Software Configuration Guide

Groundworks

MACHINE CONTROL SYSTEM

Version 2.00
Revision A
June 2025

Trimble

Legal Notices

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Release Notice

This is the June 2025 release (Revision A) of the *Groundworks Software Configuration Guide*. It applies to version 2.00 of the Groundworks software.

Contents

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Introduction

Use this guide to get started using the Trimble® Groundworks machine control system and to complete an initial calibration and configuration of the Groundworks software.

2

Using the Groundworks Software

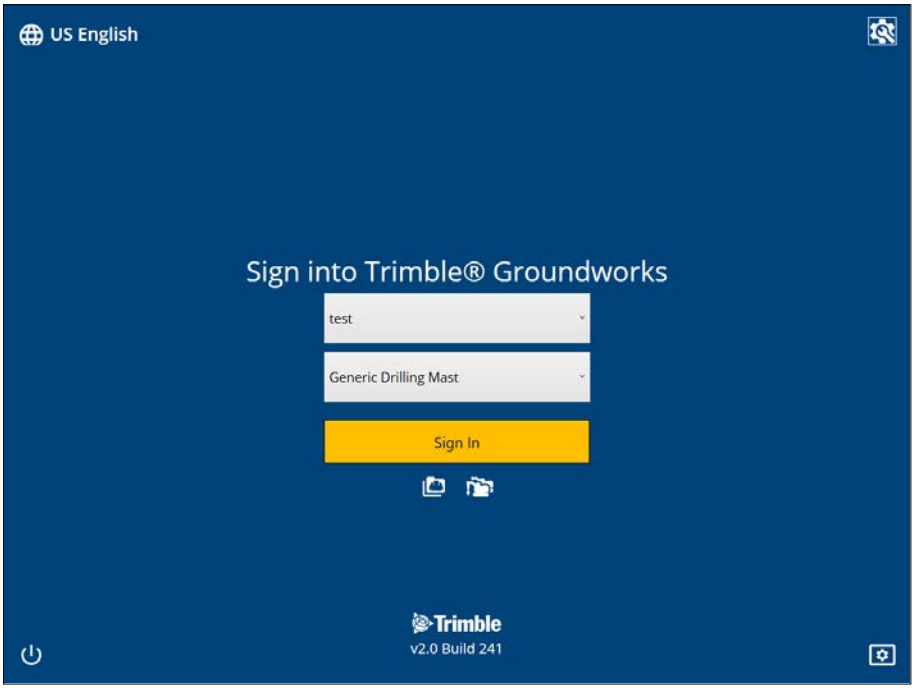
Starting the Groundworks software

1. On your Desktop, double-tap the Groundworks icon .
2. Read the Legal Notices and tap **ACCEPT** to move to the start-up screen.

> **TIP –** Disable the **Show every time** option to prevent this screen from appearing again.

Start-up screen

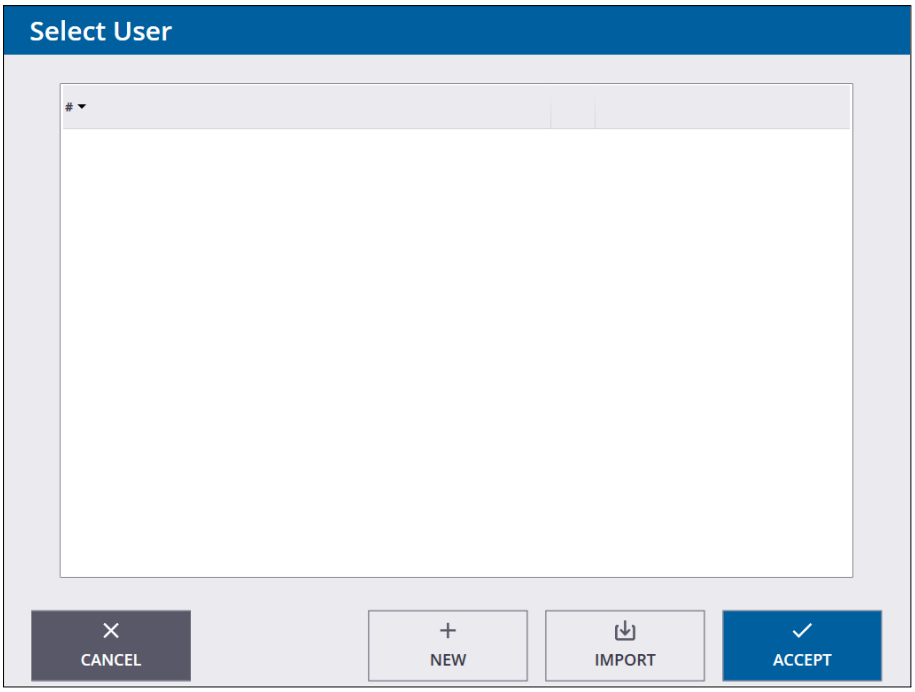
The start-up screen appears each time the software starts. It enables you to select the user and machine profile before signing in.



- Tap and select the language from the drop-down list that appears. The software will restart to switch to the language you have selected.
- Tap and select from the list of OEM images for the start-up screen.
- Tap to exit the software and return to the Desktop.

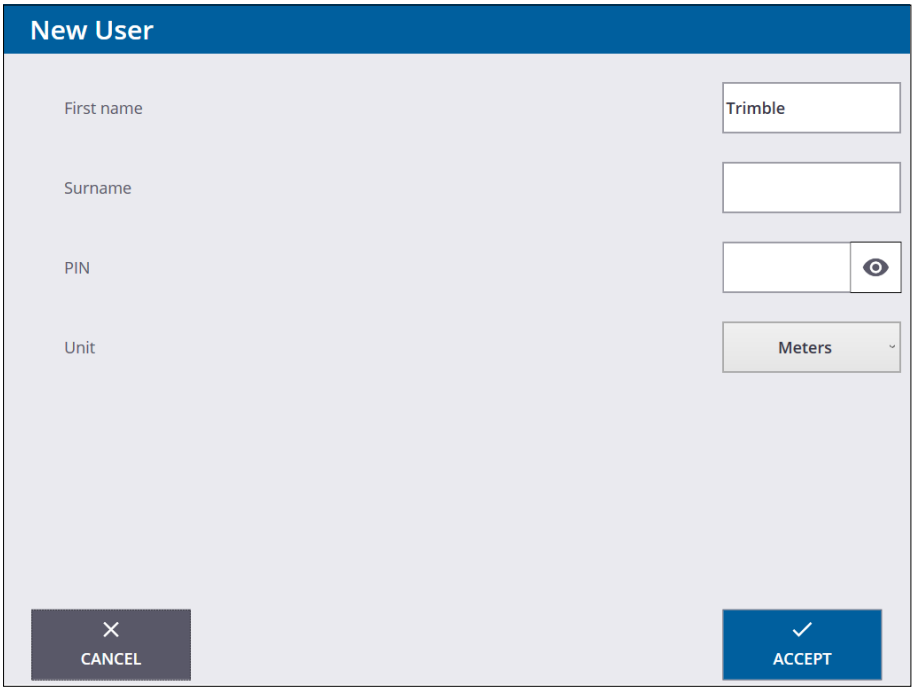
User setup

From the start-up screen, tap  to access the user setup.



