be hidden by deselecting the white square next to them, beneath the eye symbol. Calculations are only performed according to visible layers.



For example, if we want to make all roads visible in a group of models, simply check the white box to the right of its folder. It will make all roads visible on the screen. If we only want to see one road, just activate the white field to the right of the particular road file.

### 5.2.3. Side reference

Side references are geometries used for side calculations. When models are activated, they have a blue color next to them, beneath the symbol with the horizontal arrow in the 'Reference' dialog. The closest geometry, activated for side reference, will automatically be used. Lines and points can be selected as side references - not surfaces. The calculated side distance is the horizontal distance to the geometry.

### 5.2.4. Height reference

Height references are geometries used for height calculations. They are indicated with a light green color when activated in the 'References' dialog, beneath the vertical arrow symbol. The lowest geometry, with height reference enabled, will automatically be used. Height references are typically surfaces, but lines and points can also be selected for height calculations.

### 5.2.5. Alert reference

Alert references are geometries used for alert calculation. The closest geometry activated as an alert reference with a red square beneath the warning symbol will automatically be used. Lines and points can be selected as alert references - not surfaces. Unlike the calculation of side reference, the calculated alert distance is the closest Euclidean distance (shortest path) to the geometry.

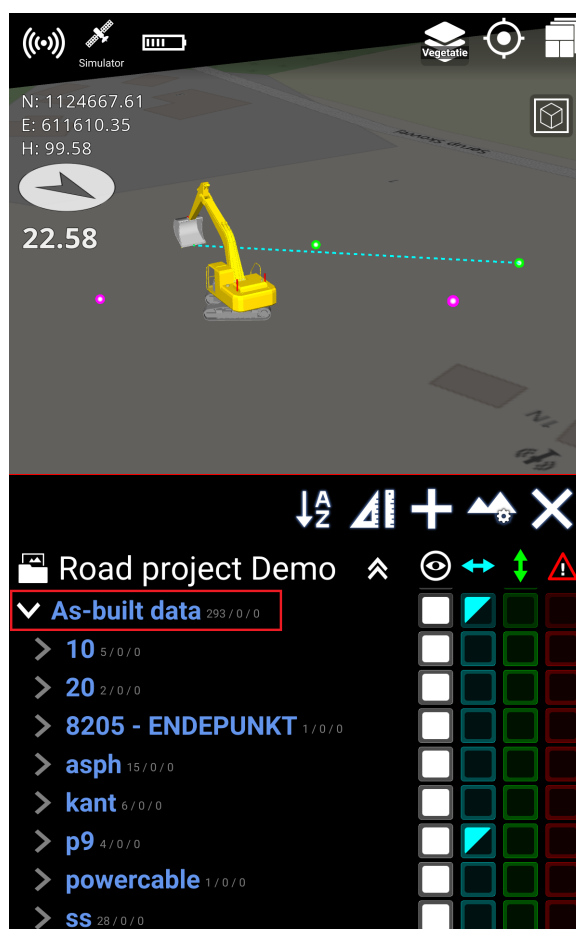
## 5.2.6. As-built data

### Menu > Project > References

As-built data is data used for documentation of the performed task. As-built data can be used in different ways: to document that the project is built the same way as it was originally designed or to document if extra work has been performed, e.g., how much soil is being removed from an area.

The as-built data is collected when the machine works, and the data is logged by the operator. These data can be used later in the process to assure the quality of the project and/or to calculate the volume of material that is added or removed from an area. As-built points will be saved in the overview if it is necessary to navigate to the points at a later stage of the project.

As-built data can be used as references in a similar way as other references. The green points are your own points, and the purple points are points from other applications. The lines and points are continuously saved and synchronized to the Makin' Cloud, where they can be downloaded as .CSV, .KOF or .XML formats.



### 5.2.7. Lock Reference (line, point, or surface)

Makin has the ability to work with multiple active references at the same time. This allows the user to activate and work with the references when moving the tool point over them. The active reference will automatically switch to the one closest to the tool point. While doing this, and with a lot of references often close together, it can be difficult to avoid the references from switching if you want to navigate to a specific height or side reference or to a reference further away than other selected references. In this case, the user can lock a reference, isolating the navigation to this specific reference without deactivating all other active references.

You can select and lock a line, point, or surface that will be used as a reference.

If you are moving the tool point around on the project, the height and side reference will keep being locked to the selected reference, thus keeping this as the reference.

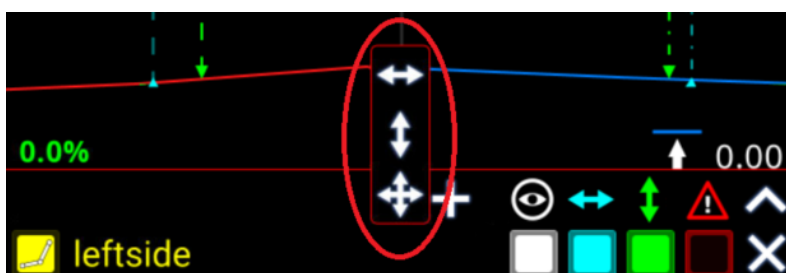
Locking a reference can be done in the reference menu or directly on the run screen:

1. Select an object by pressing the object name or directly on the visualized object in the run screen.

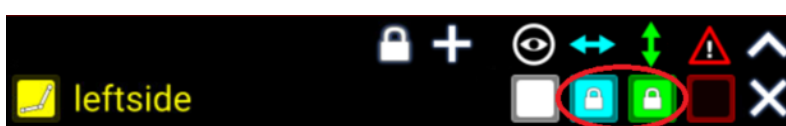
Press the **lock icon** to lock the selected reference.



Select 'Side', 'Height' or both:

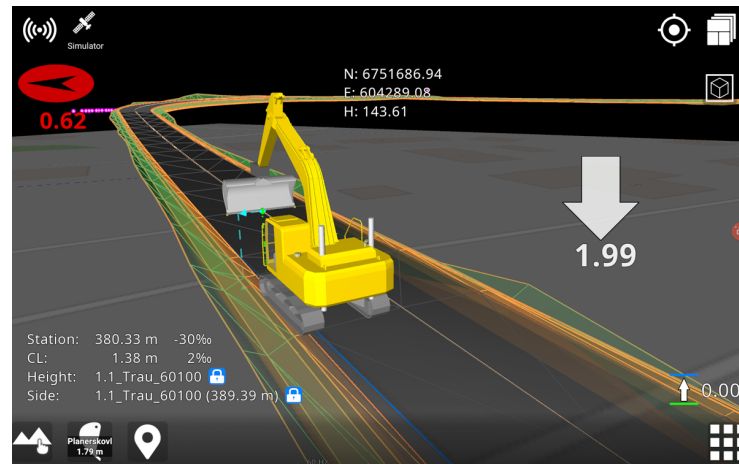


You can see that both 'Side' and 'Height' have a lock on them.



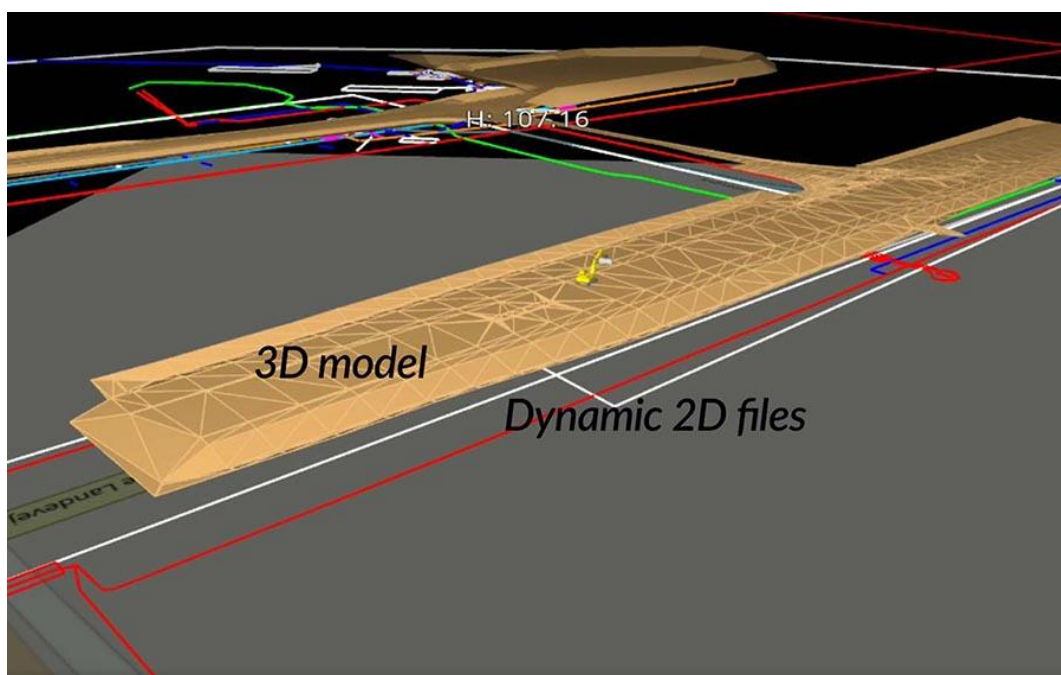
If you want to unlock it again, just tap once on the lock, and it will disappear.

2. If you want to lock the reference directly under your tool point, this can be done by pressing the lock icon next to the reference name in the runscreen. This will toggle the lock icon between open and closed for either height or side reference.



### 5.2.8. Dynamic 2D files

2D files, also known as background files or display models, are defined as files with no height information available. The height of all points in the file is set to 0.00 meters. These files are often used as background to visualize existing infrastructure or drain pipes where height was not logged originally. When working on projects with the 2D files, they are not placed at a height of 0.00 meters. They are moved closer to the project, right below the active 3D references' lowest point. These files are handled dynamically, so whenever a 3D reference is activated or deactivated, the 2D files adjust accordingly.

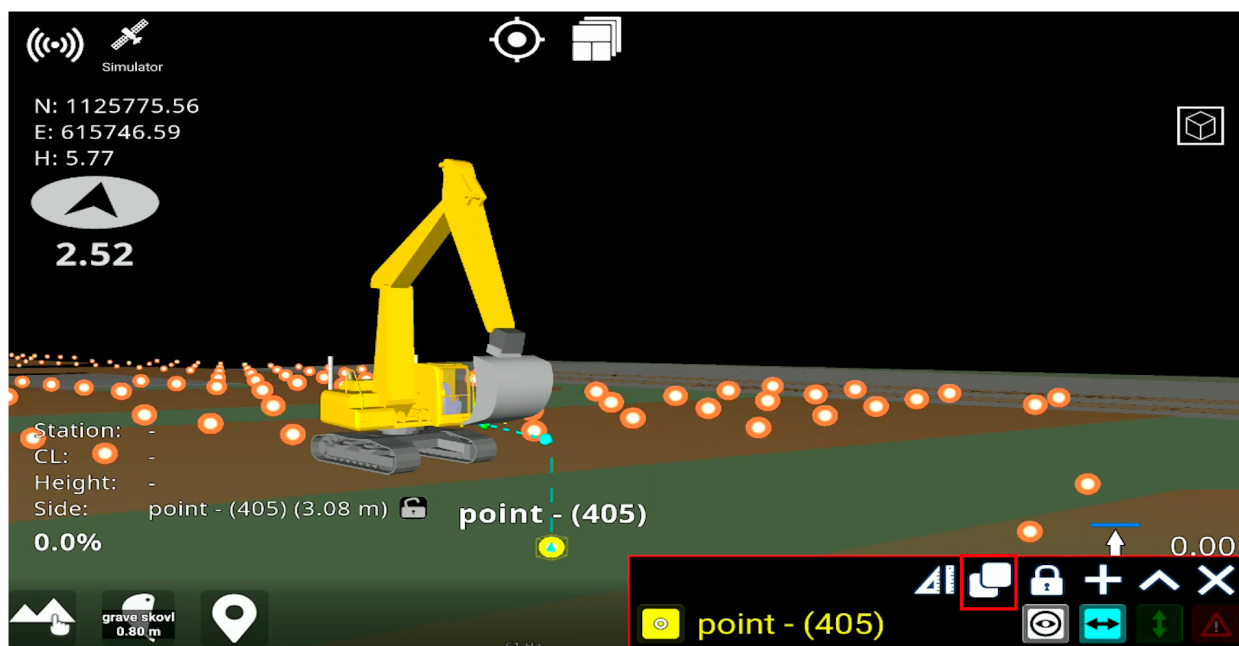


### 5.2.9. Copy Point

You can now copy and edit a point by selecting one from the design model. However, it should be noted that you are not able to modify the points in the design model itself.

By using the edit feature, you have the ability to change the point's properties, such as its height. The edited point will be saved under your own points list (*user model*).

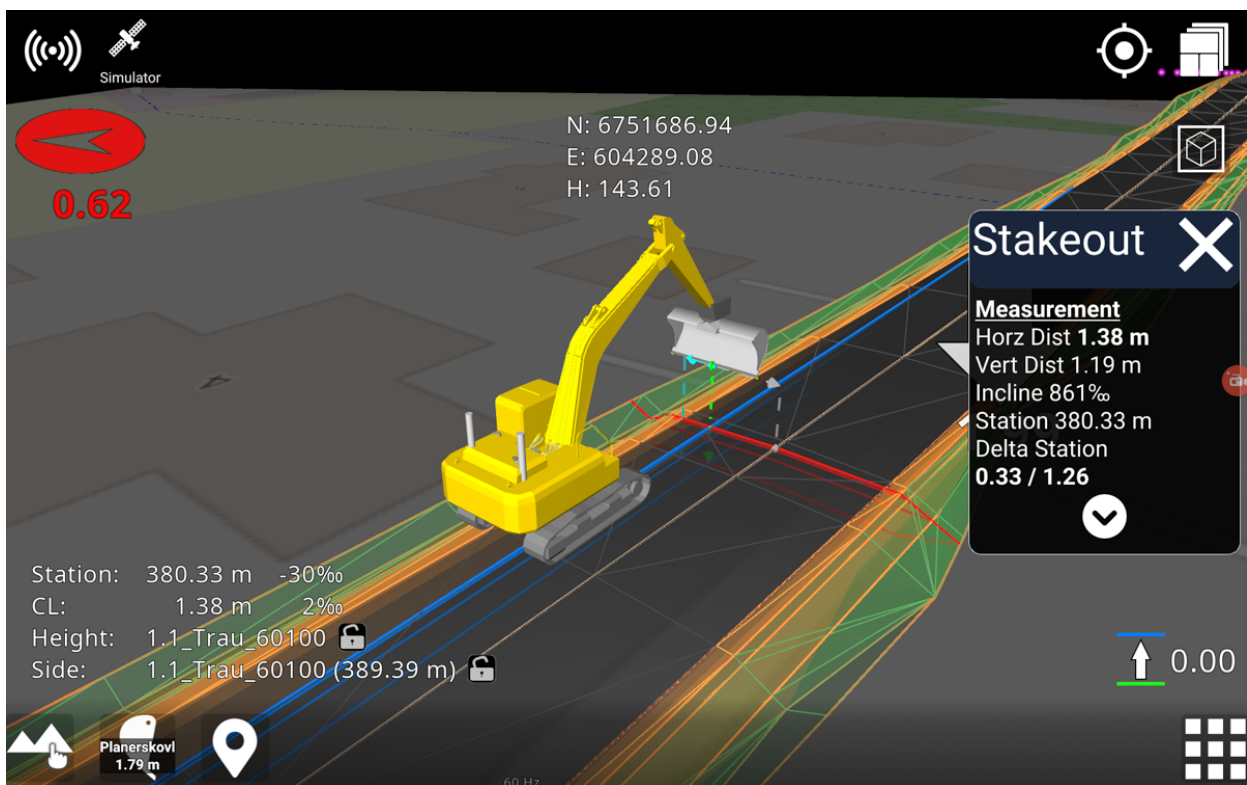
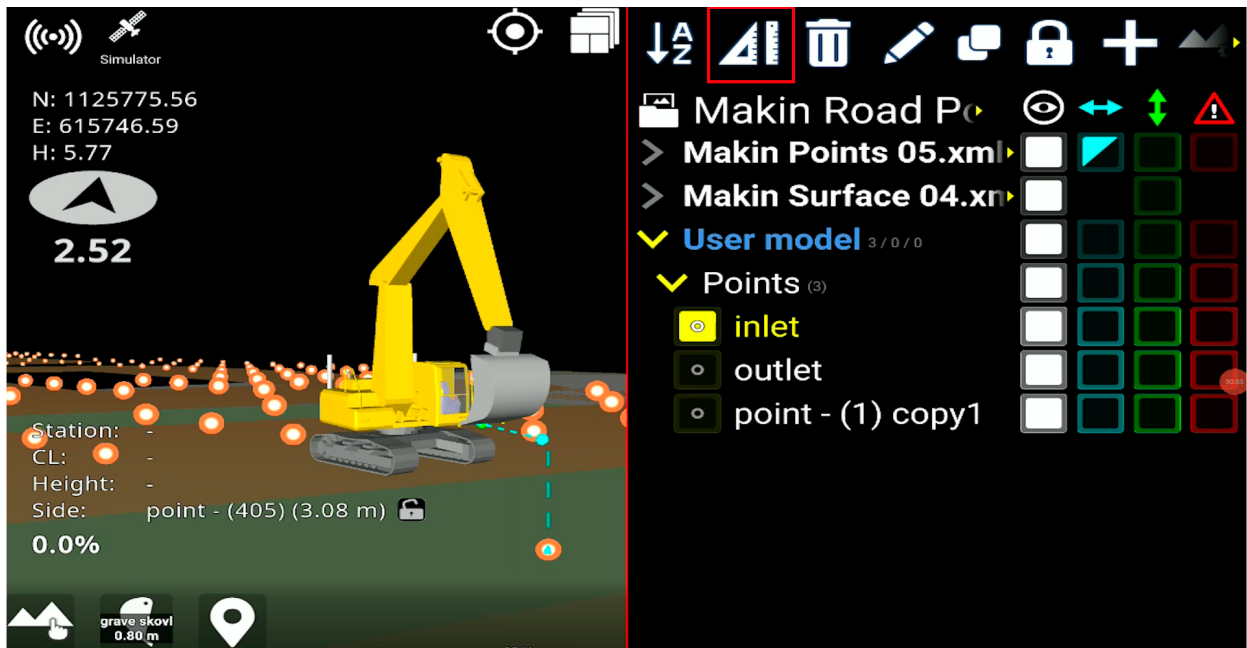
Additionally, you can utilize the Copy Point feature to duplicate any points from your personal point list.

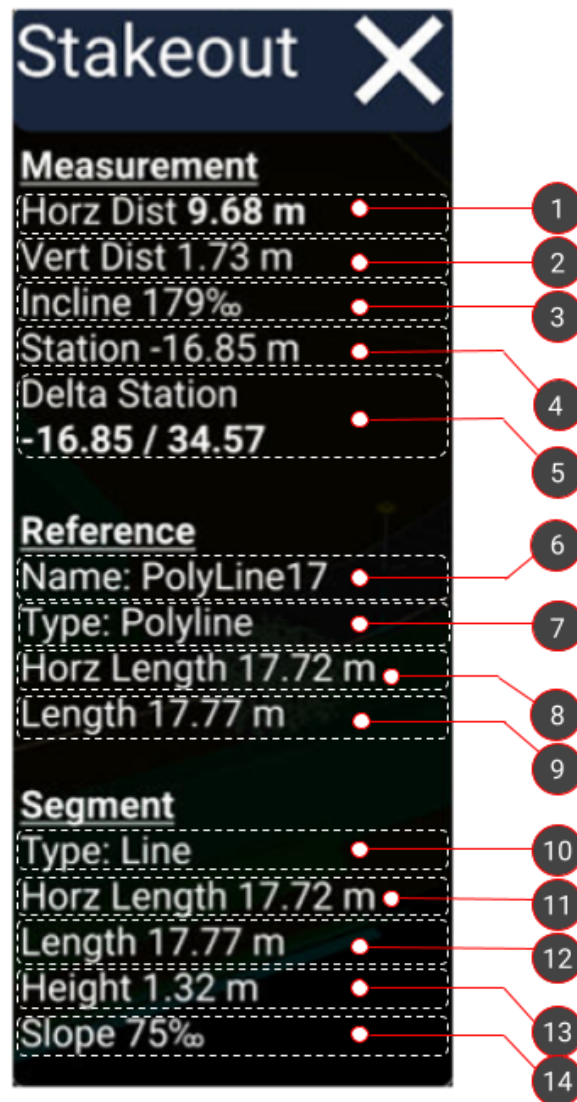


### 5.2.10. Stakeout

Stakeout is showing the information for the selected line, point, or point on a line. To stake out an element, press the element in the graphics or press the element name in the reference dialog, and press the stakeout icon at the top of the reference dialog. A popup will appear with all the stakeout information for the selected element. The stakeout menu can be freely moved around on the tablet.