Creating a new user profile

1. Tap **NEW**.



2. Enter first name and surname (surname is optional).
3. Enter a 4-digit PIN (optional).

If you have a PIN, you will need to enter it each time you sign in.

4. Select units.
5. Tap **ACCEPT**.

Importing a user profile

1. Tap **IMPORT**.

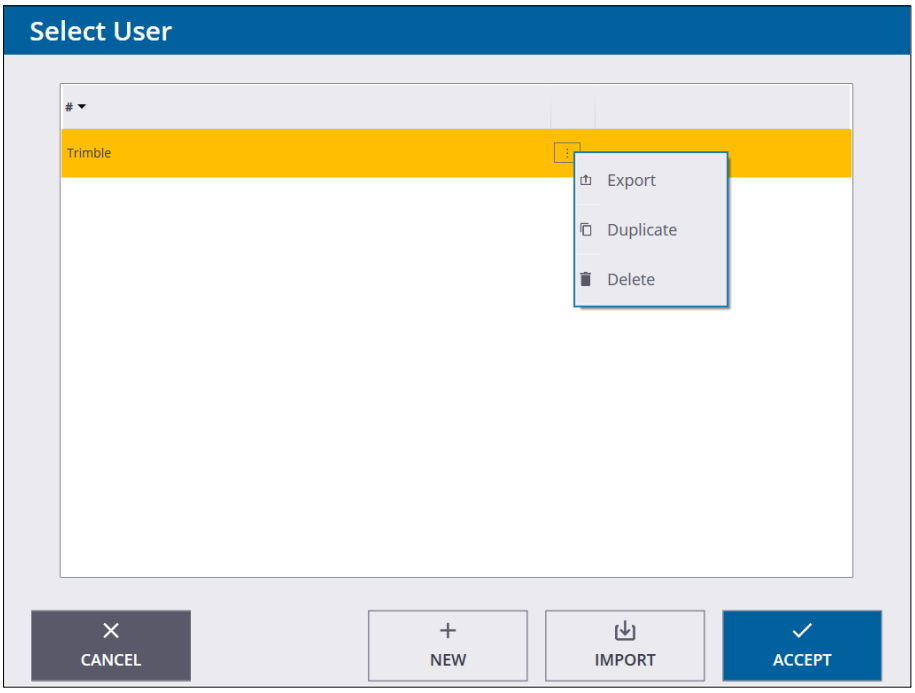
2. Browse your computer or USB drive for the user profile and tap **ACCEPT** to import it.

Selecting a user profile

Select the correct user from the list and tap **ACCEPT** to make it active.

Additional user profile options

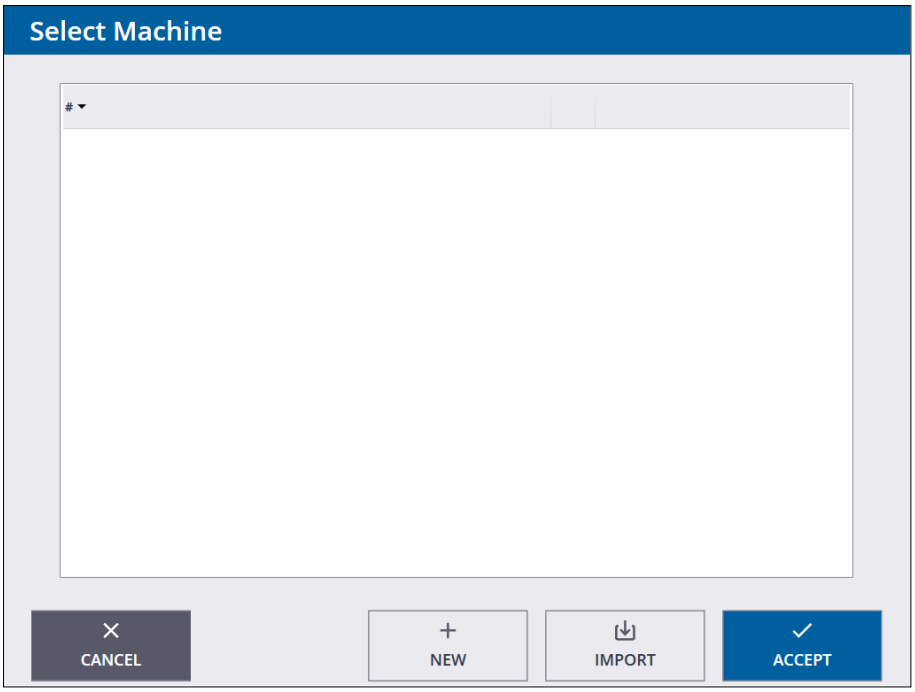
Tap ⋮ next to the user name to see available options:



- Select **Export** and follow the prompts to export the user profile.
- Select **Duplicate** and follow the prompts to duplicate the user profile.
- Select **Delete** and follow the prompts to delete the user profile.

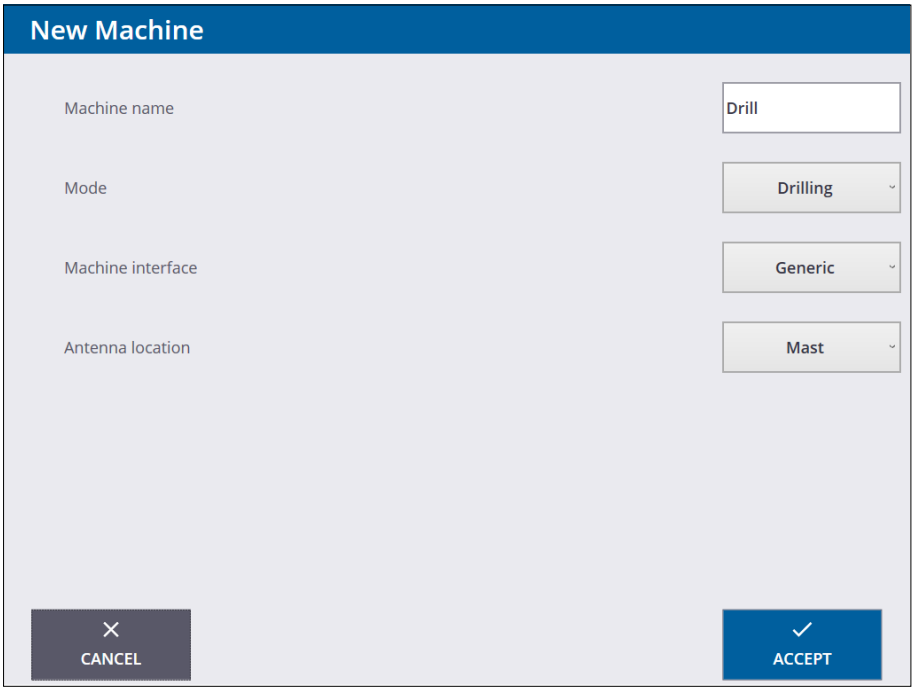
Creating a machine profile

From the start-up screen, tap  to access the machine setup:



Creating a new machine profile

1. Tap **NEW**.



2. Enter a name for the machine.
3. Select the correct **Mode**: Drilling, Piling, CFA Piling, or Dynamic Compaction.

4. Select the correct **Machine interface**: Choose **Generic** for Trimble aftermarket installs or select the correct OEM interface if applicable.
5. Select the **Antenna location**: The mounting location of the antennas affects the available options in the sensor setup and measure up settings.
6. Tap **ACCEPT**.

Importing a machine profile

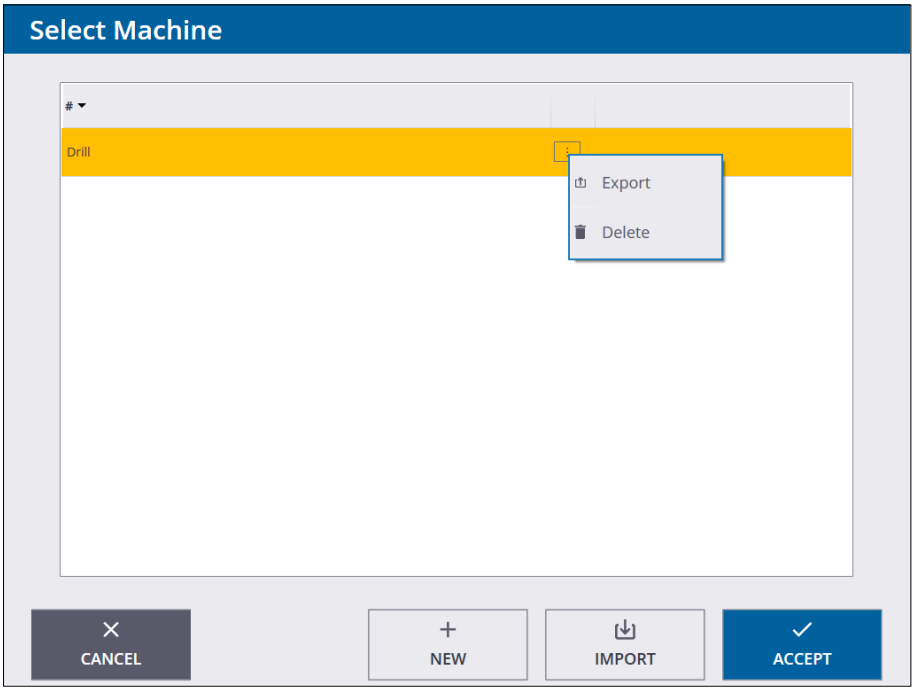
1. Tap **IMPORT**.
2. Browse your computer or USB drive for the machine profile and tap **ACCEPT** to import it.

Selecting a machine profile

Select the correct machine from the list and tap **ACCEPT** to make it active.

Additional machine profile options

Tap ⋮ next to the machine name to see available options:



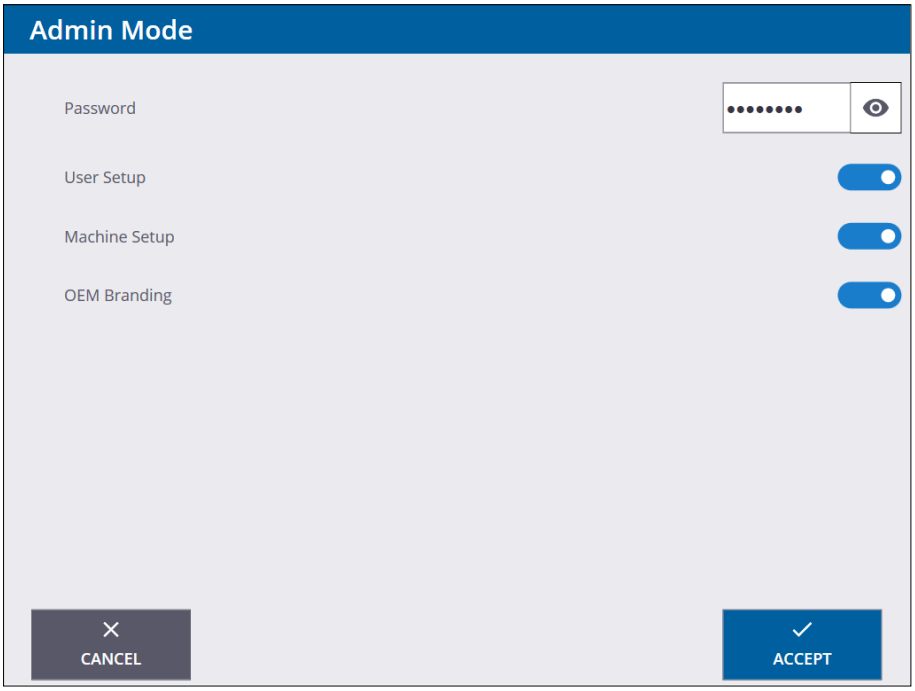
- Select **Export** and follow the prompts to export the machine profile.
- Select **Delete** and follow the prompts to delete the machine profile.

Admin mode for the start-up screen

Once finished creating user/machine profiles and selecting the OEM branding image, go to **Admin Mode** to limit access to these start-up screen features.

1. Tap from the start-up screen.
2. Enter the password and tap **ACCEPT**.

   NOTE – The default password is ***password***.



   The following options are available:

Item	Description
Password	Allows the password to be changed.
User Setup	Enable this option to allow user profiles to be managed. Disable to hide the icon.
Machine Setup	Enable to allow machine profiles to be managed. Disable to hide the icon.
OEM Branding	Enable this option to allow OEM branding to be configured for the start-up screen. Disable to hide the icon.

3. Once the appropriate settings have been enabled/disabled, tap **ACCEPT** to apply changes.

TIP – If the Admin mode password is changed and forgotten, the Groundworks.xml file can be deleted to reset password to default (password). The Groundworks.xml is located in C:\Trimble Synchronizer Data\Device Name\Trimble SCS900 Data.