**Measurement:** Shows measurements between the tool point and the selected reference for the stakeout.


**Reference:** Shows information about the entire selected reference for stakeout.

**Segment:** Shows information about the active line segment (gray line). Only shown for lines that contain segments.

- |   |  |
|---|--|
| 1. Horizontal distance between tool point and selected reference. Measured perpendicular to the line. | 8. Horizontal length of stakeout line.                                     |
| 2. Vertical distance between tool point and selected reference.                                       | 9. Length of stakeout line.  |
| 3. Inclination between selected reference and tool point.   | 10. Segment type can be line, arc, or clothoid (spiral, transition curve). |
| 4. Stationing of the selected line.   | 11. Horizontal length of line segment.                                     |

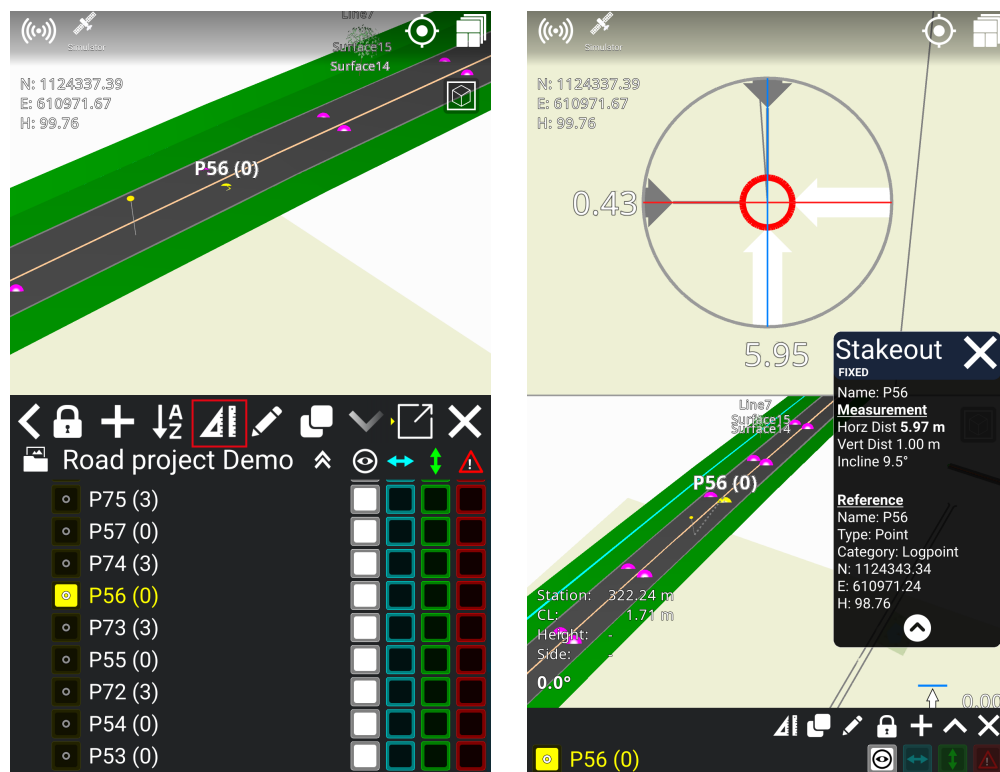
5. Horizontal distances from present stationing to the end points of the active line segment (colored gray). The line will be extrapolated, if the tool point is in front or behind end points. In this case, the value will be negative to the closest end point.
6. Name of selected stakeout line.
7. Type of selected reference (arc, circle, line, polyline, road line)
12. Length of line segment.
13. Height difference of the line segment.
14. Slope of the line segment.

### 5.2.10.1. Stakeout to a point


When you want to stake out to a point, you can press the point or click on the name of the point in the reference dialog, and then press the stakeout icon .

A *bullseye* and a popup with the stakeout information will appear on the screen. The blue line in the bullseye indicates the long slope direction, and the red line indicates the cross slope direction.

The popup with the stakeout information will show information about measurement and reference.

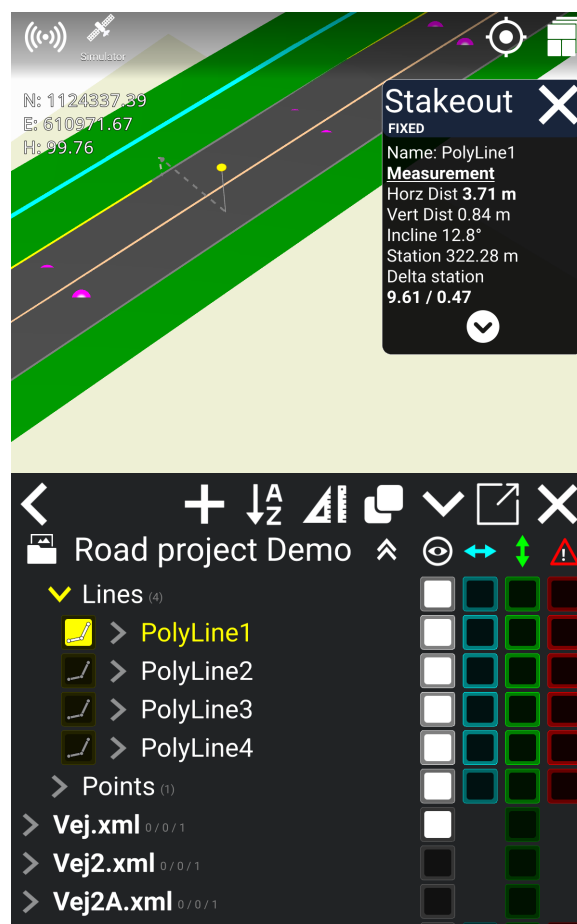


### 5.2.10.2. Stakeout to a line



When you want to stake out to a line, you can press the line on the screen or click on the name of the line in the reference dialog, and then press the stakeout icon .

A dotted line from the application to the selected line will show on the screen, along with a popup with stakeout information. The stakeout information will show information about measurement, reference, and segment.

If you move beyond the line, the dotted line will show the extrapolation of the selected line. Please note that if you stake out to a side reference, the line does not extrapolate.



### 5.2.10.3. Stakeout to a line point

If you want to stake out to a point on a line, you must press the arrow between the line symbol  and the name of the line in the reference dialog. Then the name of the line point will appear underneath the arrow. Select the line point you want to stakeout to, and then press the stakeout icon .




A bullseye and a popup with stakeout information will appear on the screen. Like stakeout to a point, the blue line in the bullseye indicates the long slope direction, and the red line indicates the cross slope direction.

The popup with stakeout information contains information about measurements and references.

#### 5.2.10.4. Stakeout to side reference

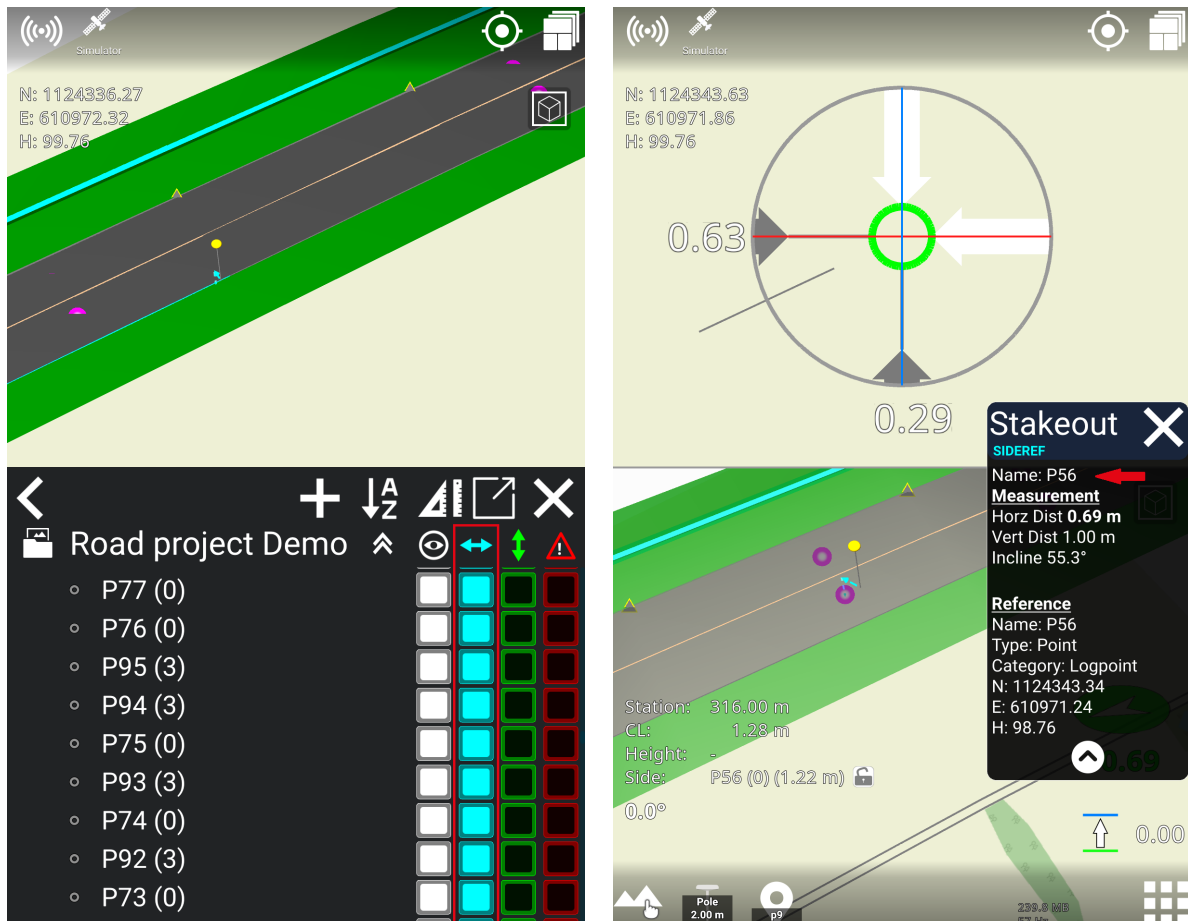
You can stake out to side references, which allows you to see multiple elements' information by jumping between them when you use the stakeout feature.

##### How to use:

- 1) Activate the elements you want to use as a side reference by pressing the boxes underneath the blue horizontal arrow in the reference dialog. When you activate a box with a blue edge it will change to a fully blue box.
- 2) Press the stakeout icon .

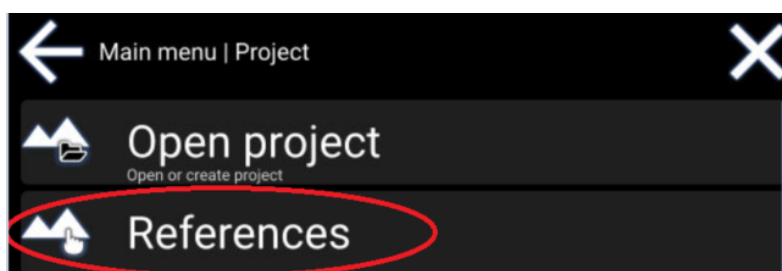
- 3) The application will now stake out to the nearest element, and when you move around, the application will switch to stake out to a new nearest element. A popup with stakeout information will also appear on the screen.

The popup with stakeout information will show information about the name of the element, so you know which element the application stakes out to. The popup also contains information about measurements and references.



## 5.2.11. Create point from coordinate

Press on **References** (red circle):



Press the '+' (red circle):



Press the **point** (red circle):



The point will have the coordinates of the bucket's selected measurement point.

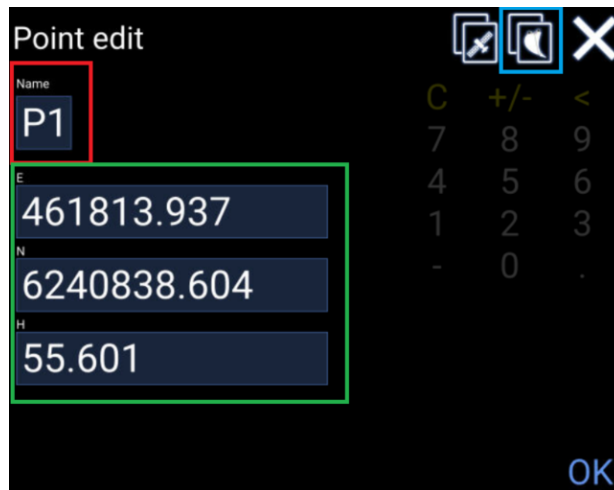
Set a name for the point (red box).

The point's coordinates can be adjusted manually (green box).

It is also possible to adjust the bucket's position and fetch the new position of the bucket (blue box).

Hit **'OK'** to confirm the new point.

Points you have created yourself can be found at the bottom of the **'References'** under **'User model' > 'Points'**.



## 5.2.12. Create line from points

From **'References'** tap **'+'** and then **'Line'**.

You can create lines between existing points - either from a design model or from points you have created yourself.

The line will be created in the order in which points are selected, and you will see how the line appears in the on-screen overview.

- You will be prompted **'Select the points for the line'**.
- Select the points individually by either picking points in the 3D visualization or highlighting the yellow icon next to them in the list.
- Finish by pressing **'OK'**.
- Give the new line a name.
- If you have selected three points or more, you can select the **'Close line segment'** option to connect a line between the first and last points.
- Finish the line by pressing **'OK'**.

## 5.2.13. Create profile along lines



From **'References'** tap **'+'** and then **'Profile'**.

The line will function as the centerline for the profile, where you can add any number of surfaces on either side of the line.

- You will be prompted to "Select the lines for the profile".



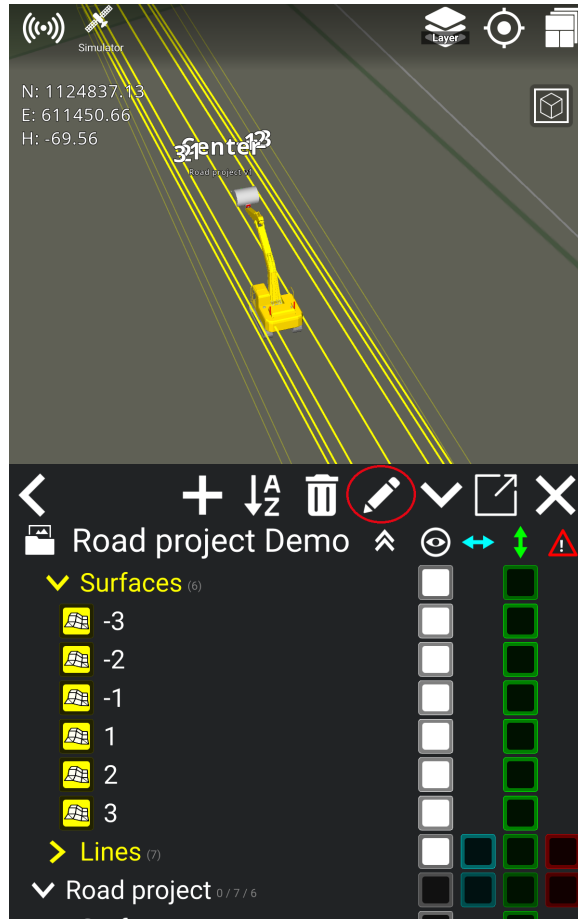
- Select the lines for the profile in the 3D visualization or in the list. When done, tap 'OK'.
- Give the profile a name.
- Press the '+' button on the left and right side of the screen to respectively add new surfaces on the left or right side of the line.
- Adjust each of the surfaces' width, Deltaheight dH, and angle according to the design that you want.
- You can also adjust the height offset of the entire profile.

### 5.2.13.1 Edit profile

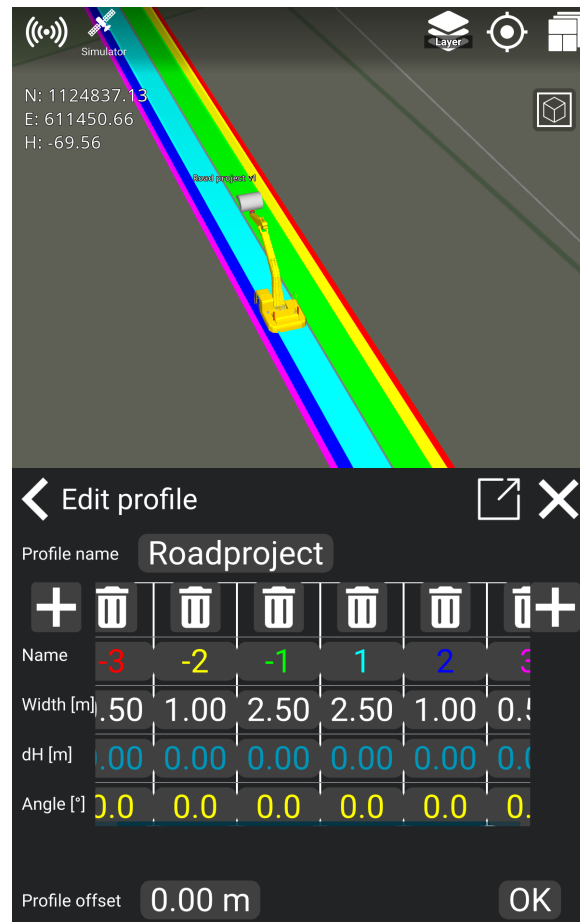
**Main menu > Project > References**

You have the possibility of editing an existing profile. In this way, you can edit the profile's width and slope of the surfaces, as well as add or remove surfaces.

1. Under **User model**; longhold on the profile surface name, which you want to edit.
2. Click on the **pen tool**, which will appear.



- Adjust the width, the deltaheight dH, and/or the angle of the surfaces by clicking on the numbers you want to change.

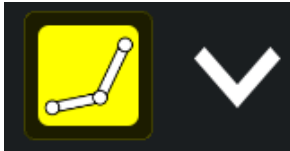


- The profile will now change according to the new width and slope of the surfaces.

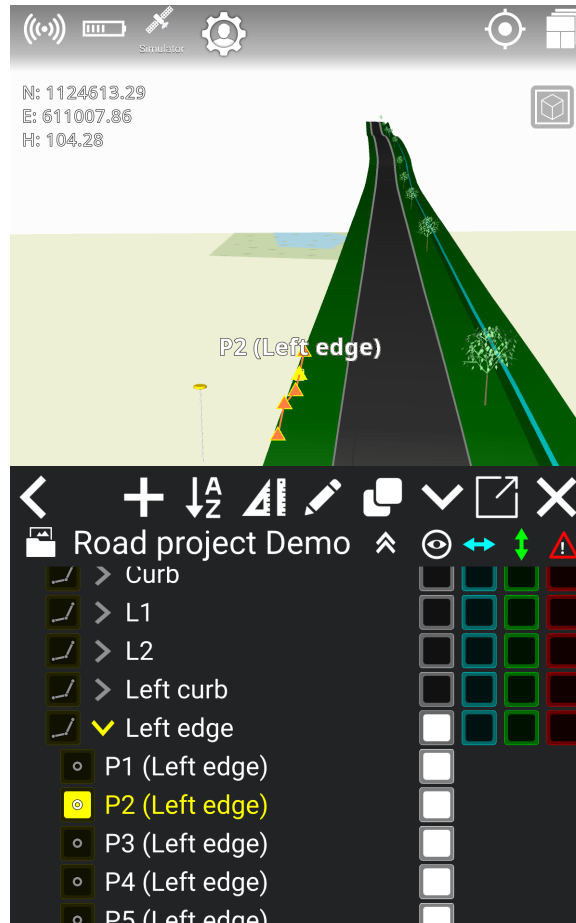
## 5.2.14. Edit Line

You can edit line points in the user model if you need to change the coordinates/location of an existing line. Be aware that you can only edit your own lines located under the user model, meaning that you cannot edit lines from project- or As-built data.

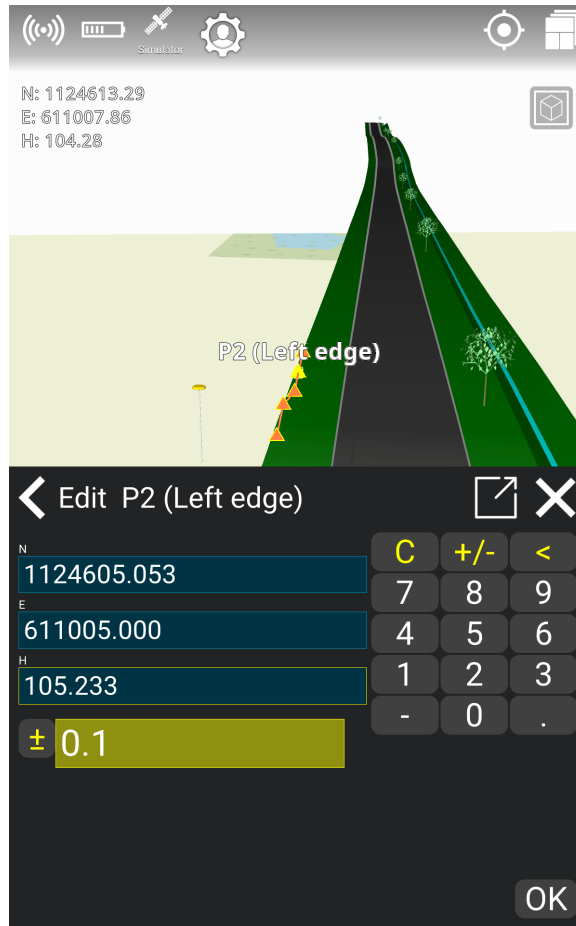
- Go to **References > User model > Lines**.
- Click on **'Lines'**.
- Choose the line you want to edit by clicking on the line or the arrow in front of the name of the line. For example:



- Click on the point of the line you would like to change, for example:



- Click on the **pen tool** to edit the line point.
- Change the desired coordinates of the point's position. The line will now change in relation to the point's new position.