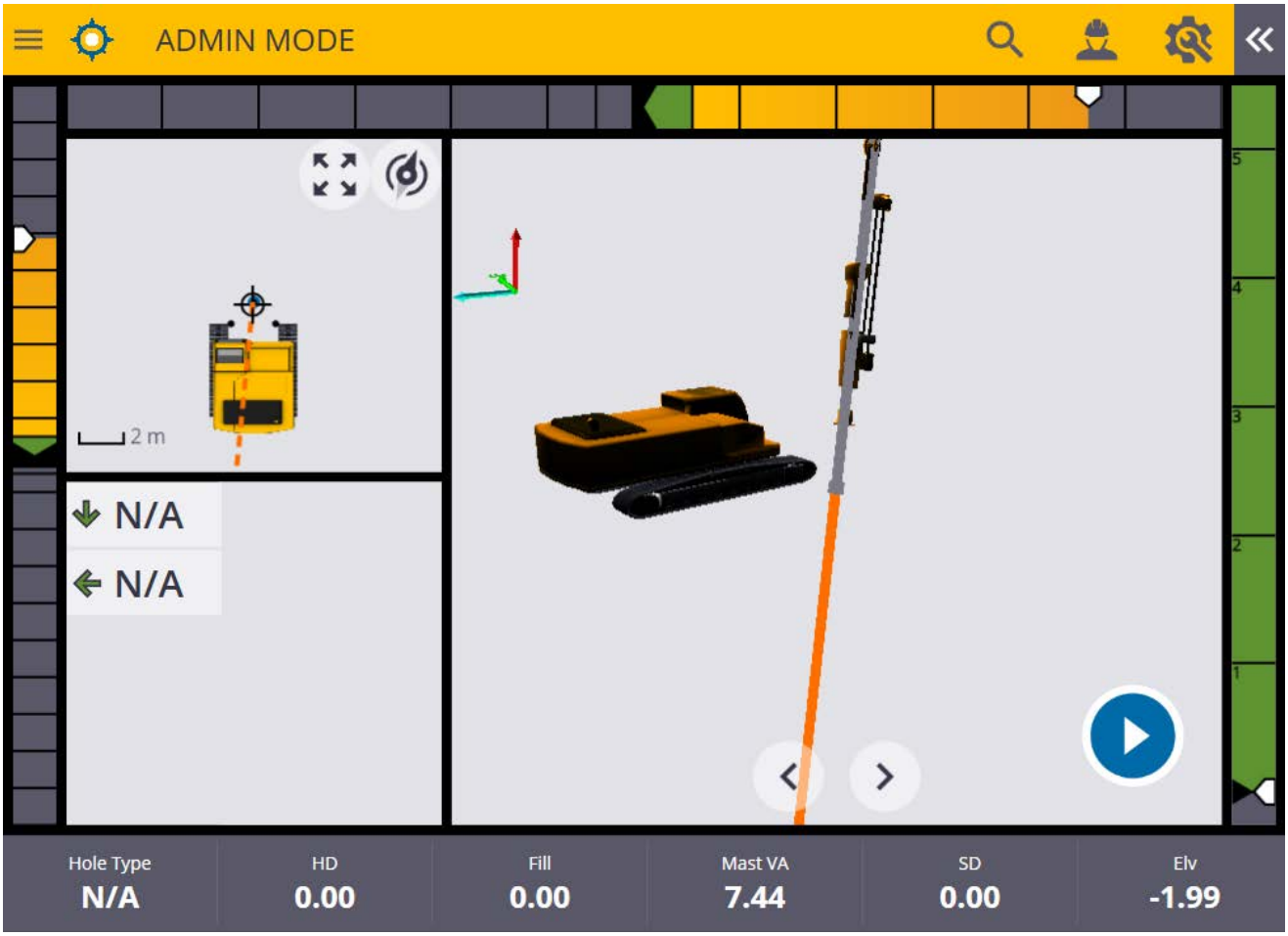
Admin mode

Once finished setting up the user/machine settings, go to **Admin mode** to limit permissions to these settings:

1. Tap  from the start-up screen.
2. Select **Start Admin**.
3. Enter the password and tap **ACCEPT**.

> **NOTE –** The default password is ***password***.

Once in **Admin mode**, the header of the main screen shows ADMIN MODE and remains in that mode until tapping on and selecting **Stop Admin** or restarting the software.



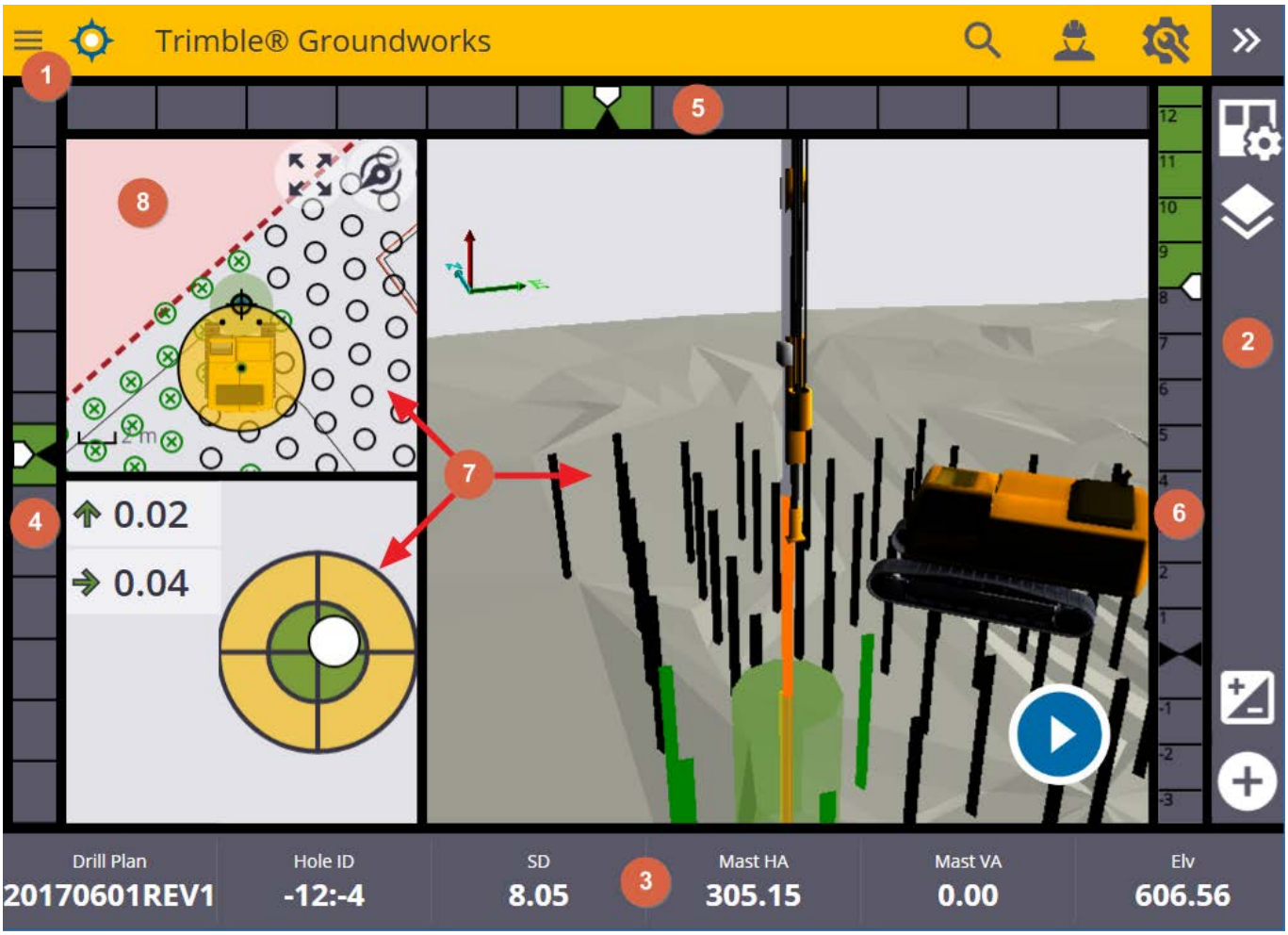
When in Admin mode, you have access to all software features and can change permission levels for the active user from the **Account settings** screen.