#### 5.2.14.1. Copy a line from design data in order to edit it

Because you cannot edit lines from design data, you can instead copy a line from the design and edit the copied line points in the **User model**. In this way, you can still follow the line and make adjustments to the line points, e.g., if you want to change the height of a line point.

##### How to copy a line:

1. Select the line you want to copy from the design.
2. Click on the 'Copy' icon:



3. You can rename the copied line. Press '**Ok**' to copy the line.
4. The copy is now under **User model**, where you can edit the line.

## 5.3. Geodetic systems

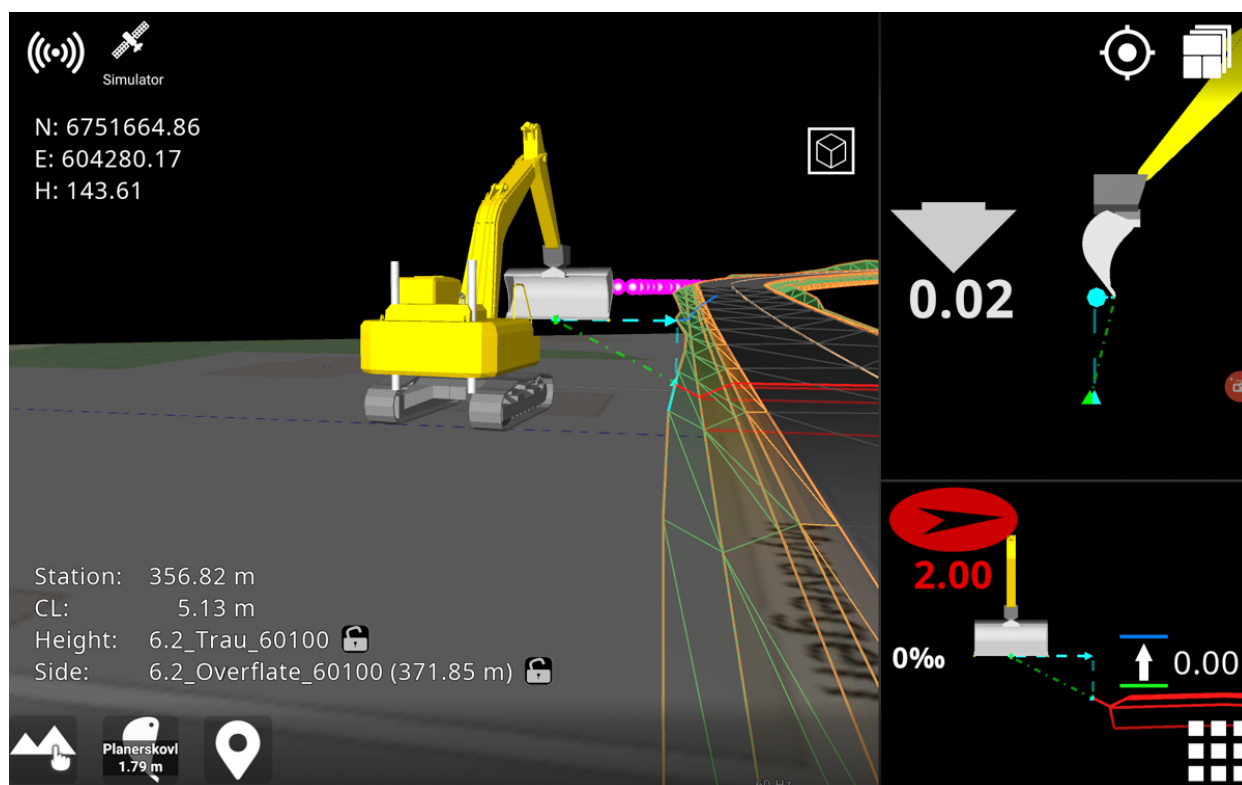
### Menu > Project > Geodetic system

Only in rare cases should the machine operator be concerned about selecting the correct coordinate system and geodetic model. With Makin' 3D these matters are handled in a central place - e.g., the construction office. When made available, the geodetic system cannot be changed on the excavator. It is possible though, to handle the geodetic system locally when required by simply not having it preselected for a particular project.

## 5.4. Extend surface

### Menu > Project > Extend surface

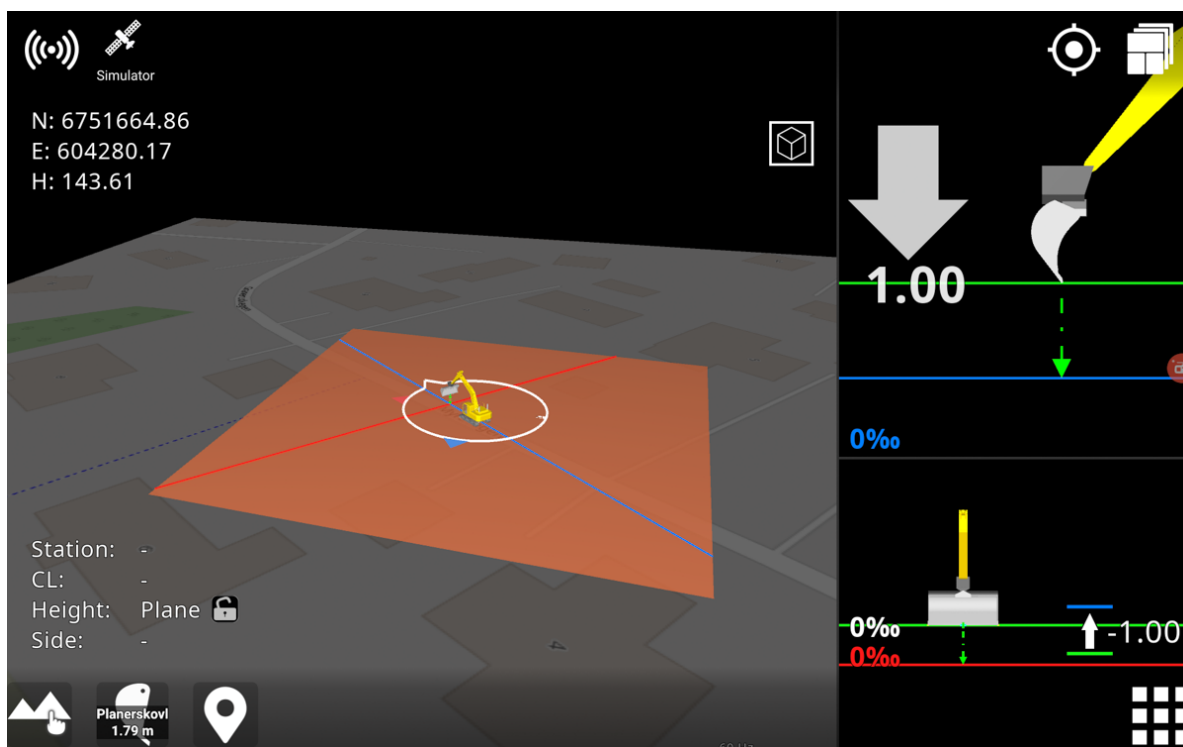
Extending the surface allows you to continue your excavation even if you are beyond the design that is already at hand. By selecting '**Extend surface**', you extend the road surface you are working on - even if the actual design has limitations. The same is true for cuts where the cutting surface is too short for you to find the cutting top.



## 5.5. Plane

Menu > Project > Plane

By activating the '**Plane**' feature, you get a virtual reference plane, which can be either flat or sloping with a 1-sided or 2-sided fall.



Use '**Main direction**' and '**Main slope**' to indicate the plane's longitudinal direction and angle. Likewise, set the transverse slope of the plane with '**Side slope**'.

With the '**Elevation**' option, specify the absolute elevation height or quickly get the current height of the tool point. Another option, called '**Set plane here**', also uses the current tool point height, but with the addition of taking the reference height offset into account.

When the plane is active, you can tap the visual part of the plane to quickly change its values. When you no longer need this feature, it is important to disable the plane. If you do not do this, the activated plane will follow the machine wherever it may be located.

Here you can activate and deactivate a virtual plane and change the longitudinal direction, longitudinal slope, and transverse slope.

If you set the height manually and then enter a longitudinal fall, the point for starting the slope will still be below the "cross thread", which forms the center of the measuring point on the bucket. Those are the E and N coordinates that you can see in the upper left corner. It is important to keep in mind that the measuring point on the bucket is above the desired starting point for length/cross slope.

## 5.6. Temporary profile

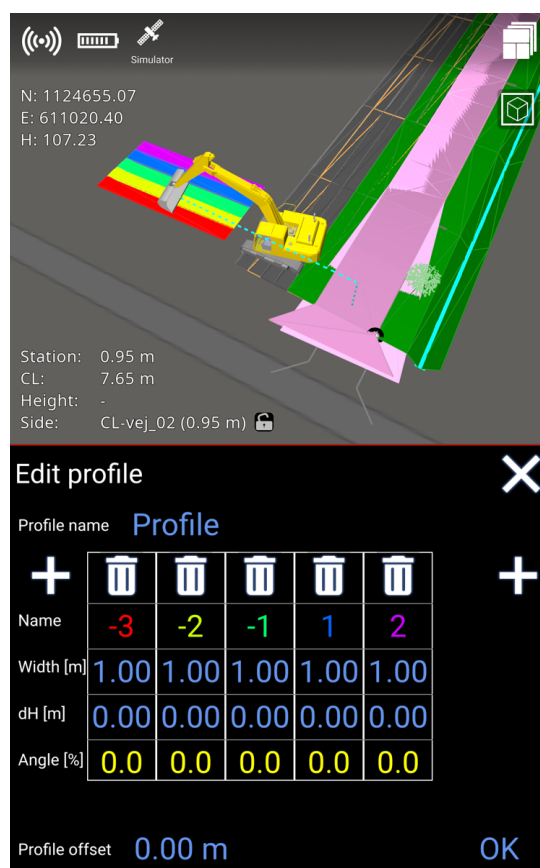
Menu > Project > Temporary profile

Toggling the **'Profile'** option turns the temporary profile on or off while its settings are retained.

There are two options for moving the profile, respectively **'Set profile here'** and **'Set profile & direction here'**. The first option horizontally displaces the profile and positions the middle of its centerline at the tool point. In addition, the latter option also rotates the profile according to the heading of the bucket/attachment.

Adjusting the **'Slope'** will tilt the profile along its baseline.

Under **'Edit profile'** you can change the profile's contours by adding and removing surfaces as well as changing the width and slope of the surfaces. Changing slopes can be done either by specifying the height difference between two surfaces or by specifying the percentage slope between them. Also, you can specify a height offset for the profile, where the baseline is indicated by a gray line in the 3D view.

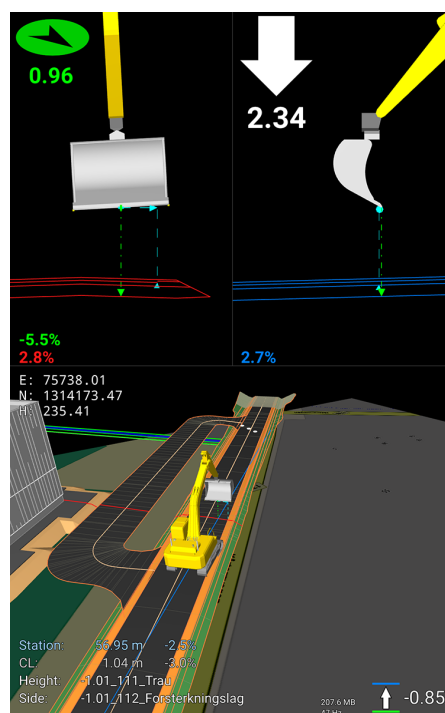


The profile can be rotated by using **'Edit direction'**. North corresponding to 0 (zero) degrees. The feature **'Get direction from tool'** will align the profile according to the bucket/attachment.

As an alternative to going via the menu, you can jump to this feature by tapping the profile in the 3D view.

## 5.7. Change offset

Menu > Project > Change offset



Entering this menu adjusts the height offset you want to have for the whole project. Typical uses are whether one has only been given the surface of a road and should dig for a ditch or other layers beneath the surface. If the ditch is known to be 0.85 meters under the finished road, then adjust the offset value to -0.85. A parallel surface/line will then be created 0.85 meters beneath the theoretical model. The whole model will be offset. You can enter the desired value manually or use the + characters, as well as move your finger up or down in the vertical field.

## 5.8. Project offset

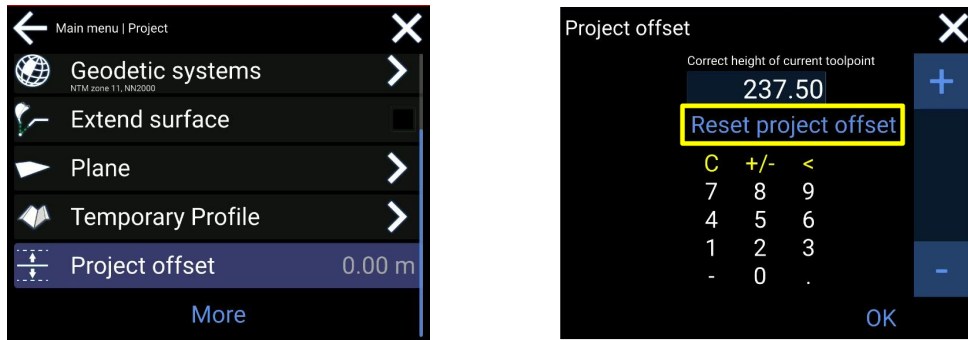
Project offset is designed to adjust a machine's height to match the height of the design project you are working on. Even if a machine is correctly calibrated, the height measured by the tool point in the application can differ from the height of a known point on the project. These differences can occur as a result of differing reference systems, e.g.: localized coordinate projections vs. official coordinate projections. Other sources include small variations between GNSS manufacturers as well as incorrect heights used in the initial project design. It can also differ because of:

- different GNSS systems
- placing the project at the wrong height when the project was planned.

To mitigate this, we have added the project offset functionality, which adjusts the received GNSS height (not the antenna height) to match the height of the known point on the project.



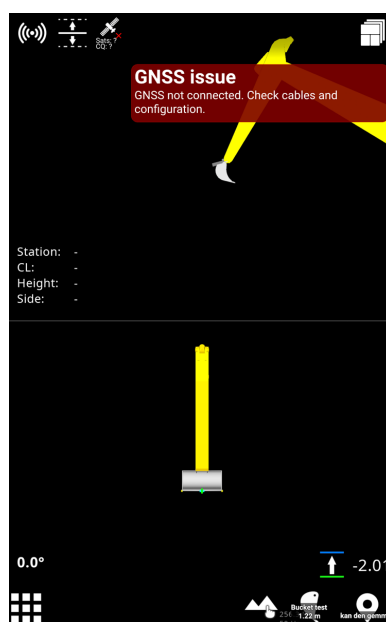
*Note: You must ensure that the machine is calibrated correctly before adjusting the project offset. Project offset is limited to adjustments of +/- 50 cm.*



Project offset can be adjusted in: **Main Menu > Project > Project offset**

### How to use

1. Inside the project offset menu, you will see the tool point height of your application in the value area.
2. Enter the correct height of the known point in the value area to calculate a project offset.
3. It is also possible to adjust the project offset with the +/- buttons, which will increment or decrement the value by 1 cm.
4. A project offset is calculated and visible in the project menu. When you have a project offset, the icon will be visible on the run screen.



To remove the project offset, go into the **Project Offset** menu and press **Reset project offset**.

# 6. Display

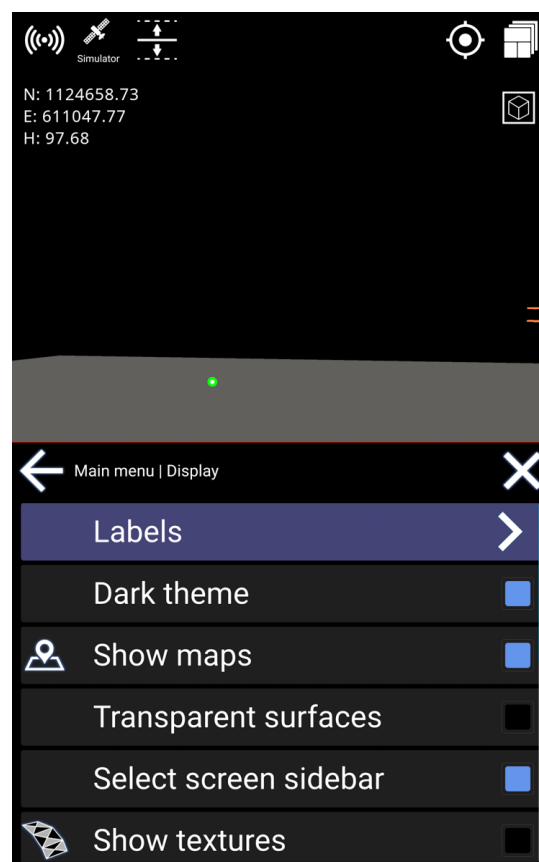
## 6.1. Display labels

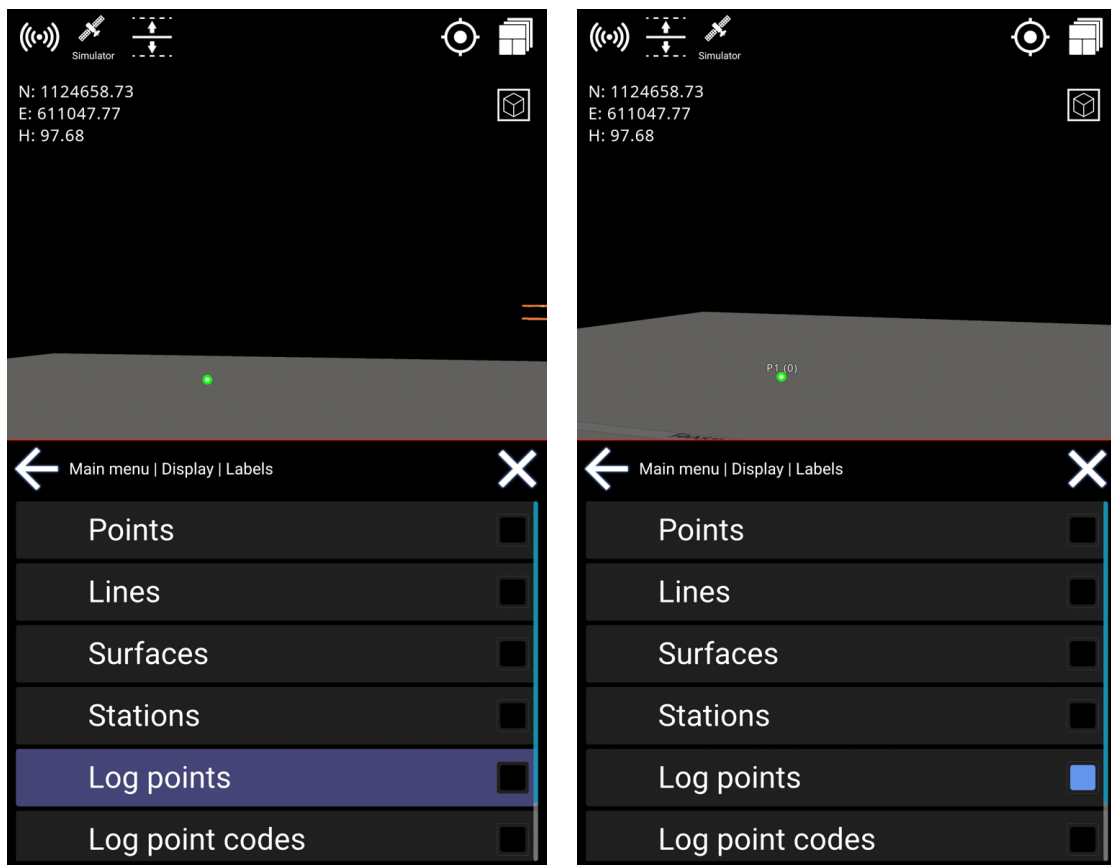
**Menu > Display > Labels**

A label is the name of a geometry object of the following type:

- Points
- Lines
- Surfaces
- Stations
- Log Points
- Texts

It is possible to choose which type of label should be visible by selecting/deselecting it on the list.





## 6.2. Use file color

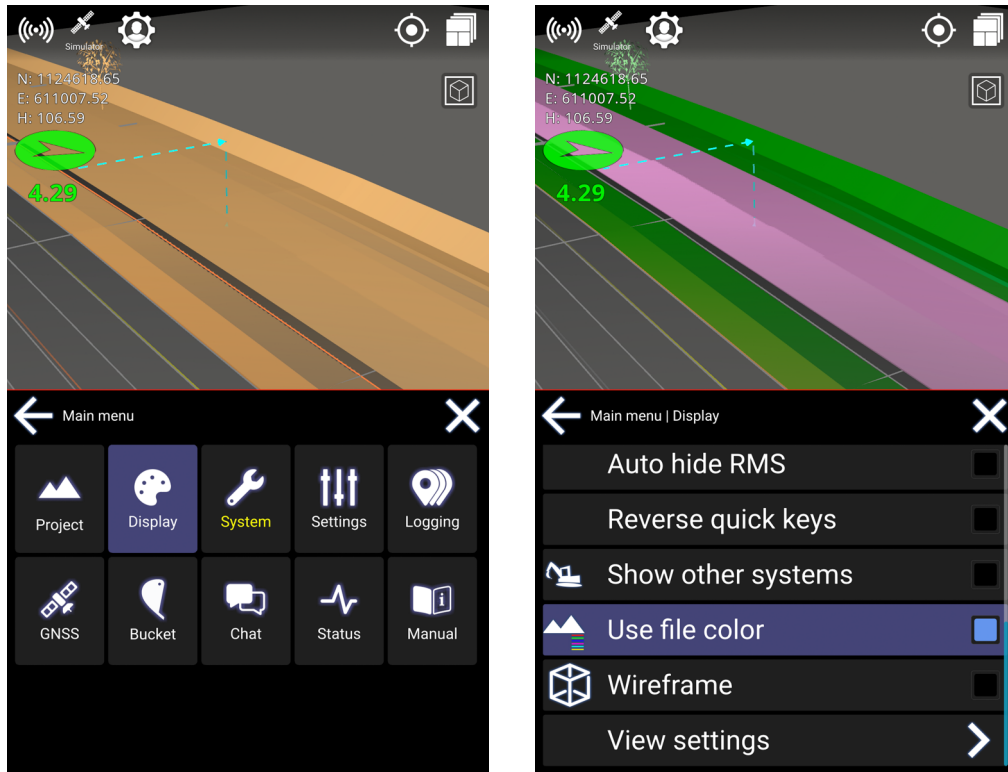
### Menu > Display > Use file color

This feature changes between using the colors stored on file or the default color scheme of Makin' 3D. In some situations, it gives a better overview using the colors of the model file and will make it easier to separate elements in a complex file.

If file color is not enabled, Makin' 3D will use default colors.

Be aware that some files can include black-colored lines or designs, and these will not be visible if file color is selected.

- Tap to select/deselect file colors.



## 6.3. Show maps

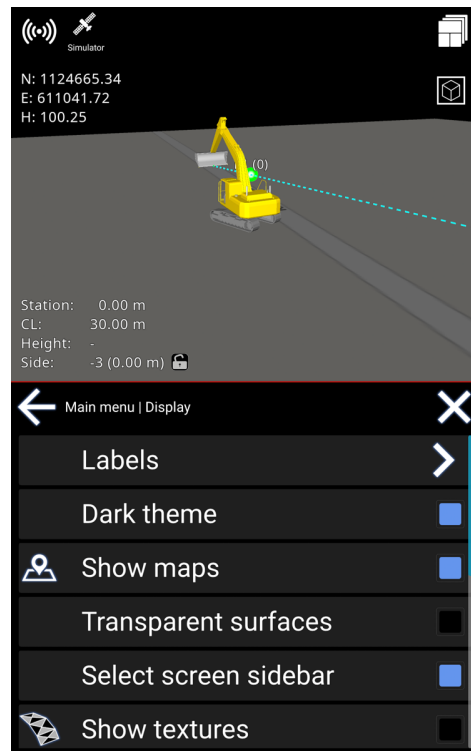
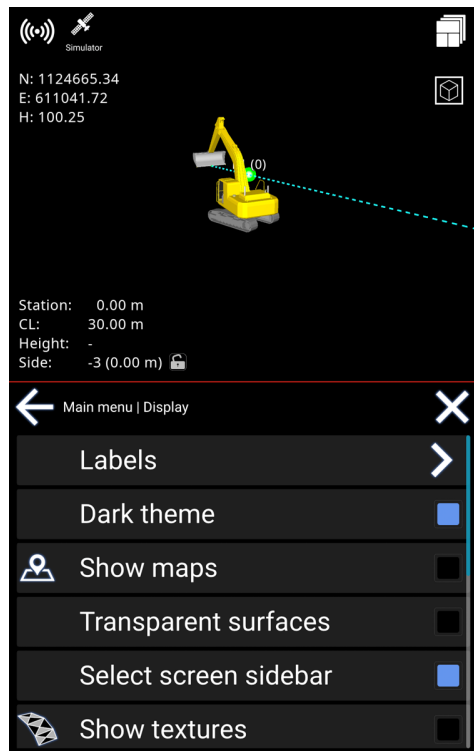
### Menu > Display > Show maps

The user can hide or show maps along with the project to get a better overview. The map will be shown below the lowest active 3D reference in the project.

The tool cuts are shown on the map in Top View. Otherwise, tool cuts are only shown on elements of the 3D model marked as a height reference.

Note: In the 3D View, the map will be seen in a perspective view. If you want to see it straight from above, use the Top View instead.

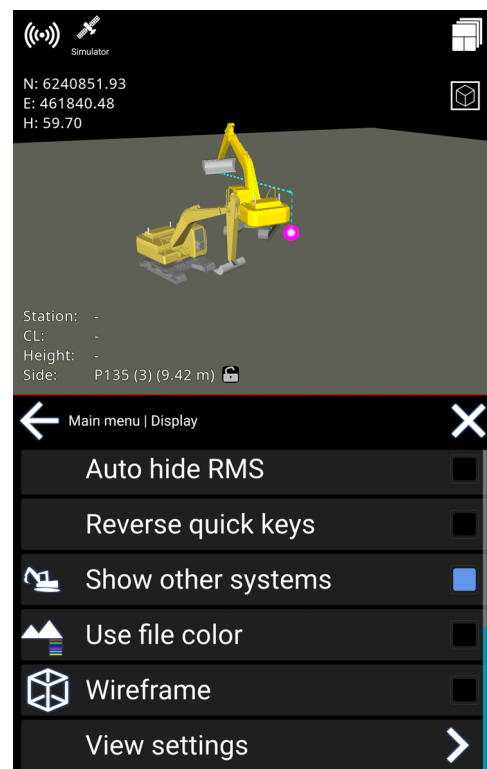
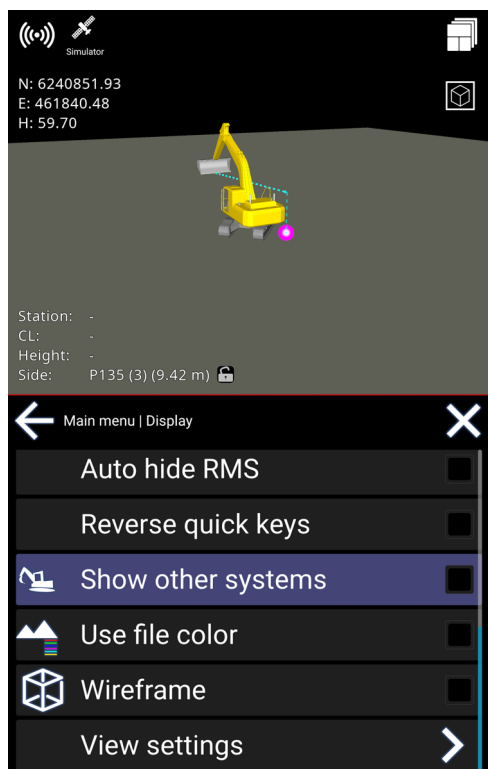
- Tap to select/deselect visibility of map



## 6.4. Show other systems

**Menu > Display > Show other systems**

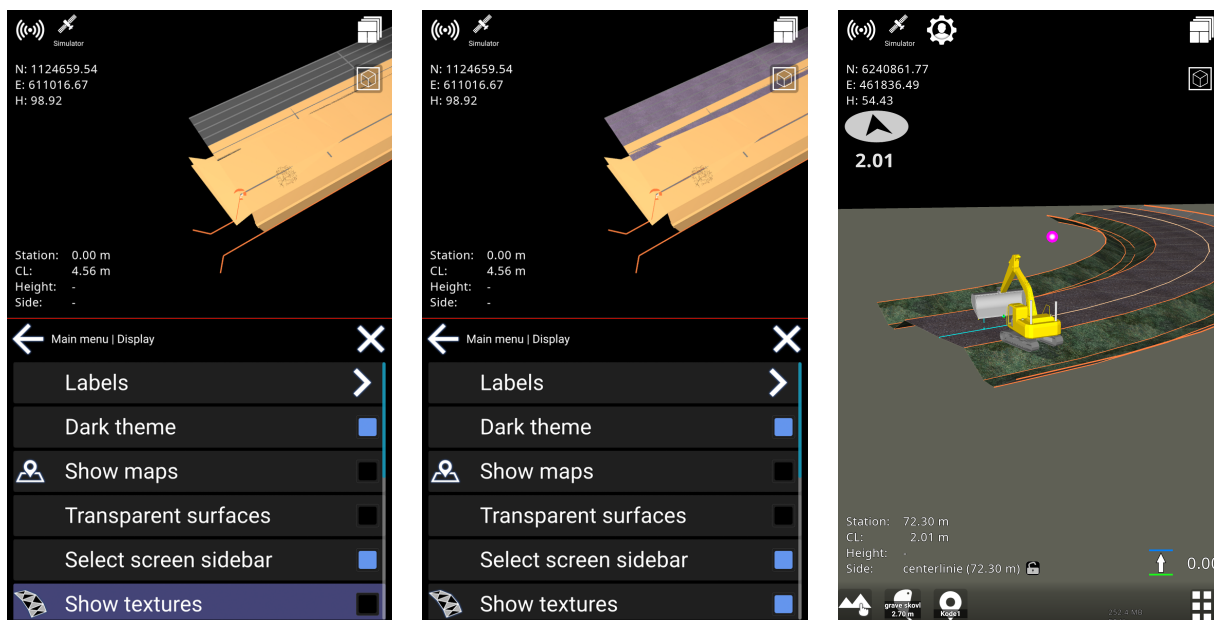
Other systems currently working on the same project—like machines, rovers, etc.—will show up.



## 6.5. Show textures

**Menu > Display > Textures**

Instead of using solid colors, you can have textures shown. This is only possible with road geometry.



## 6.6. Auto hide quick keys

**Menu > Display > Auto hide quick keys**

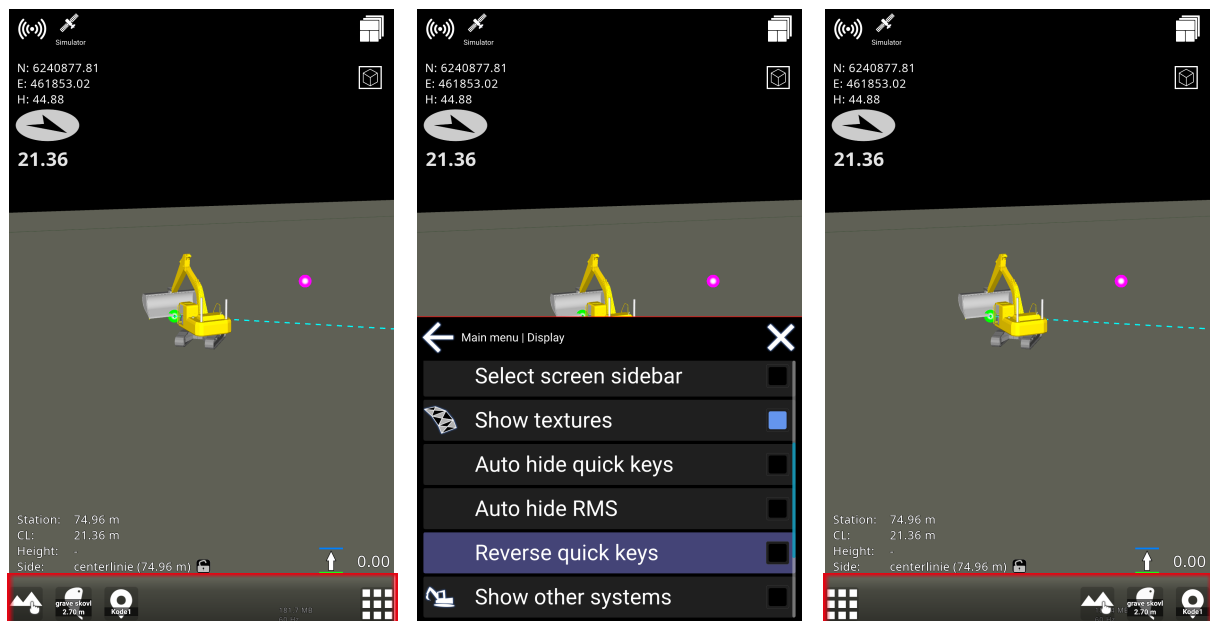
Auto Hide Quick Keys will hide the “quick keys” at the bottom of the screen after about 8 seconds of not touching the display.

When you touch the display, they become visible again. It will give you a more clean view of what you are working on when icons are hidden.

## 6.7. Reverse quick keys

**Menu > Display > Reverse quick keys**

This feature places the quick keys to the right of the menu button. It makes it more convenient to log points from the right-hand side of the screen without having to visually locate the point logging feature.



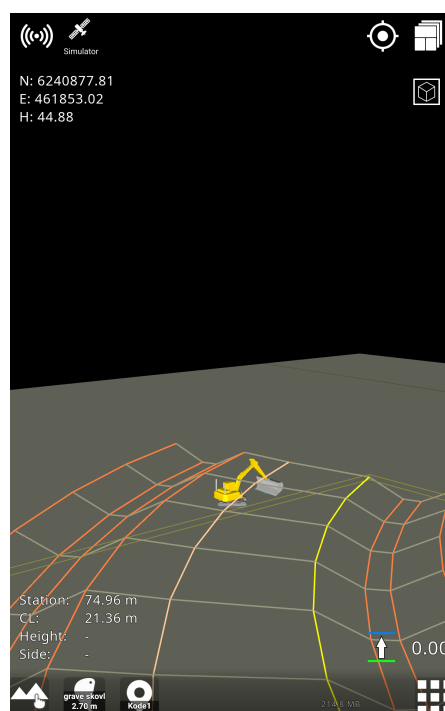
## 6.8.Transparent surfaces

**Menu > Display > Transparent surfaces**

Hide the surfaces to be able to see lines and points beneath them.

Note: Surfaces with textures will not be transparent.

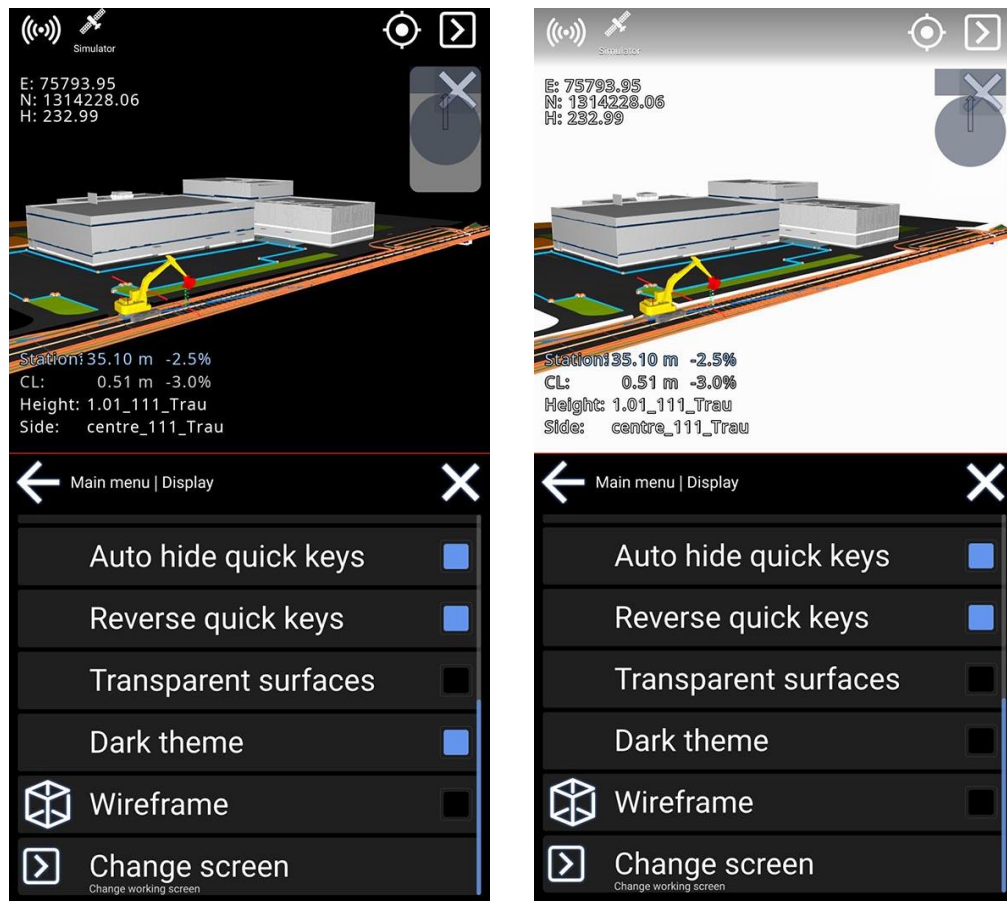
Warning: Reference selection is not visible when transparent surfaces are enabled.



## 6.9. Dark theme

Menu > Display > Dark theme

By default, the machine control system has the 'Dark theme' enabled, which is great at night time or when working in dimmed conditions. It is recommended to disable this feature when working in a bright environment, especially while working in direct sunlight, when staking out points outside the cabin, etc.

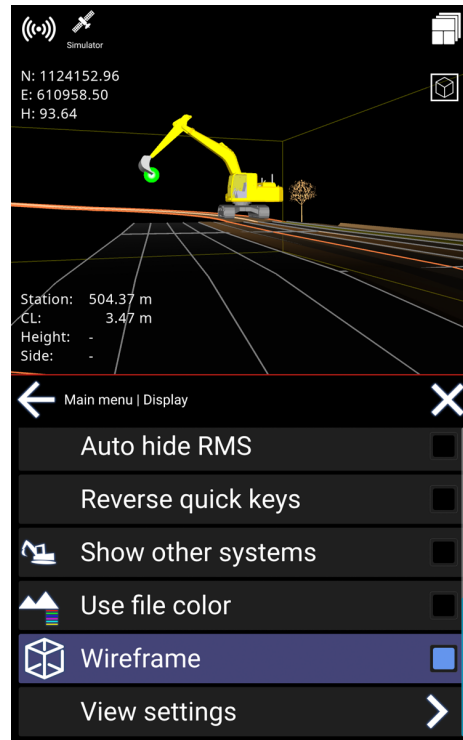


## 6.10. Wireframe

Menu > Display > Wireframe

Tap **Wireframe** to enable the triangular design to be visible. This will show the edges of the triangles and might improve their visibility.

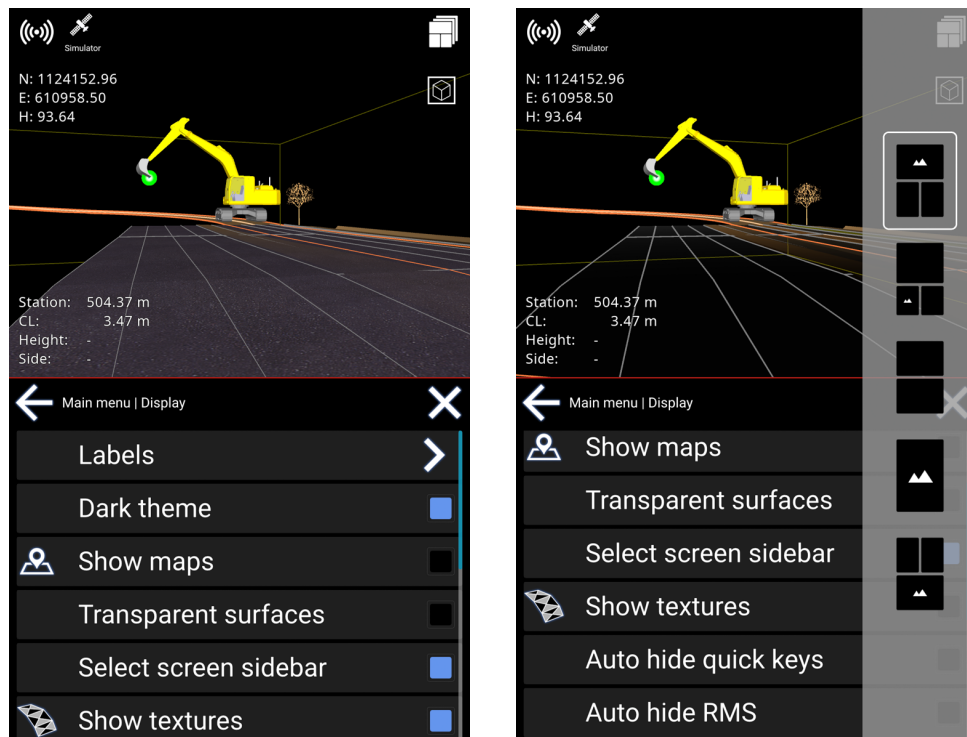




## 6.11. Change screen

### Menu > Display > Select screen sidebar

This option is to change the working screen. 'Select screen' is also accessible by tapping the icon in the upper right corner.