Account settings

Tap in the top right corner to open account settings.

- Tap **Profile** to change units, PIN code, and view permission levels.
- Tap **Log Out** to return to the Groundworks start-up screen.

Typical screen layout



1	Hamburger menu	5	Roll bar
2	Toolbar	6	Depth bar
3	Infobar	7	Map views
4	Pitch bar	8	Avoidance zone

Interacting with map views

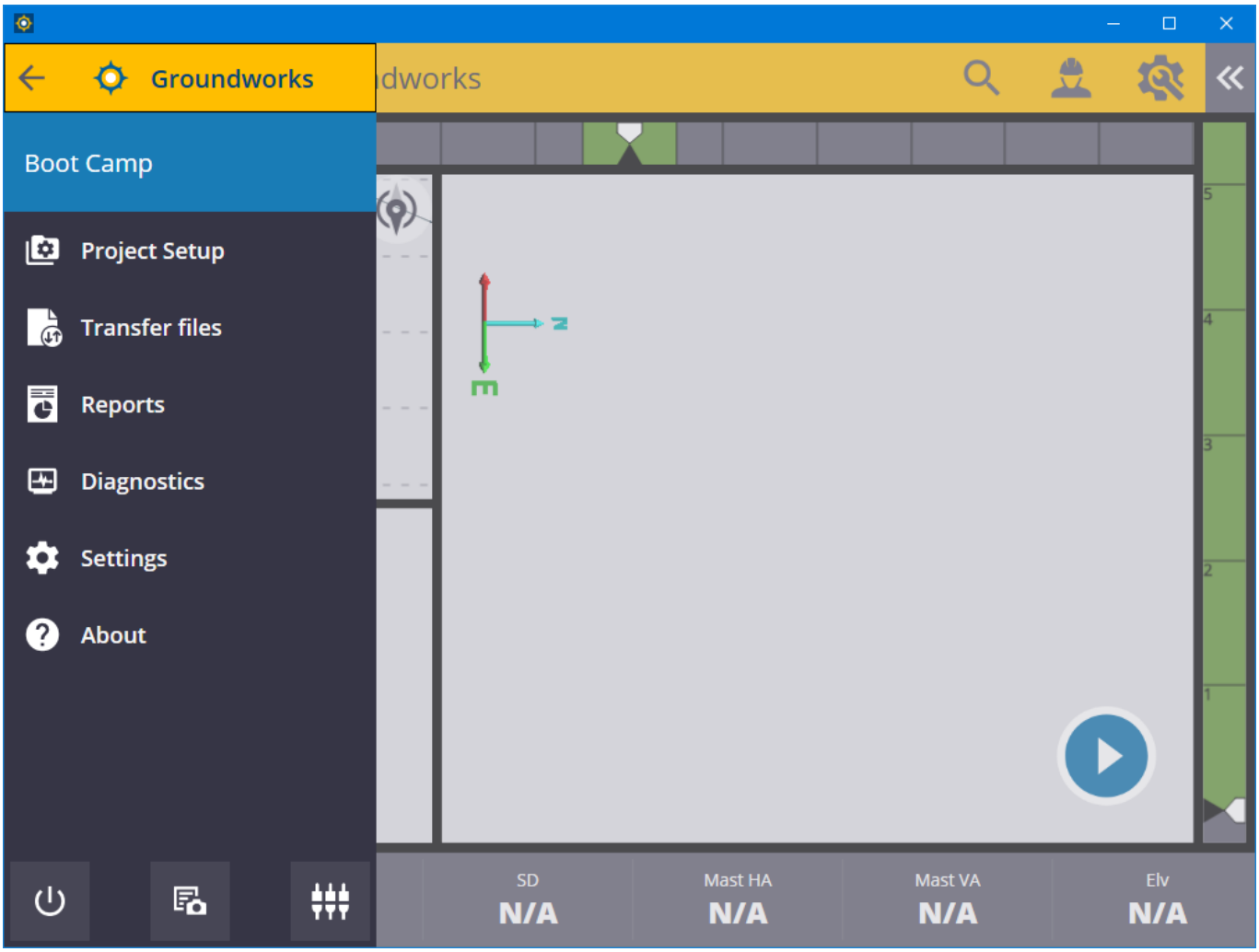
Use the following options in the map views to customize how they are displayed:

Icon	Mode	Description
	Zoom out	Tap to zoom out.
	Zoom in	Tap to zoom in.
	Zoom extents	Tap to zoom in/out to make all of the design and/or drill plan visible and centered in map views.
	Machine center	This places the machine tool position in the center of the map while the machine is moving. It only appears if you tap **Zoom extents** or pan around on screen.
	North up	Plan view is fixed so that North is always up. Tap to toggle to **Machine up** mode.
	Machine up	Plan view rotates so that the machine is always facing up. Tap to toggle to **North up** mode.

TIP – Use two finger pinch-to-zoom gesture as an alternative to tapping the zoom in and zoom out icons.