## 6.12. View settings

### Menu > Display > View settings

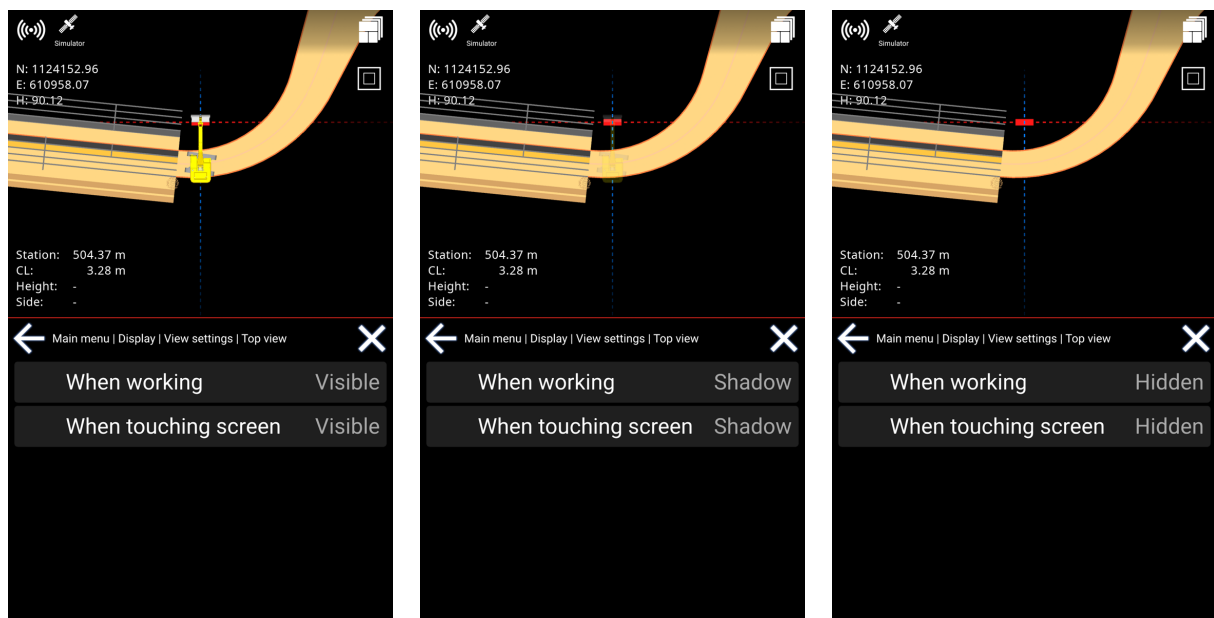
To obtain a better overview of your work, you now have the option of hiding the excavator or making it transparent.

Open the menu and select **Display**. Scroll down to **View settings**.

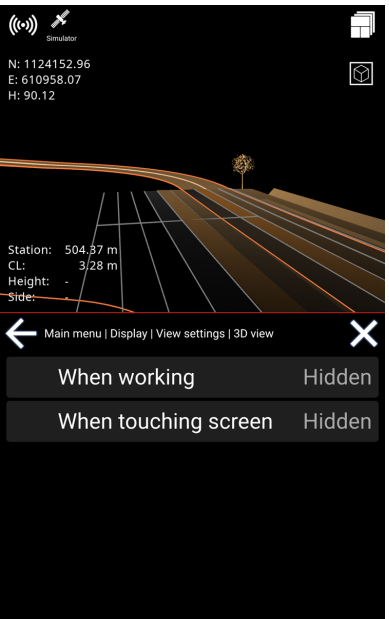
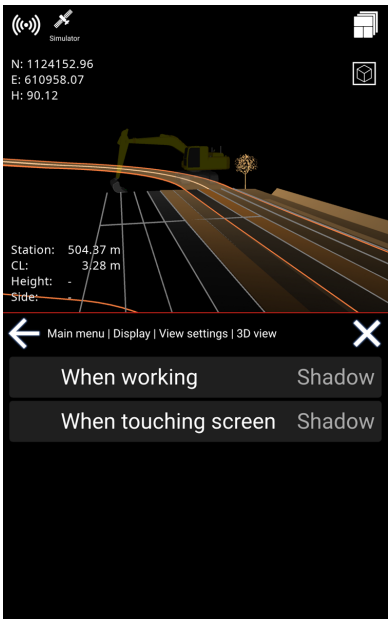
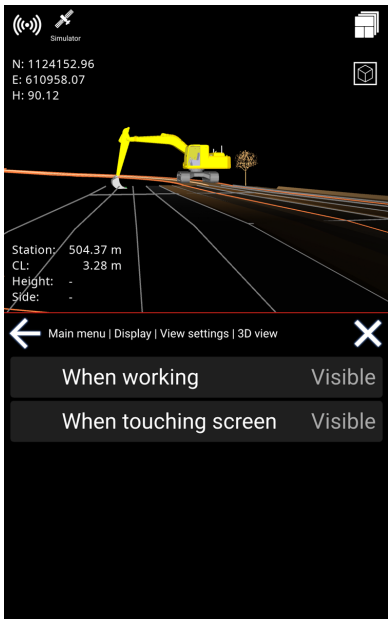
It is possible to set this individually for a work situation or when you touch the screen. You can also choose individual settings for runscreens with 3D View or Top View.

You can now easily toggle between 3D View and Top View by pressing the icon in the upper right corner.

### Menu > Display > View settings > Top view



Menu > Display > View settings > 3D view



# 7. Settings

## 7.1. Tolerances

**Menu > Settings > Tolerances**

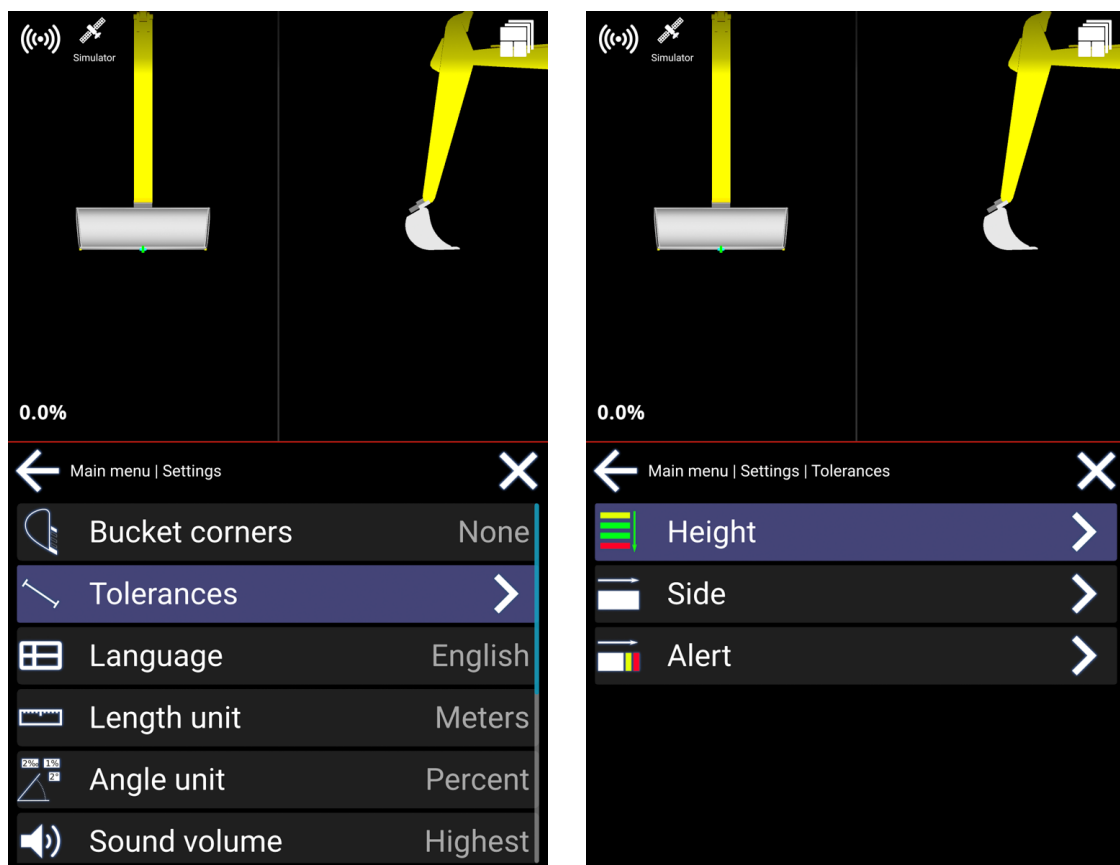
Tolerances are thresholds for calculations. They are used for different indications, like colors and sounds. You can change the tolerances for height, side, and alert.

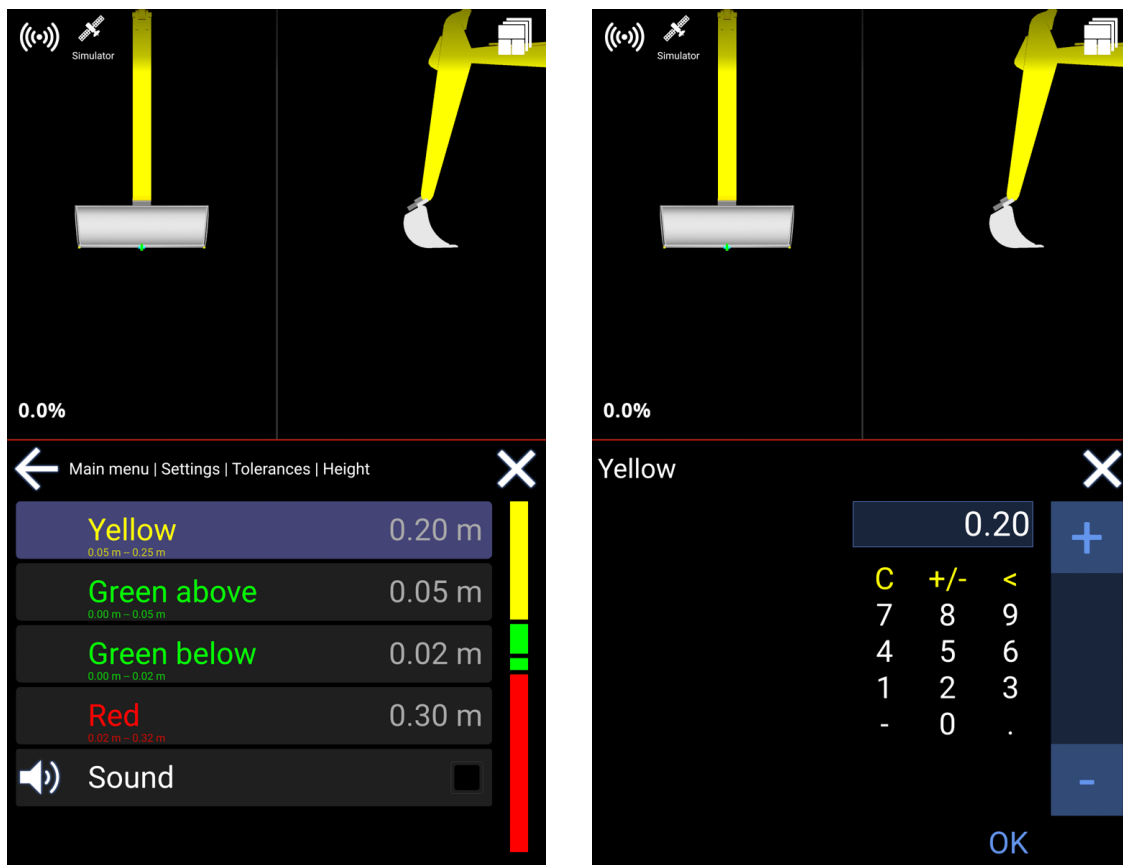
When working outside the specified tolerances, the indicator in question is shown in white color.

### 7.1.1. Height tolerances

**Menu > Settings > Tolerances > Height**

The 'Yellow' band for the height tolerance indicates a distance for when to start showing that you are near a selected height reference.





'Green above' and 'Green below' are the limits for the accepted height deviation, respectively above and below the reference. It basically means that, as long as you are "this close" to the reference, the job is well done.

'Red' is an indication of excavating too deeply into the ground. The tolerance is actually an expression for when to ignore the warning when you are far below the reference.

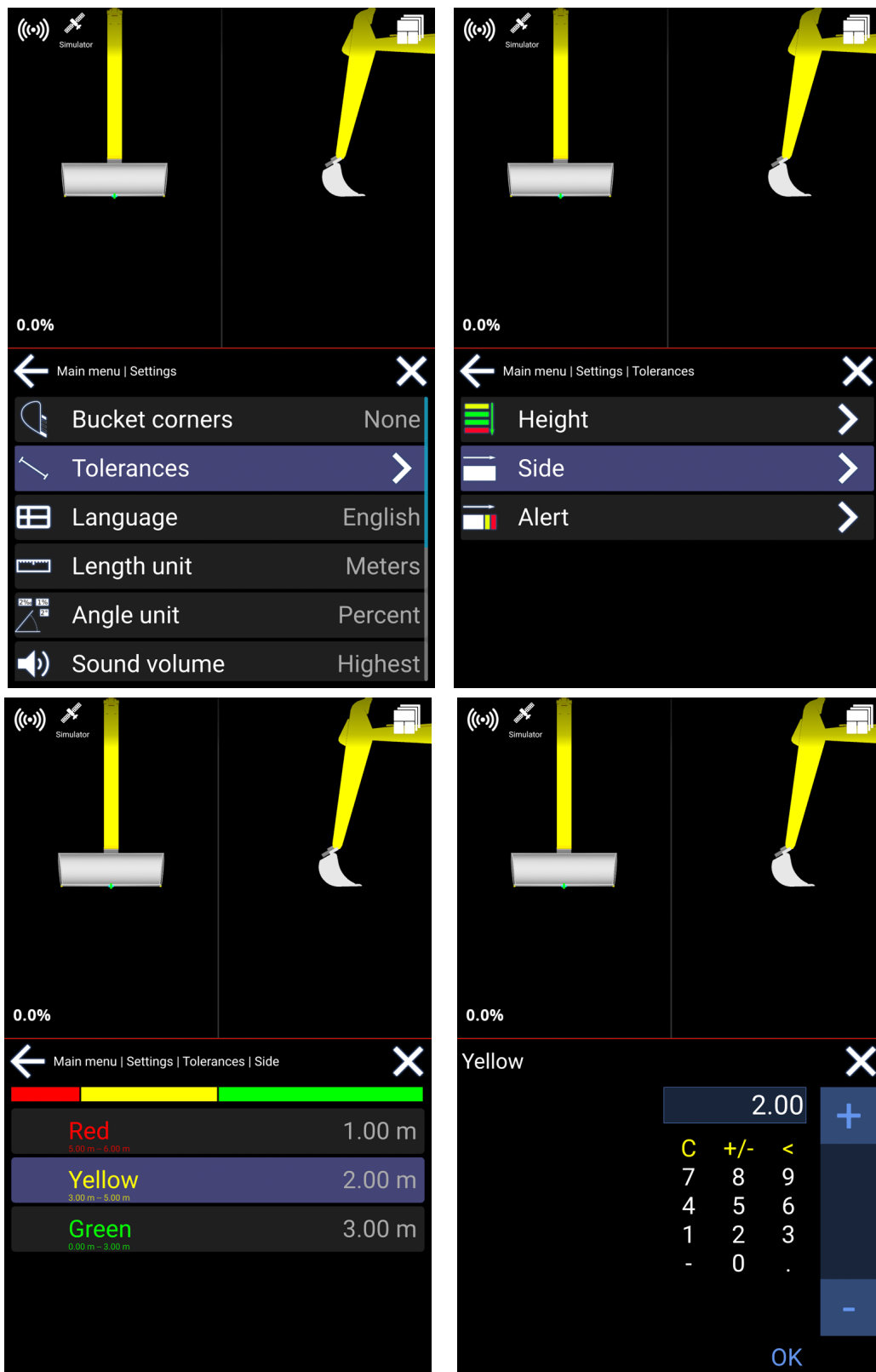
The sound option will enable different sounds depending on the band within which you are working. Check the blue box for sound or uncheck to mute. There will be no sounds when working above the yellow band and below the red band.

## 7.1.2. Side tolerances

**Menu > Settings > Tolerances > Side**

For the side distance, 'Red' means that you are approximately within reach of your target, and 'Yellow' means that you are even closer. The 'Green' band indicates the accepted deviation from target.

Keep in mind that the side distance is calculated horizontally and is not the shortest path.



## How to use

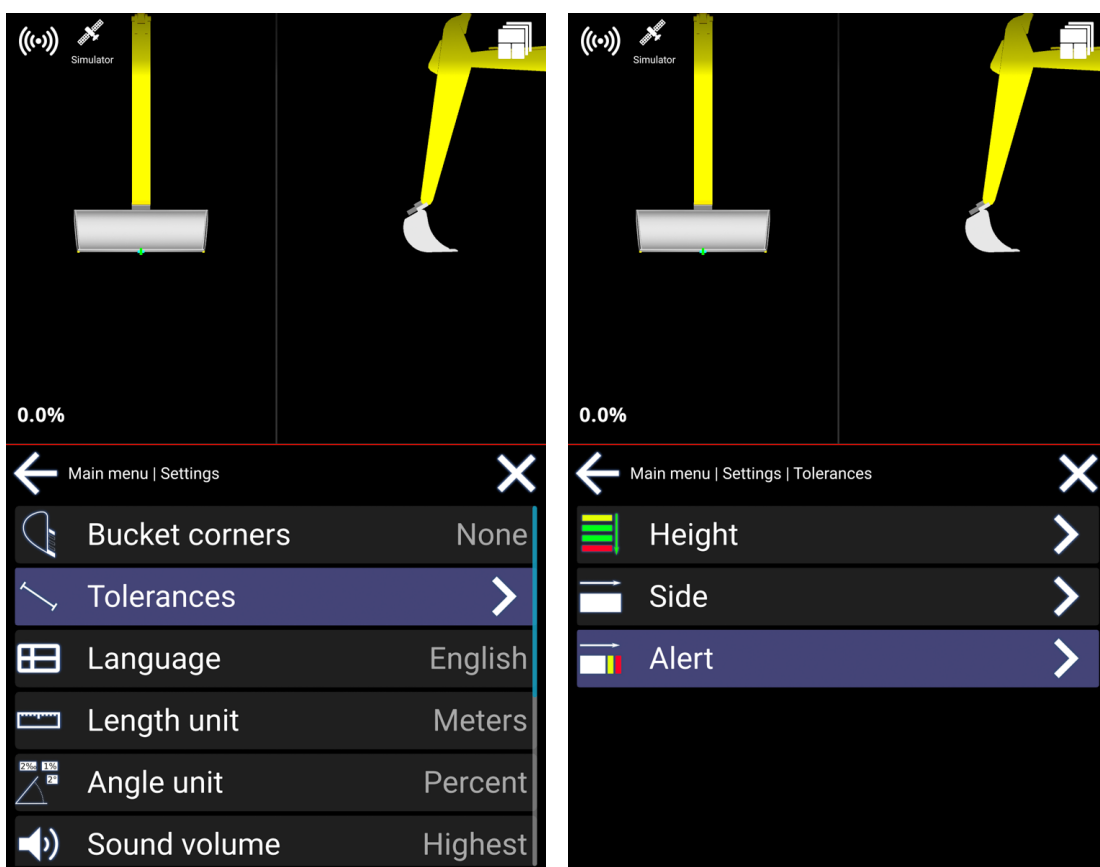
- Choose any of the 3 options ( Red, Yellow, Green )
- Set tolerance

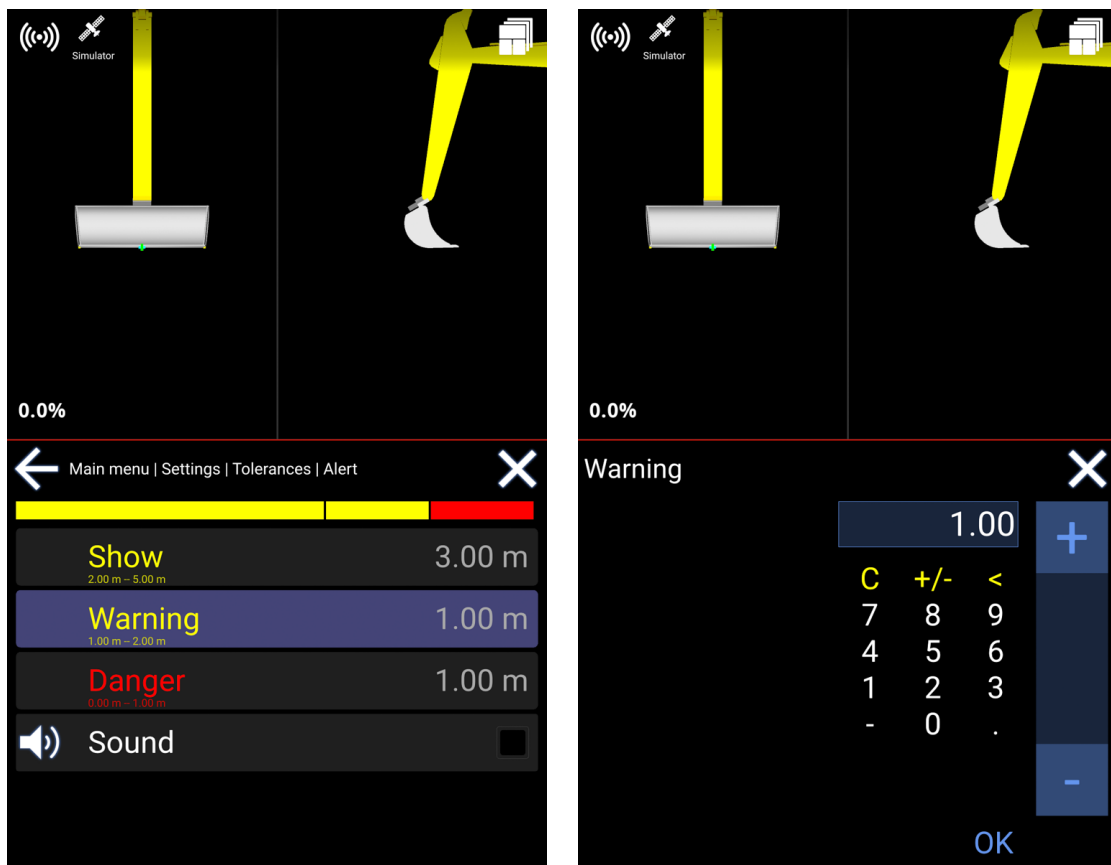
### 7.1.3. Alert tolerances

**Menu > Settings > Tolerances > Alert**

The tolerance for alert is divided into *Show*, *Warning*, and *Danger*.

- If you are in the “Show area,” a red 3D line will be shown.
- If you are in the “Warning area” you will get a warning notification saying “Too close”.
- If you are in the “Danger area” you will get a Danger notification, also an alarm will sound if turned on.





### How to use

- Choose any of the 3 options (Show, Warning, Danger)
- Change the distance you want from the point of alert.

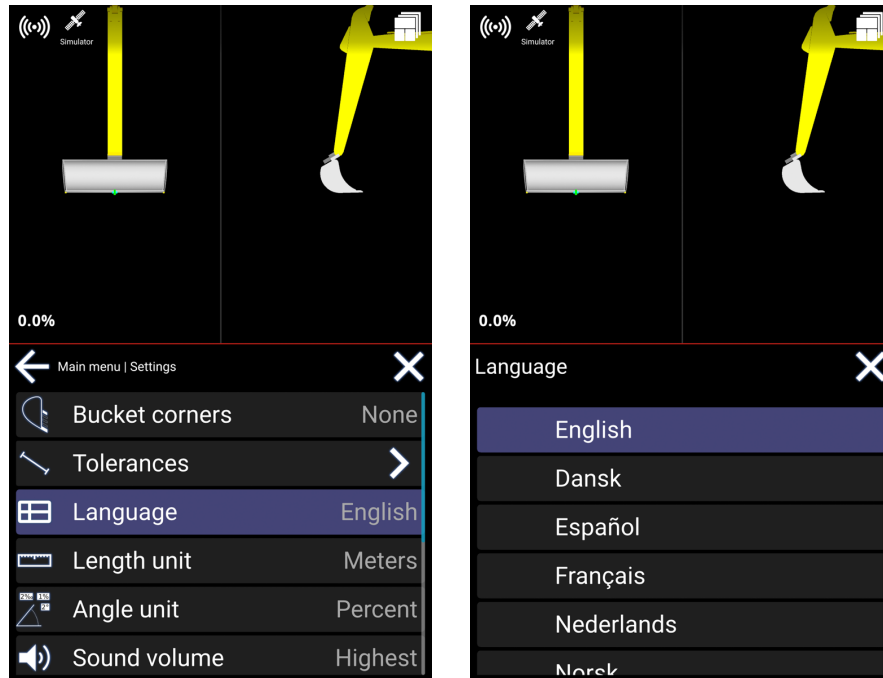
You will have a sound option as well. Check the blue box for sound or uncheck it for mute.



## 7.2. Language

Menu > Settings > Language

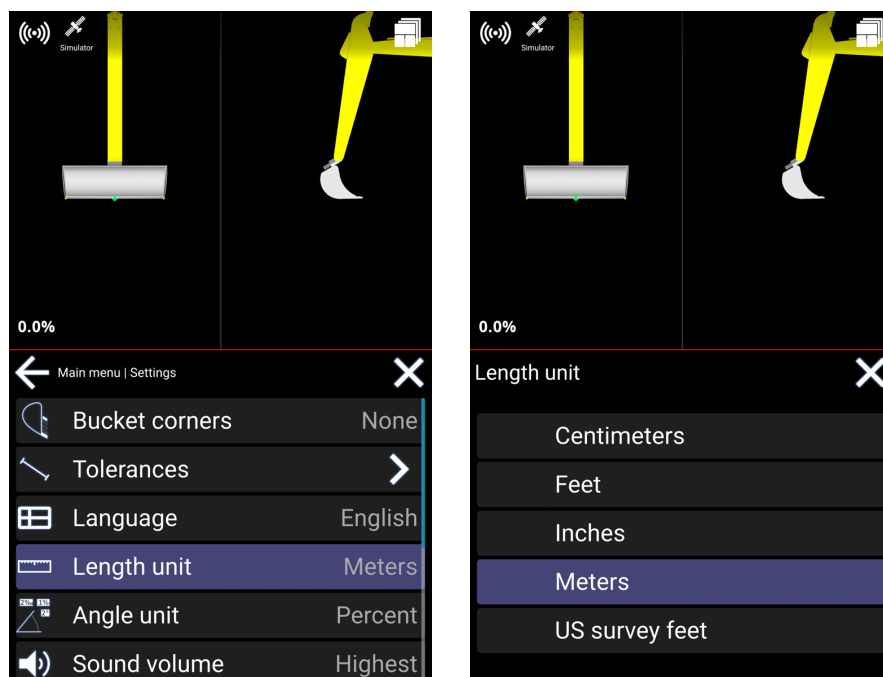
Simply select the language of your choice. The language is automatically changed and saved.



## 7.3. Length unit

Menu > Settings > Length unit

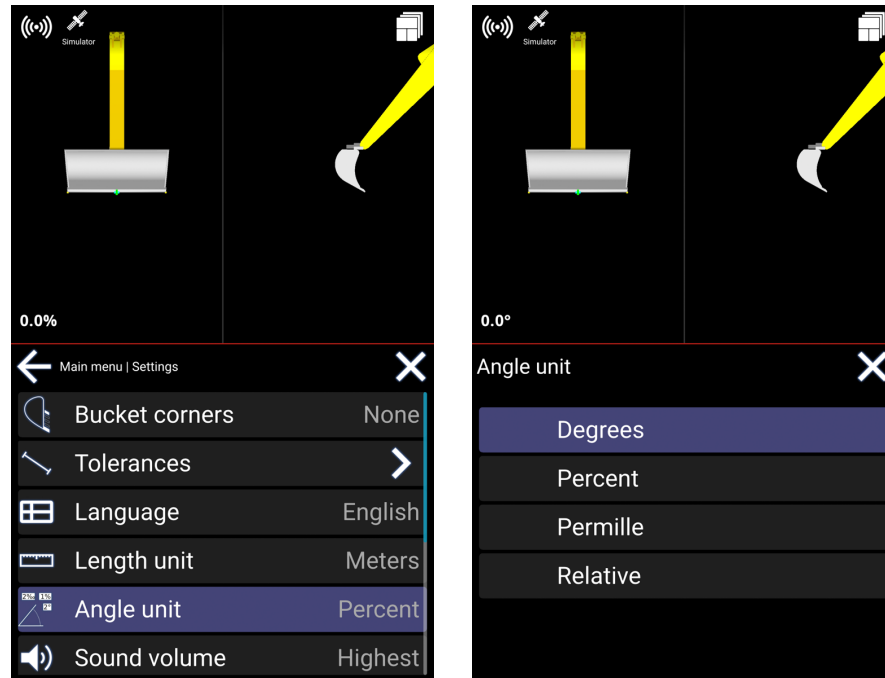
Tap to choose the length unit. It is automatically changed and saved.



## 7.4. Angle unit

**Menu > Settings > Angle unit > Set angle unit**

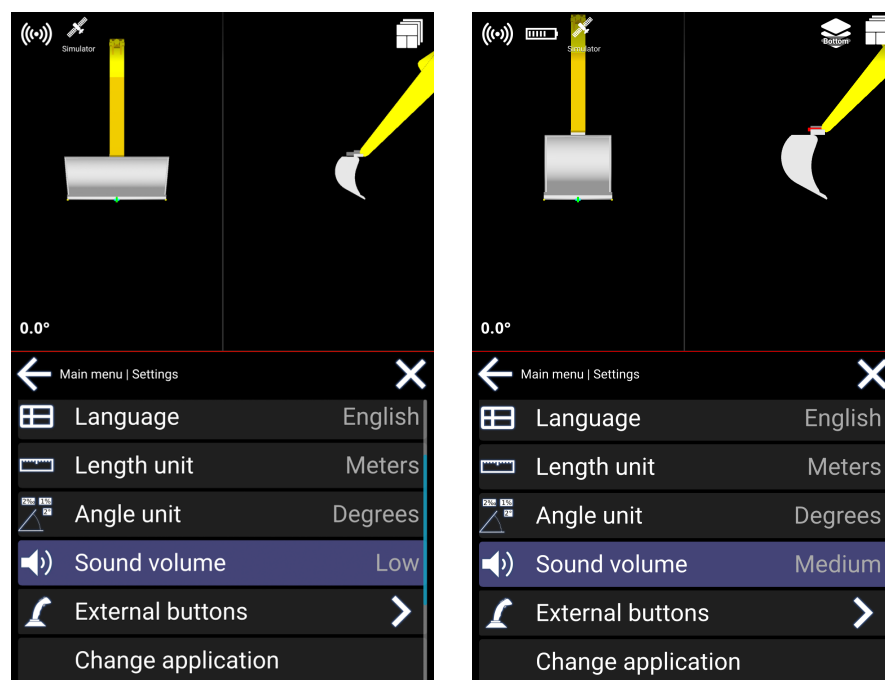
Tap to choose the angle unit. The angle unit is automatically changed and saved.

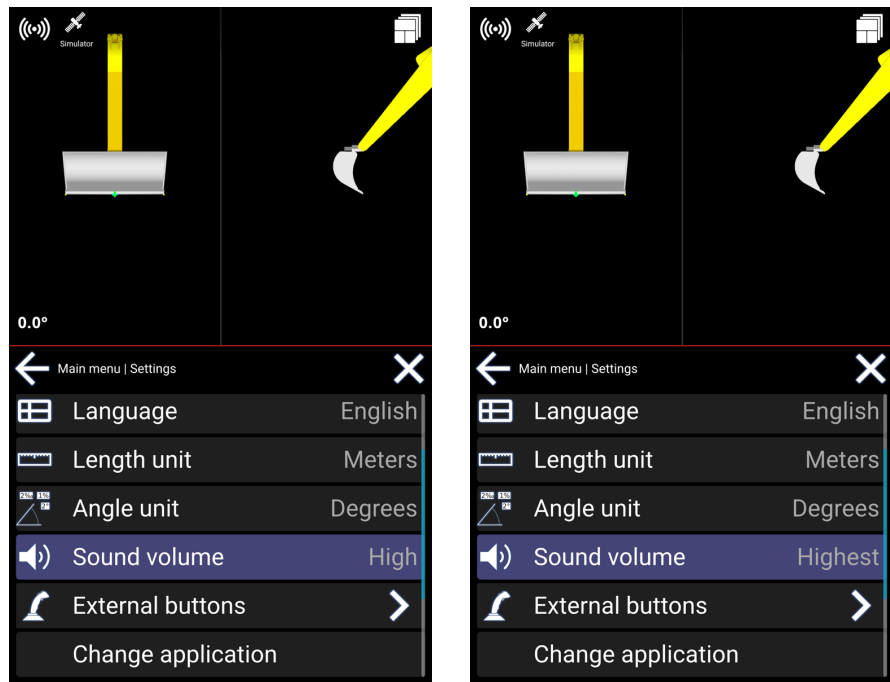


## 7.5. Sound Volume

**Menu > Settings > Sound volume**

Tap the sound volume again and again to change the sound level. Choices are given: *Low*, *Medium*, *High*, *Highest*.

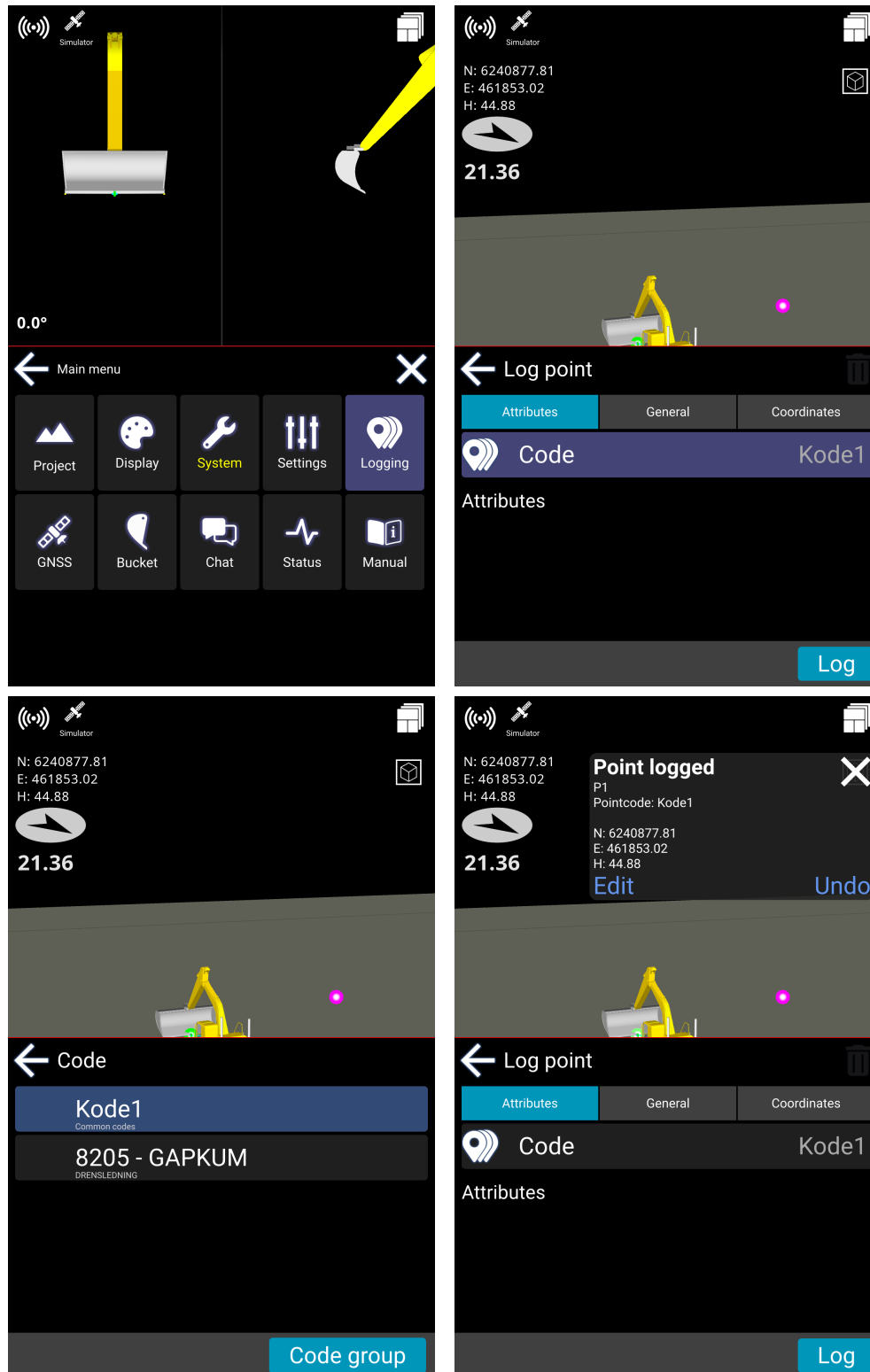




## 8. Logging (As-built)

Menu > logging

Point logging can also be accessed by long-pressing the shortcut in the run-screen.



The 10 most recently used point codes are shown in the list.

If no point codes are shown, tap '**Other codes**' and select a group of codes to select a point code from - e.g. Common codes, Own codes, etc.

Log a point with a specific point code:

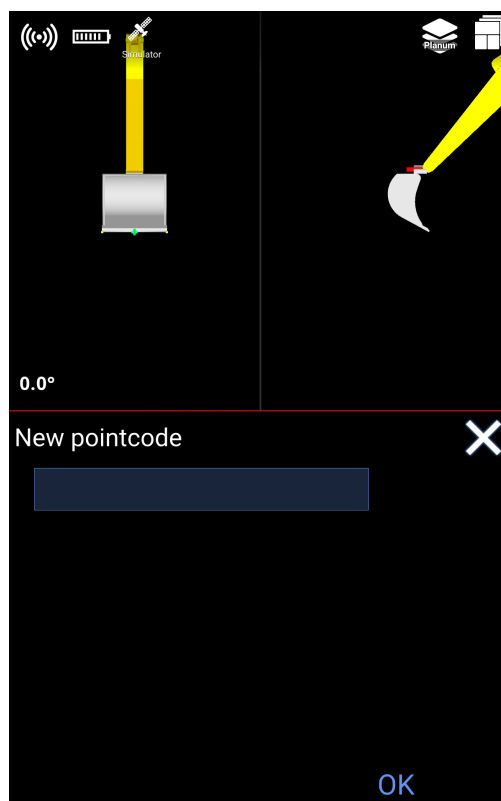
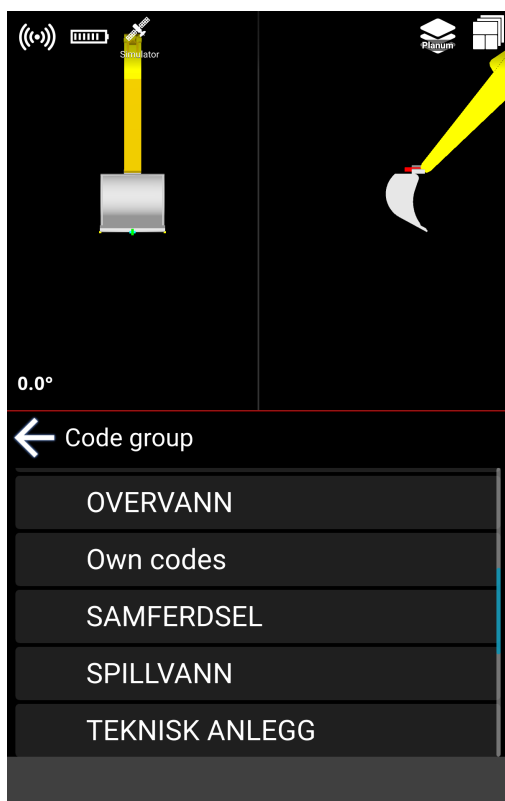
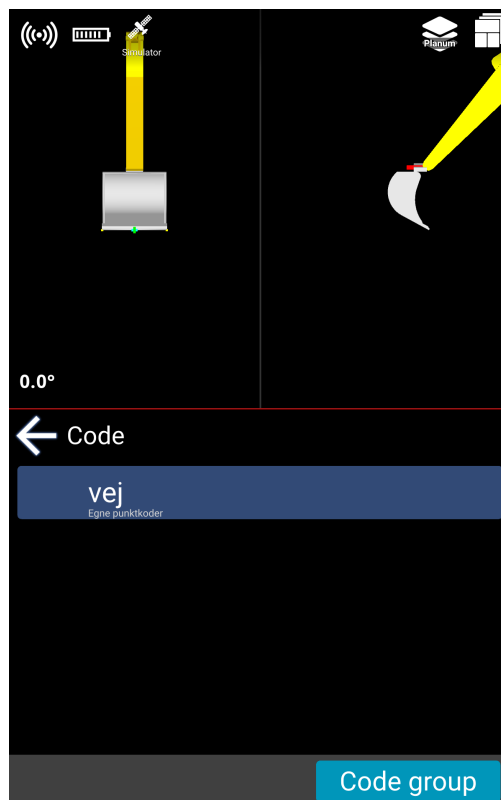
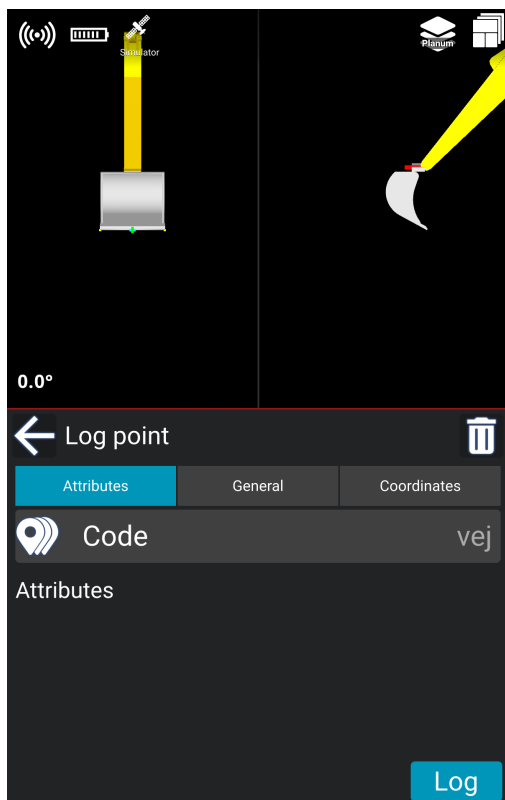
- Select a point code from the list.
- With a code chosen (the one marked blue at the top of the list), tap 'Log point' to log a point with that code.
- You will get a confirmation message that you logged the point with information about the point number, point code, and coordinate.
- You can press undo if you regret your last logging. The confirmation pop-up will disappear after approximately 10 seconds.
- The last used point code will remain active until it's changed.