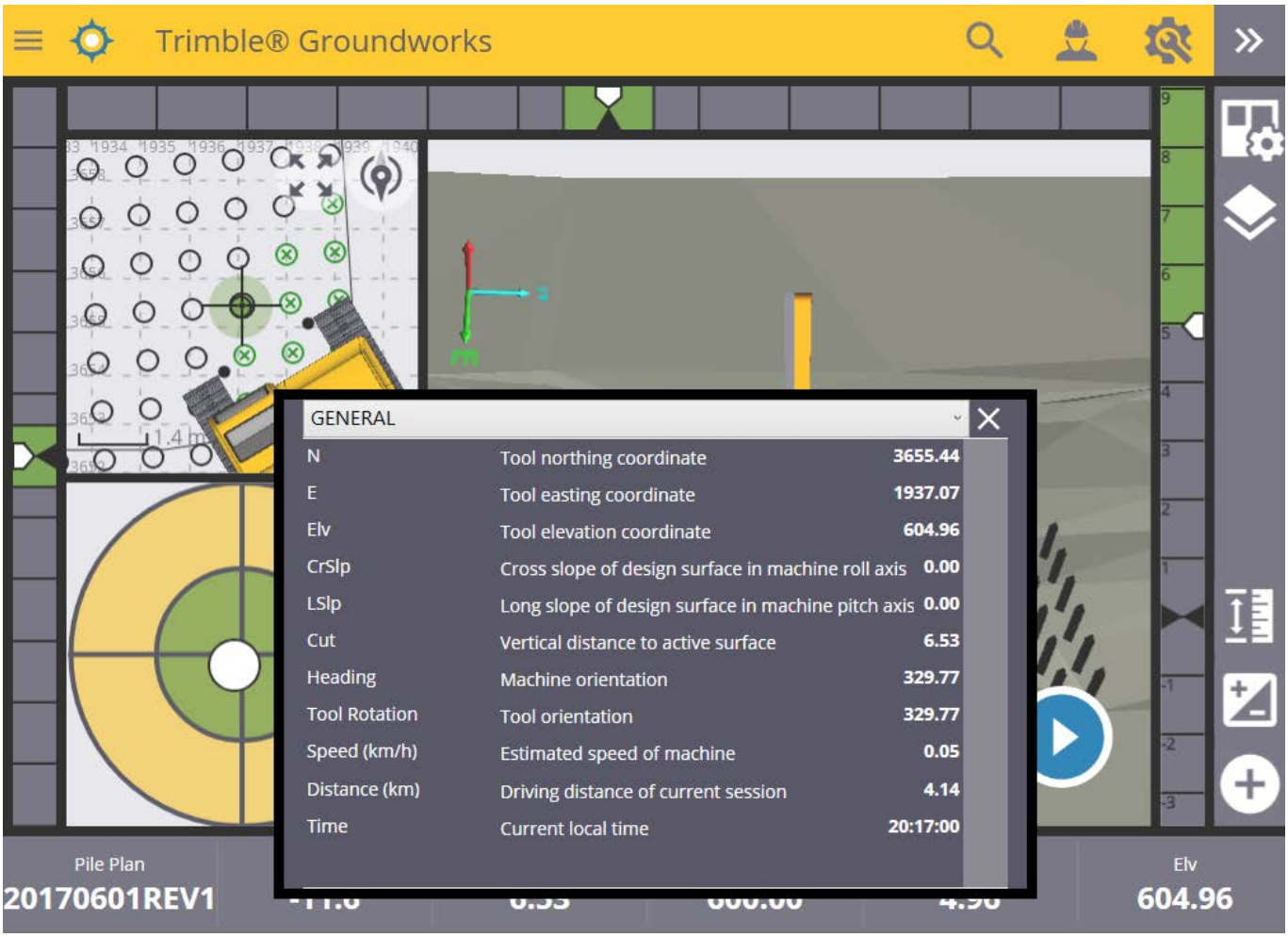
Hamburger menu

Tap ☰ in the top left corner to access the menu options: Project Setup, , Reports, Diagnostics, Settings, and About.



Infobar

The Infobar displays data values of planned and actual drilling operation.



- Tap an item in the infobar to open a list of available items.
- Select a new item to replace the existing item.

Search Feature

Tap in the top right corner to open the search feature.

All items that you can interact with (holes, lines, piles, drop locations, and points) show up in the search; selecting an item gives you the same options as if you had tapped it from a map view.

About

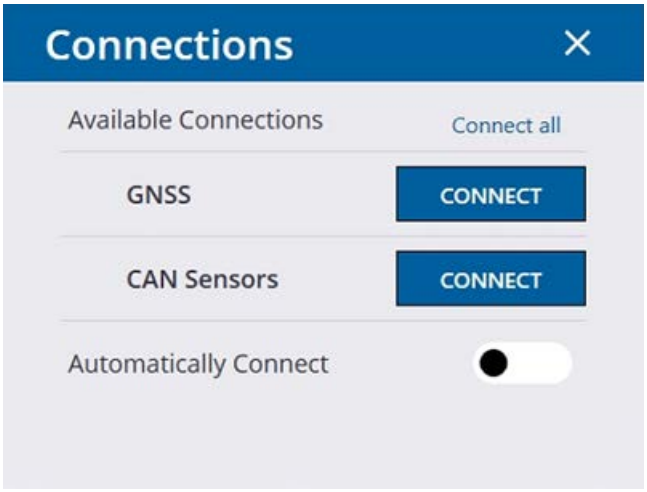
The About section shows information such as the Groundworks software version, the device serial number, the software expiration date, the working directory being used, and the legal notice.

To access the **About** menu, tap / **About**.

Connecting the GNSS and CAN sensors

To manually connect GNSS and CAN sensors:

1. Tap ☰ then tap  to open the **Connections** screen.



2. Tap **Connect all**. If a connection fails, tap **CONNECT** to retry.
3. When all connections are successful, tap ✕ to close the **Connections** screen.
4. When prompted to manually reset the depth sensor, move the tool to ground level then tap **ACCEPT**.

   If the depth sensor is reset in the wrong position, on the toolbar tap  to manually reset the depth sensor again.

> **TIP –** Enable the **Automatically Connect** option for the software to automatically connect on startup.

Generating a system snapshot

If hardware or software issues arise with the Groundworks system, you can generate a system snapshot to capture diagnostic information. This information is useful for support personnel to replicate and identify the issue. This system snapshot is not encrypted and contains important data such as device credentials, active project data, geoid, GNSS/CAN data, settings files, and an event log.

1. To generate a system snapshot, tap ☰ then tap  .
2. Tap **ACCEPT**. A system snapshot is saved to the Desktop.

Exiting the Groundworks software

Tap ☰ then tap ⏻ to open the **Power** options:

- Tap **CANCEL** to keep the Groundworks software running.
- Tap **SHUTDOWN** and follow the on-screen prompts to exit the Groundworks software and turn off the display.
- Tap **YES** and follow the on-screen prompts to exit the Groundworks software and return to the Windows Desktop.