## 8.1. Own log codes

**Menu > Logging > Log point**

You can create your own point codes this way:

- 1) Select **Logging** in the menu
- 2) Select Code
- 3) Select Code group
- 4) Select Own codes
- 5) Tap '+'
- 6) Name your code
- 7) '**OK**' to save



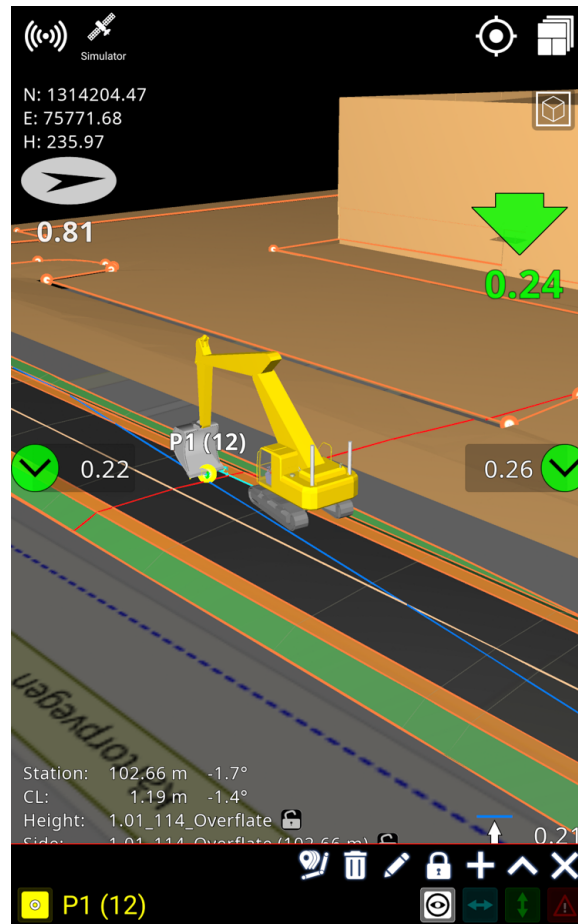
The new code is now stored under '**Own codes**'. The new code is automatically selected as the default code for point logging.

**Common code** is a project-related code group that contains the codes within the same project.

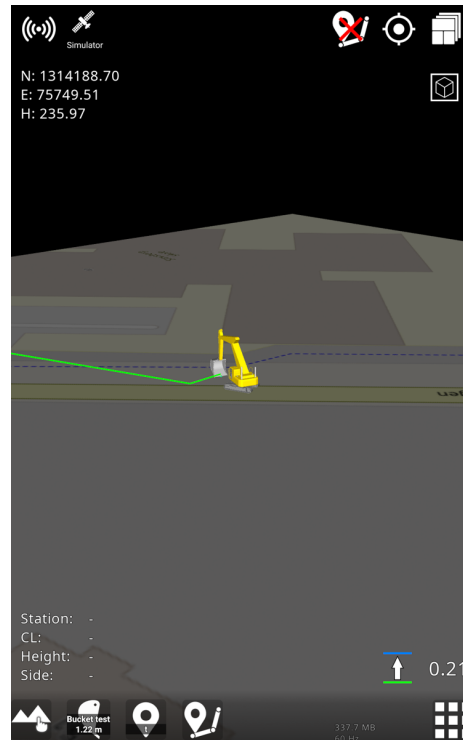
## 8.2. Log line

Log line is an as-built functionality used to document how points are connected to each other. Log line can be used to document line breaks where there are changes in slope or direction, or if the project requires it, to document every line junction.

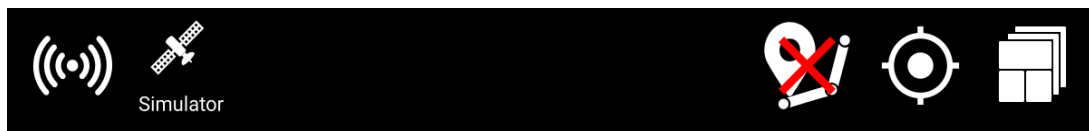
To start a new line, you must log the starting point of the line or select an existing point in the project. When a point is selected, you press the log line icon in the reference menu to enable the log line mode.



Move the tool point to the next point in your line and press the log line button in the runscreen to log this point.



To stop this line, press the **Cancel log line** button at the top of the runscreen.



## 8.3. Upload your own point code list to the Cloud

You can create your own point code list and place it in the project you are working on in the Cloud.

The name of the point code list must be **pointcodes.txt** (If the name is wrong, it will not be visible in the Makin' 3D software)

Point code list must be created like this:

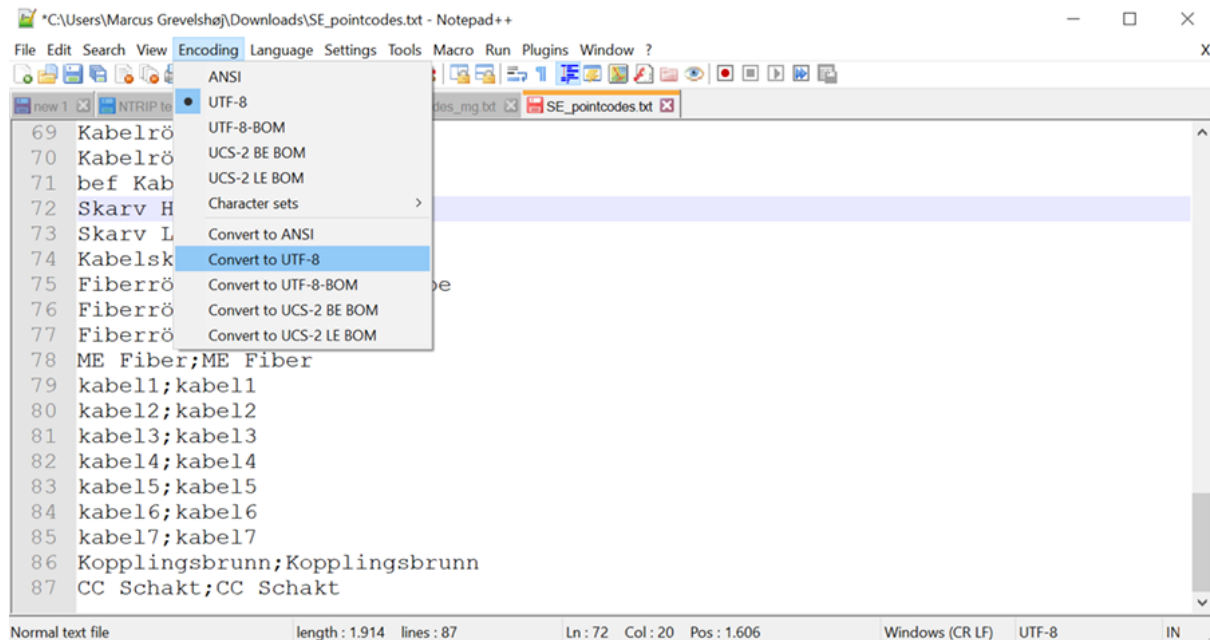
NAME	PointCode="NAME"
ID;NAME	PointCode="ID" PointCodeName="NAME"
GROUP;ID;NAME	PointCode="ID" PointCodeName="NAME"
GROUP;ID;NAME;DESCRIPTION	PointCode="ID" PointCodeName="NAME"

The point code list must be made in the UTF-8 format.

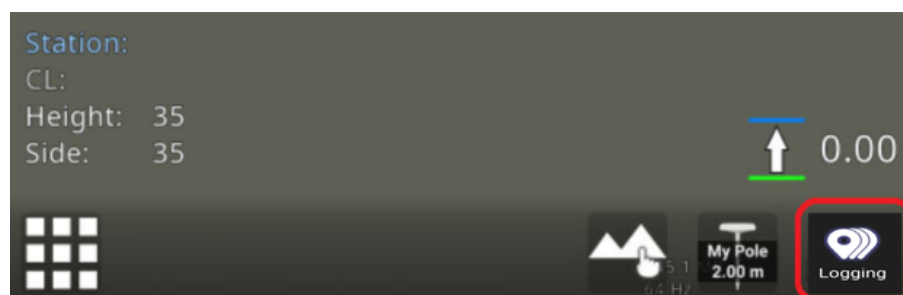


If the pointcodes.txt file is not made in UTF-8 the special regional letters can not be shown in the Makin' 3D software.

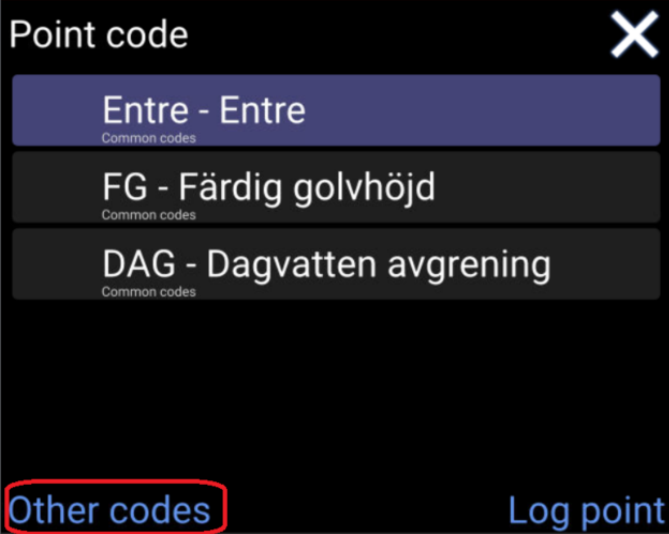
Notepad++ is a free text program that can make or convert a .txt file into the UTF-8 format



The point code list you have made can be selected by long-holding the **log** button.



Select **Other Codes**



Point code

Entre - Entre  
Common codes

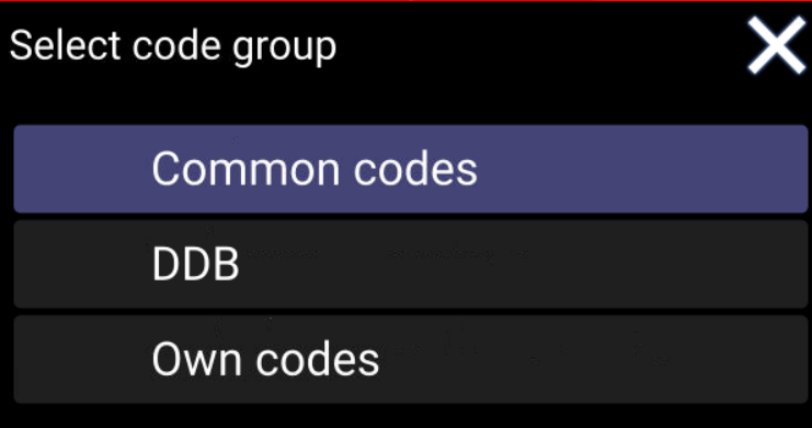
FG - Färdig golvhöjd  
Common codes

DAG - Dagvatten avgrening  
Common codes

Other codes

Log point

Common codes



Select code group

Common codes

DDB

Own codes

Here, you can select a point code from the list and then log the point.

## 8.4. Point code information and attributes

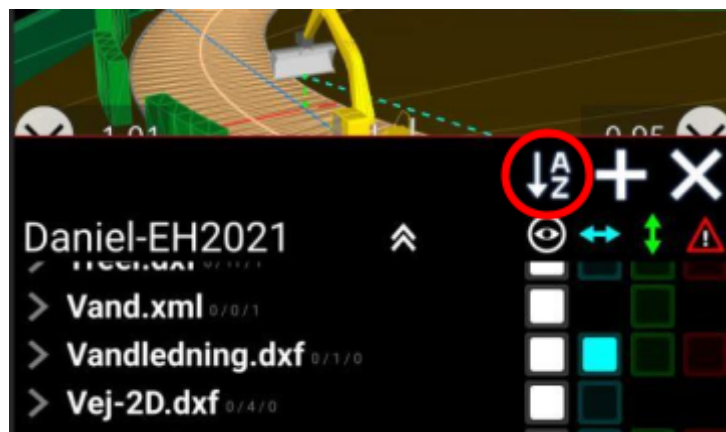
When a point is logged, a number of different information are logged together with the point code and coordinate. Below, you can see a list of information with an explanation of the different values.

<b>Point name:</b> A unique name used to identify individual points	<b>N:</b> The measured points northern coordinate. This value is measured on the tool point
<b>E:</b> The measured points eastern coordinate. This value is measured on the tool point	<b>H:</b> The measured points elevation. This value is measured on the tool point
<b>VRMS:</b> Shows the vertical accuracy of the GNSS when the point was logged. Accuracy is defined on the GNSS antenna, not the tool point	<b>HRMS:</b> Shows the horizontal accuracy of the GNSS when the point was logged. Accuracy is defined on the GNSS antenna, not the tool point
<b>Mount point:</b> Shows which mount point was chosen for the connected NTRIP server	<b>Project offset:</b> If an application has a project offset entered to adjust tool point elevation to match the elevation of a known point on the construction site.
<b>ExtSurf:</b> Showing if the point measured is done on an extended surface value can be 0(no) or 1(Yes)	<b>ToolHeight:</b> Shows the height offset applied to the measured tool point, e.g. Pole height for Makin' Survey, or Tablet height for Makin' PerFormans
<b>Time:</b> The time where the point was logged logged in a YYYY-mm-dd HH:MM:ss format Example: 2022-02-15 09:43:34	<b>systemName:</b> Shows the name of the system that logged the point. This system name matches the system name on the Cloud
<b>PDOP:</b> Dilution Of Precision, indicates how errors in measurement will affect the absolute position calculation. Dop can be calculated in different variants. (HDOP, VDOP, PDOP, TDOP, GDOP) The DOP value logged in the as-built data is the PDOP value. (Position dilution of precision) This can be considered as the 3D DOP. The value is relative and not related to a specific measurement unit.	<b>Sats:</b> Showing how many satellites were visible when the point was logged. The value is the sum of satellites, and not divided into specific satellite constellations (GPS, Glonass, Beidou, Galileo)
<b>CQ:</b> Coordinate Quality. Shows the calculated accuracy of the GNSS antenna position when the point was logged. This is not a definition of the accuracy of the tool point position that is measured. Value shows accuracy in meters	<b>SidereffFile:</b> Side reference file. Shows the name of the file used as active side reference when point was logged
<b>LogOffset:</b> Delta height. Shows if the operator has added an offset to the logged	<b>SidereffName:</b> Side reference name. Shows the name of the specific reference inside the

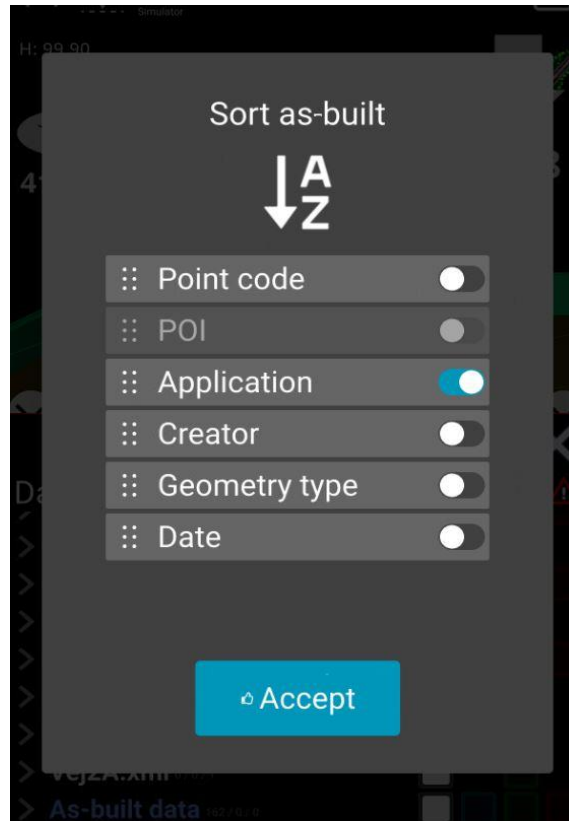
point. Often used if it is impossible to log the exact position due to limited space. E.g., logging the inlet in a manhole. Then the operator can log a point on the top of the manhole, measure the distance from the measured point to the inlet, and enter this as a delta height.	reference file, used as an active side reference when a point was logged.
<b>App:</b> Shows which system has logged this specific point.	<b>Sidedist:</b> Shows the horizontal distance from the tool point to the side reference when the point was logged.
<b>HeightOffset:</b> If the operator has entered an offset, the value is documented in this field. This offset will have a direct effect on the Href value.	<b>HeightrefFile:</b> Height reference file. Shows the name of the file used as the active height reference when the point was logged.
<b>POI:</b> This is set if the operator has marked a point as a <b>P</b> oint <b>O</b> f Interest. The value can be 0 (no) or 1 (yes).	<b>HeightrefName:</b> Height reference name. Shows the name of the specific reference inside the reference file, used as the active height reference when the point was logged.
<b>ToolPoint:</b> Shows which tool point was used to log the point. Only relevant for Excavators that can switch and log with Left, Center and Right tool point on the bucket.	<b>Height:</b> Shows the vertical distance from the tool point to the height reference when the point was logged.
	<b>Comment:</b> If the operator has written a comment for the point, it will be shown here.

## 8.5. Sort as-built data

Inside the reference menu, it is possible to enable sorting of the project's as-built data. Press the AZ button to open the sorting dialog.



In this dialog, you can choose which criteria you want to sort by. Press the button to activate or deactivate the criteria. You can also change the order you want to sort by. This is done by pressing and holding on a criterion and then moving it up or down the list.



# 9. GNSS

Menu > GNSS

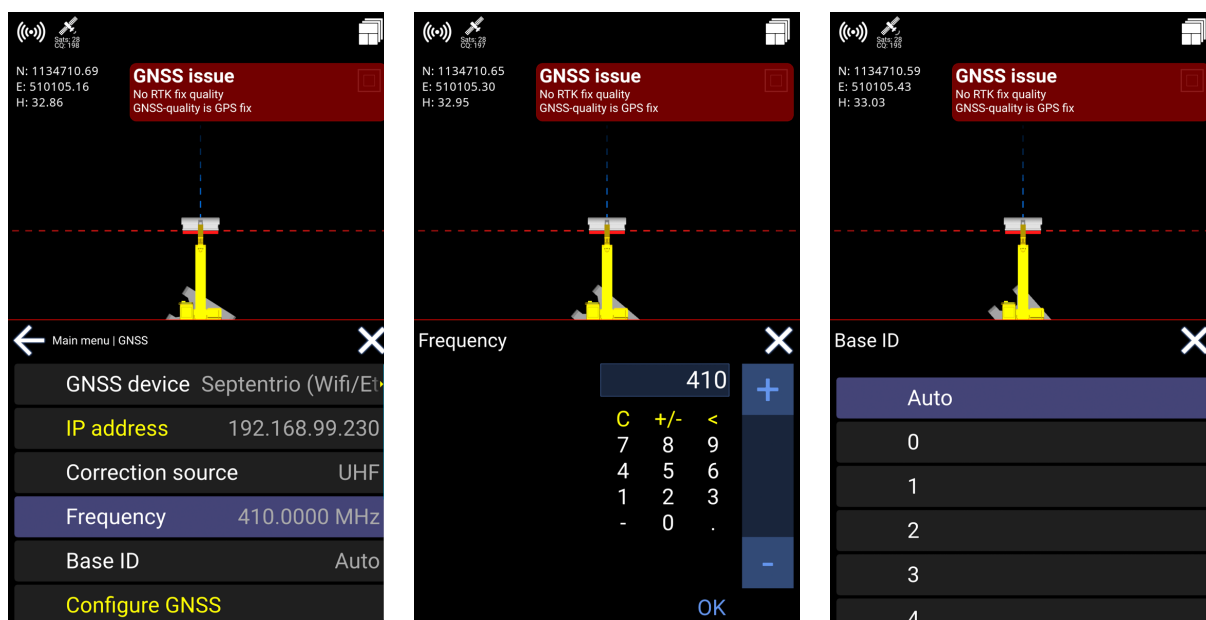
## 9.1. Correction source

In the 'GNSS' menu, you can choose whether you want to run with the GPS receiver towards **NTRIP** (CPOS, Smartnet, TopNet) or **UHF** (radio) towards a local base station. If you choose UHF, you must select the frequency and ID that allow Makin' 3D to communicate with the base you want.

### 9.1.1 Radio

Under 'Correction source' you see the current type of correction source being used.

- Tap 'Correction source' to change it.
- Tap your choice of 'NTRIP' or 'UHF'. Choose 'UHF' if you use a radio to connect to the correction signal.
- Tap 'Frequency' to set the frequency of the base station.



In situations where you have to specify the frequency according to a channel, refer to the table below for guidance. Channel 0 is the center frequency, and channels are distributed with a 25 kHz spacing (in this example).

Channel	Frequency (MHz)
0	446.6000
-1	446.5750
-4	446.5000
-5	446.4750

- Tap 'Base ID' and choose 'Auto' to automatically jump between base stations with the same frequency, or choose an ID of a specific base station to lock on to it. Please note, if you use the 'Auto' option, you might experience corrections from two bases, which is not optimal.

### 9.1.2. Ntrip

Makin is able to use corrections from several Ntrip providers. Depending on the installed GNSS receiver, the information must be entered by the Makin supporter or installer, either in the Makin application's GNSS menu or in the GNSS receiver's interface. Common to all of them is that Makin needs some Ntrip server details to be able to connect to the server and receive useful corrections. These details will be delivered from the selected Ntrip provider when subscribing to an account.

To connect to the Ntrip network and receive corrections, the following details must be entered:

- **Ntrip server:** The web address where the server can be accessed.
- **Ntrip port:** This is usually a 4-digit number from where Makin must receive the corrections.
- **Ntrip user:** Every Ntrip account on the server has a unique username that Makin needs to log in to the server.
- **Ntrip password:** Every Ntrip account on the server has a unique password that Makin needs to log in to the server.
- **Ntrip mountpoint:** This mount point defines which corrections and from which GNSS satellites Makin can calculate an accurate position.

## 9.2. Heading method

Makin has the ability to change the heading method to suit the needs of the user. The heading method defines how the background map and references are rotated on the tablet.

### **Centerline:**

If the centerline heading method is chosen, the map and references will by default be rotated so the project centerline is pointing up/down on the screen.

### **North:**

If the north heading method is chosen, the map and references will by default be rotated so that north is pointing upwards on the screen.


### **Trace:**

When trace heading is selected, the map and references will dynamically rotate upwards on the screen in the direction of travel. Trace heading angle is calculated between previous positions and the current position. When the direction of travel is changed, the map and references on the screen will automatically rotate to the new direction of travel.

## 9.3. Bluetooth

Some of the Makin' PerFormans and Makin' Survey applications are using Bluetooth to communicate with the GNSS receiver. To set up the Bluetooth connection, you must go to **Main Menu > GNSS > GNSS device** and select **Reach Emlid**.

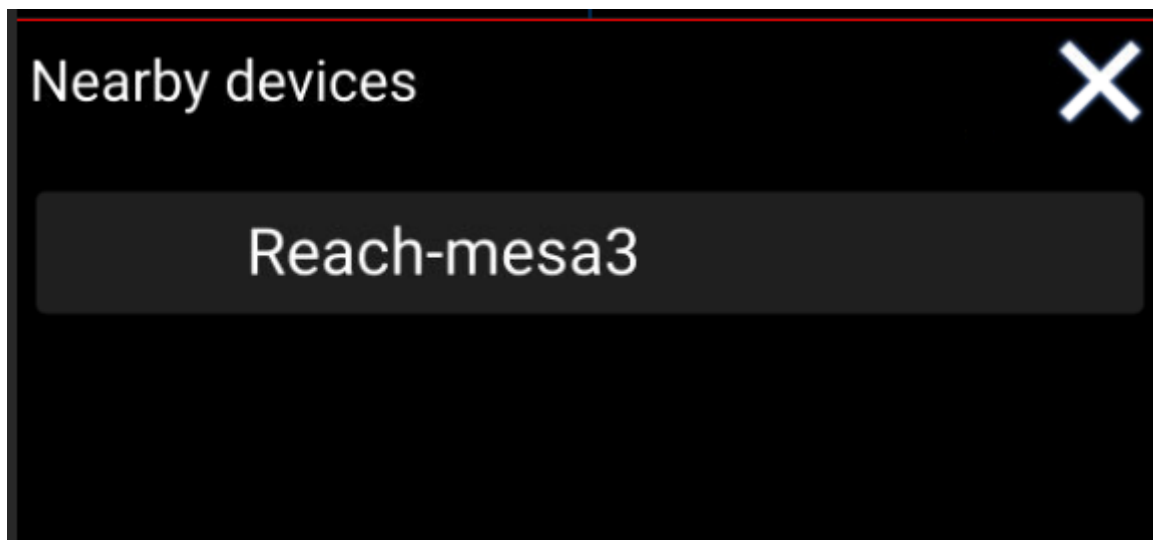
## 9.4. Connecting and pairing bluetooth

Go into **Main menu > GNSS > Bluetooth** and press the Bluetooth icon at the top .



Now you will start a search process, searching for the unit among any nearby devices.

When the unit is located, the device name will show up. In the below example the unit name is *"Reach-mesa3"*





Press the device name to connect to the device. In the Bluetooth menu, you will see the Bluetooth address. Press **Ok** to establish a connection.

Pay attention to the GNSS icon at the top . With this icon connection to the GNSS device means that it is still waiting to be established; this might take 2-3 minutes when all LEDs on the GNSS device are turned on with a solid light. When a connection has been established, the GNSS indicator changes to this icon . The connection has been established. You will see the warning "No position from main antenna". When the receiver is tracking available satellites and "No RTK Correction" until the device has connected to the Ntrip server and established a RTK fix position.

## 10. Pole

In this menu, you can enter different offsets for pole length. If you are working with several different pole lengths, it is possible to store several poles for later use.

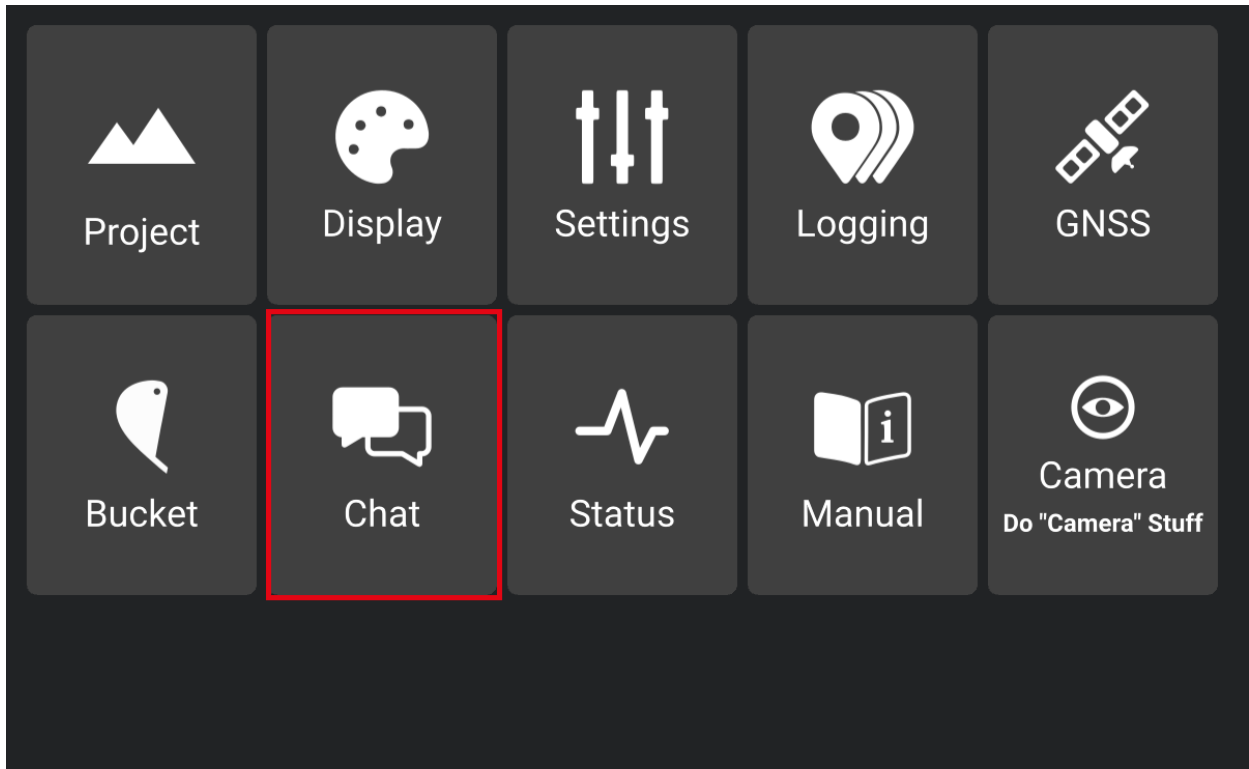
When a pole with a height is selected, this height is added to the measured GNSS height.



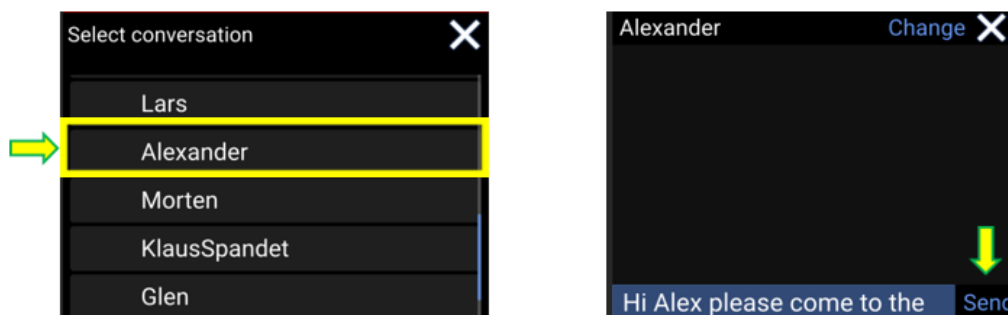
# 11. Chat

## Menu > Chat

The chat feature helps you communicate with your colleagues about the project you are working on.



- You will see all office personnel and coworkers from your company or project. This depends on the structure created by your management.
- Tap a contact from the list to begin messaging.

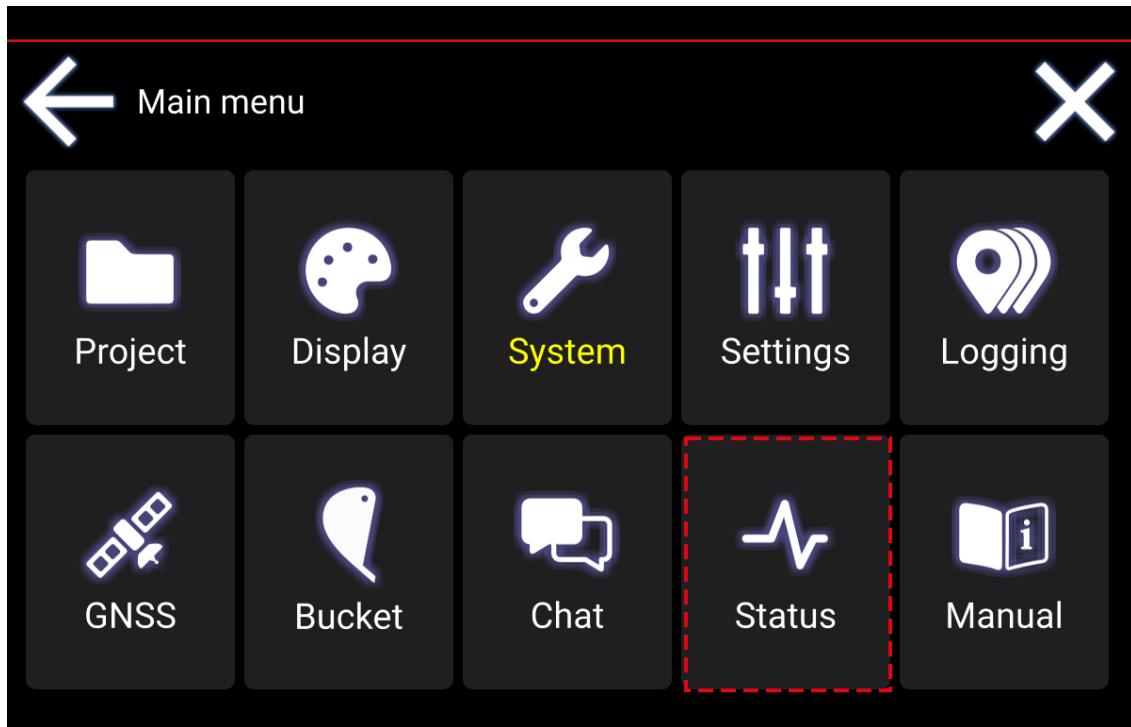


- Write a message and tap '**Send**'.

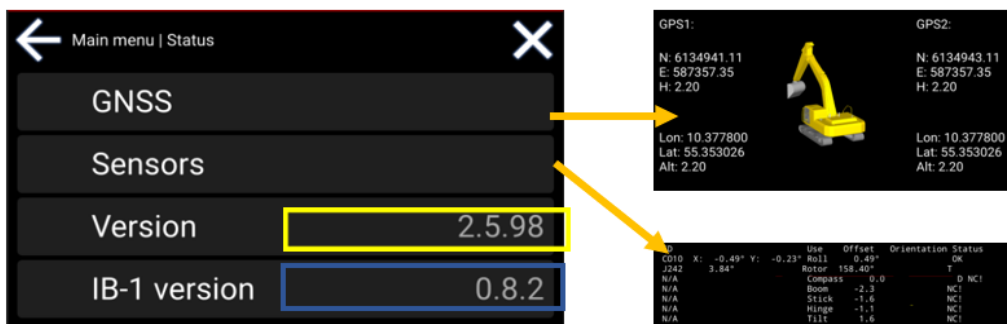
## 12. Status

Menu > Status

This is where you will find various details about the system information.



- Tap '**GNSS**' to see the connection status and your location.
- Tap '**Sensors**' to see detailed sensor information.
- 'Version' is the current Makin' 3D software version of the Android app running on your tablet.
- 'IB-1 version' is the firmware version of the interface box connecting all the sensors to the system.



- **System info:** You can find all relevant information about your system by selecting 'System info'. Information such as System name, System number, System owner, and the associated licenses are shown here. When changes are made to the system, they will be shown under System info.

# 13. Troubleshooting

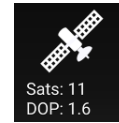
Error message	Possible cause	Possible Solution

If you cannot solve the problem using the advice found in the above table, contact your reseller.

# 14. Appendix

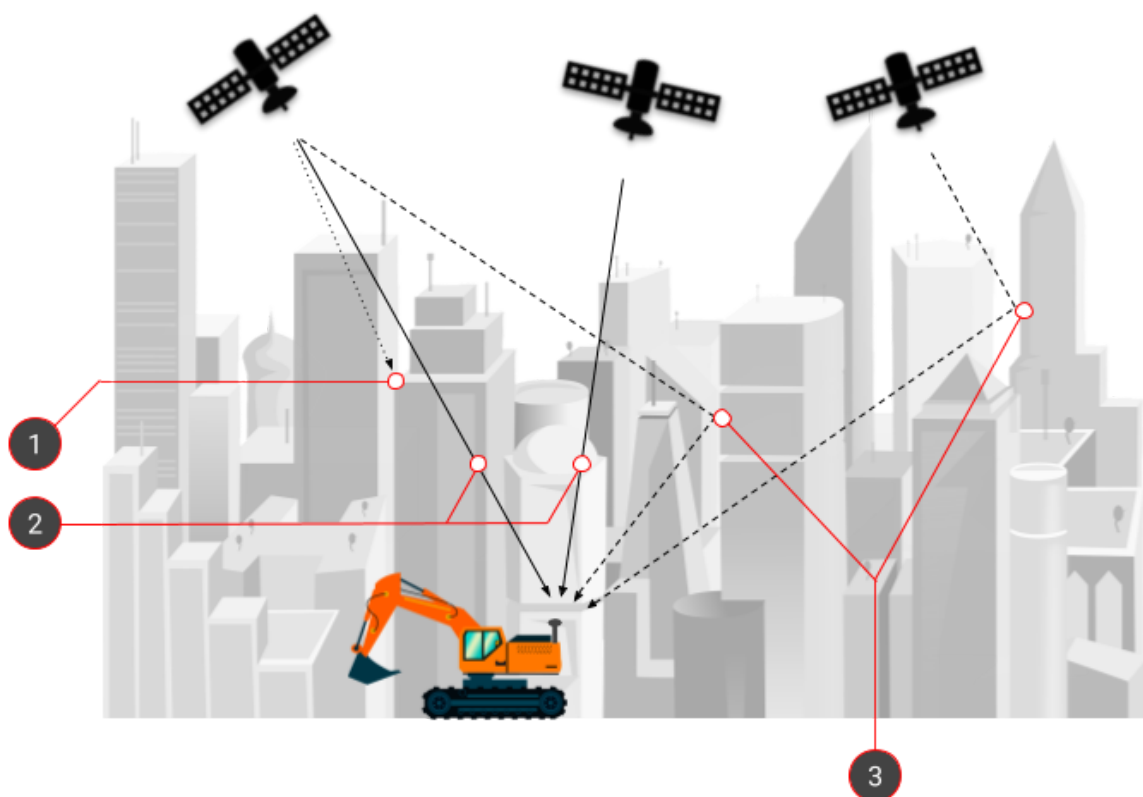
## 14.1. GNSS limitations

Always take into consideration where your machine is located. Especially when the construction site is within city limits with tall buildings or other obstacles.



Also, if working near forest and mountain areas, interference could block the signal from one or more satellites and cause poor precision. Reflections could also occur.

Makin' 3D will inform you if there are not enough visible satellites or if your CQ/DOP is too high.



1. Direct signal blocked

3. Multipath errors

2. Direct signals perfectly received

## 14.2. Demo mode

You can use your Makin' 3D system on Windows in demo mode to gain confidence in the user interface.

Please find below the shortcuts for the functions.

Keyboard	Function
j	Jump to near the project
J	Jump to the roundabout in Odense S
n/N	Move forward/backward
b/B	Turn to the left/right
m/M	Turn to the right/left
space	Start/stop automatic driving
s/S	Move forward/backward on the centerline
+/-	Raise machine/lower machine
r	Screen and machine back to standard view
u	Jump to current side reference
1....8	Move the machine parts. Holding down ALT together reverses the movements.
1	Roll

2	Pitch
3	Rotate tracks
4	Boom
5	Stick
6	Bucket
7	Tilt
8	Rotor



## 14.3. Network requirements

Due to various network security and firewall limitations when connecting to a network to run:

- Demo system
- Makin Win

You must verify with the local network administrator that the following requirements are fulfilled to connect to Makin Cloud.

Outbound traffic on port:

- 80
- 3740
- 8008
- 10000-12000

Access to IP address of: [cloud.makin3d.com](https://cloud.makin3d.com)

## 14.4. Xbox controller

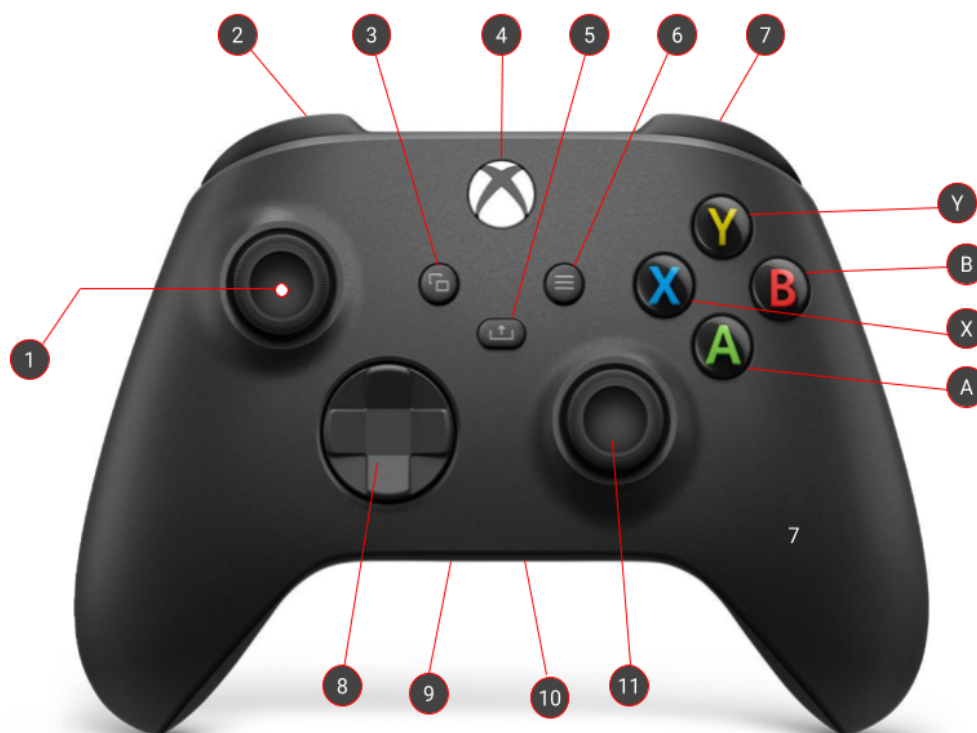
You can use an Xbox controller to navigate the excavator in the Makin' 3D system on your tablet. It is an easy way to gain confidence in the user interface. This feature is only available when you connect the Xbox controller to a Panasonic FZ-A3 tablet. Please note that you can also navigate the Survey and the PerFormans in the Makin' 3D system on the tablet, but you can only move around with the application and go to side references (*use button directions 1 and 5 for this; see picture below*).

### How to connect the Xbox controller to your tablet:

- 1) Go to **Settings** on your tablet.
- 2) Click on '**Connected devices**'.
- 3) Press the connect button on the Xbox controller on top of the controller (*between button number 2 and 4. See picture below*).
- 4) Click on '**Pair new device**'.
- 5) Click on the available Xbox Wireless Controller on the tablet screen. Wait for the devices to pair.
- 6) Your Xbox controller is now connected to the tablet and ready for use.

### How to use:

You can switch between **Dig mode** and **Drive mode** on your Xbox controller. Please find below the instructions for the button functions.



Button direction	Dig mode	Drive mode
1 Press down	Switch to drive mode	Switch to dig mode
1 Forward	Arm out	Drive forward
1 Backwards	Arm in	Drive backwards
1 left	Swing left	Turn machine left
1 right	Swing right	Turn machine right
2	Tilt left	Decrease turbo (stepwise)
3	-	-
4	Power on/off	
5	Jump to side reference	
6	-	-
7	Tilt right	Increase turbo (stepwise)
8	-	-

9	-	-
10	-	-
11 forward	Boom down	Pitch machine down
11 backwards	Boom up	Pitch machine up
11 left	Close bucket	Roll machine left
11 right	Open bucket	Roll machine right
A	Move machine down to 1 meter	
B	Rotate bucket right	
X	Rotate bucket left	
Y	Move machine up 1 meter	