3

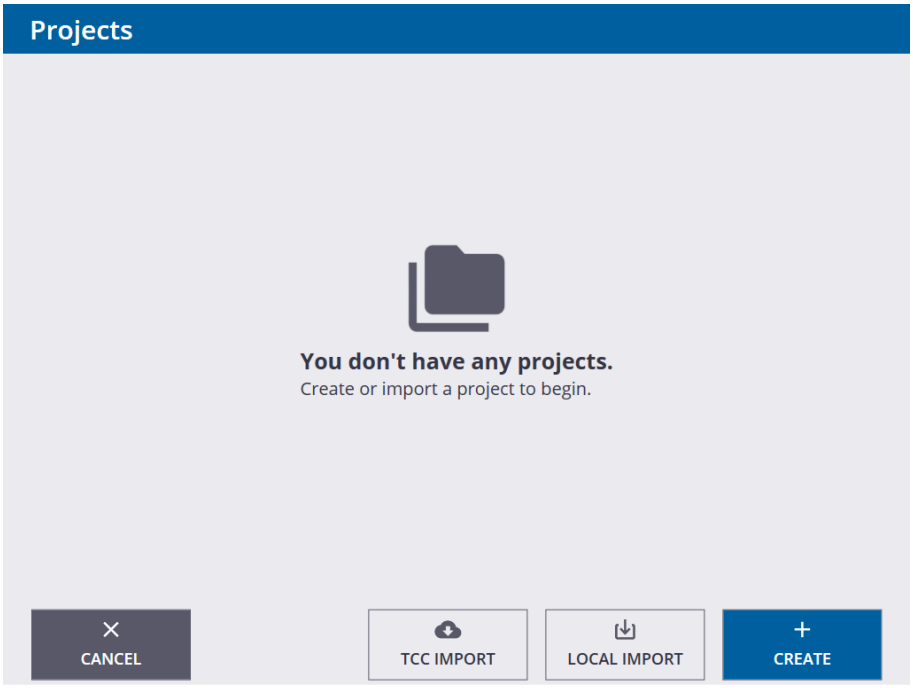
Project Setup

Accessing the Project Setup menu

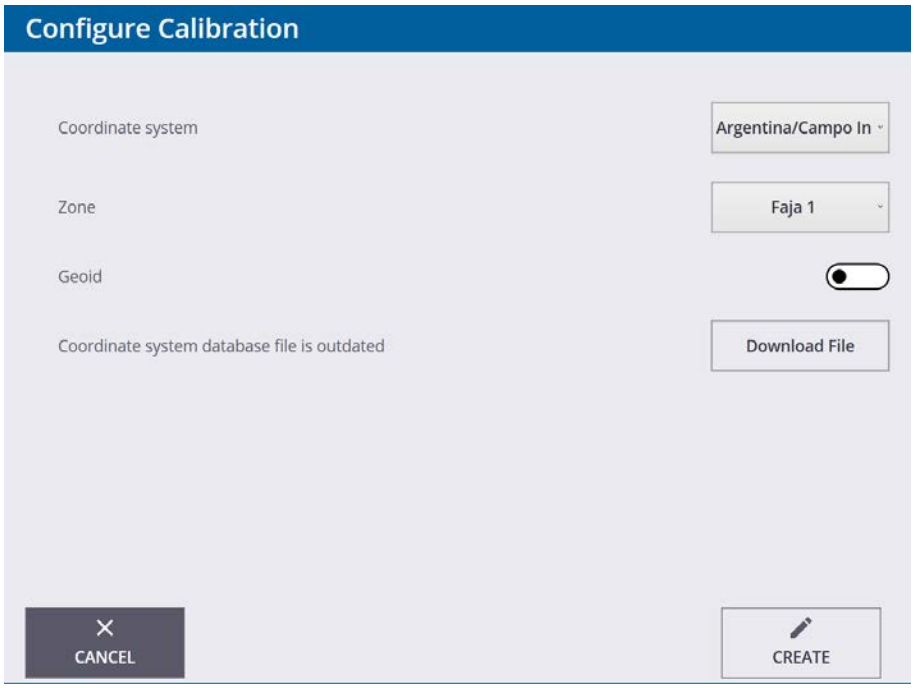
Once signed into the Groundworks software, a new project can be created in the **Project Setup** screen.

Tap ☰ / **Project Setup**.

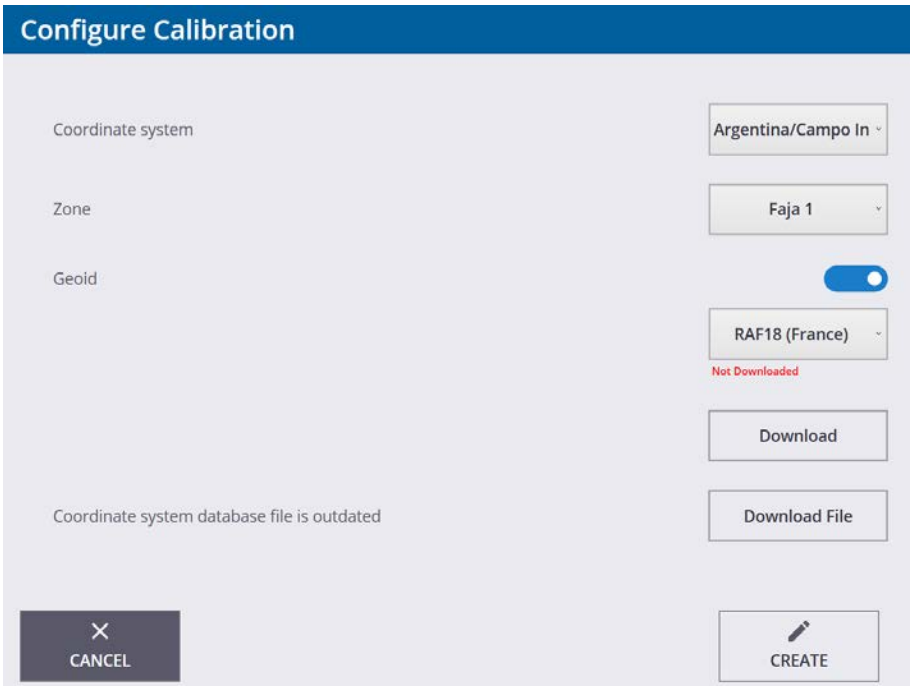
If no projects exist, the following screen appears with these options:



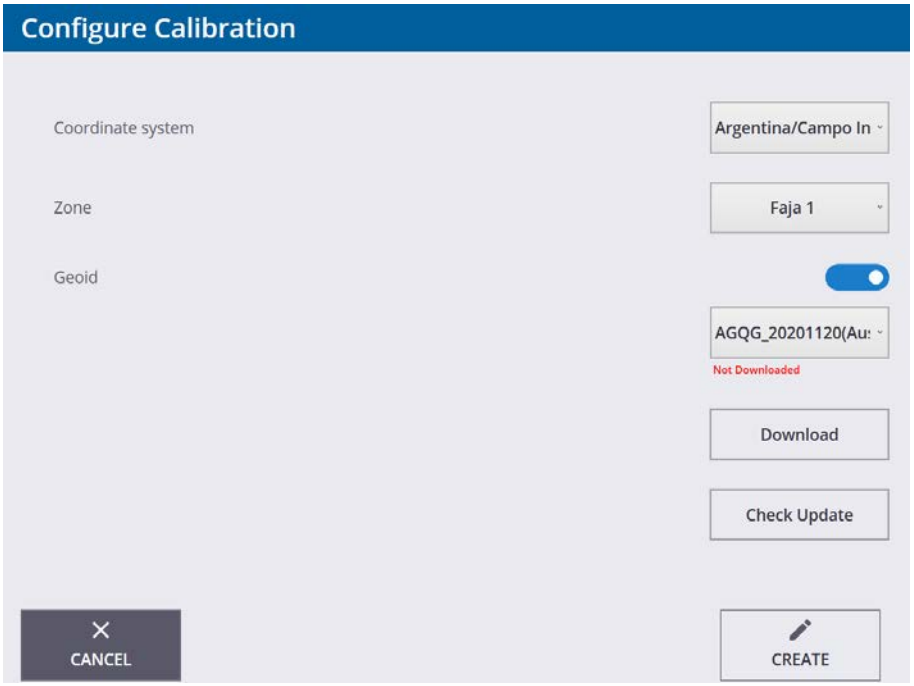
- **TCC IMPORT**: Tap to sync a project from Trimble Connected Community (TCC). Requires internet access and valid TCC credentials.
- **LOCAL IMPORT**: Tap to import a project from a computer or USB drive.
- **CREATE**: Tap to create a new project.
  - Set the Project name.
  - The new project has options to use calibrations. Set up the calibration options for the new project:



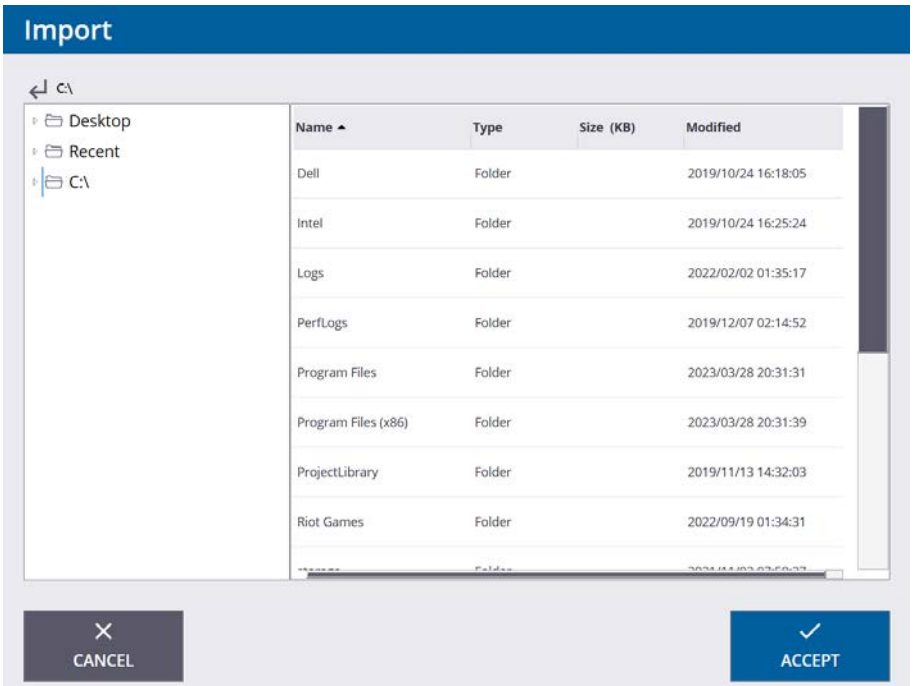
- **Create** – use build-in coordinate system/zone/geoid to create your project.
- **Coordinate system** – selection of coordinate systems from the database.
- **Zone** – based on your coordinate system selection, zones are available.
- **Geoid** – selection of a geoid from the database. If the selected geoid is not currently available in the local display, the software will prompt a message that the selection is not downloaded. The download button appears and if the display has an internet connection, the geoid will download from the Trimble database.



- **Check update** – The Groundworks software checks to see if the coordinate system database has the latest version. Otherwise download the file by tapping **Download** to make sure you have the latest version.

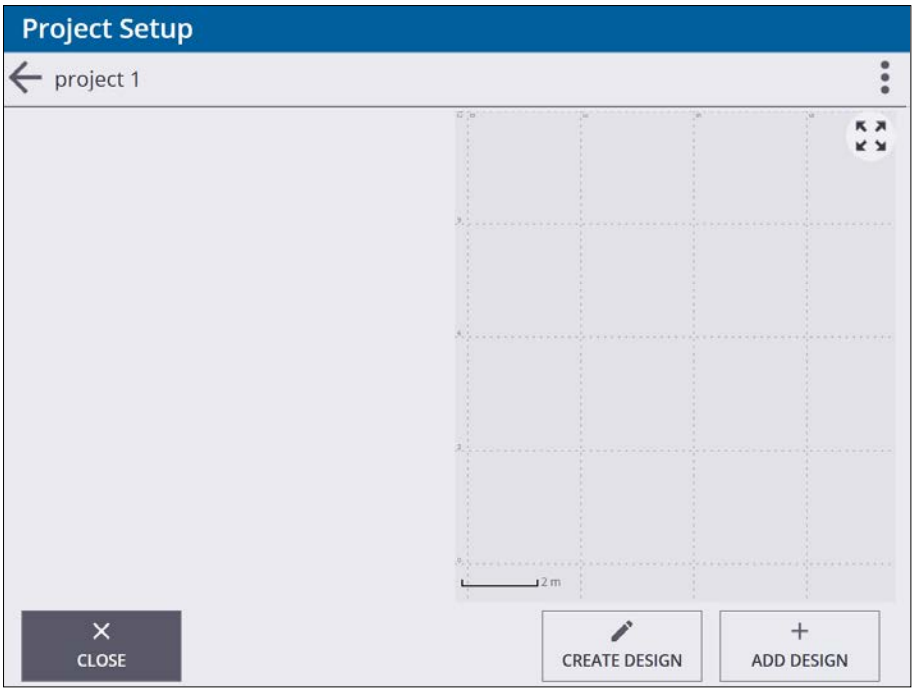


- **Import** – import a .dc file that contains the calibration information of the project.



- **No** – does not create any calibration file for the project.

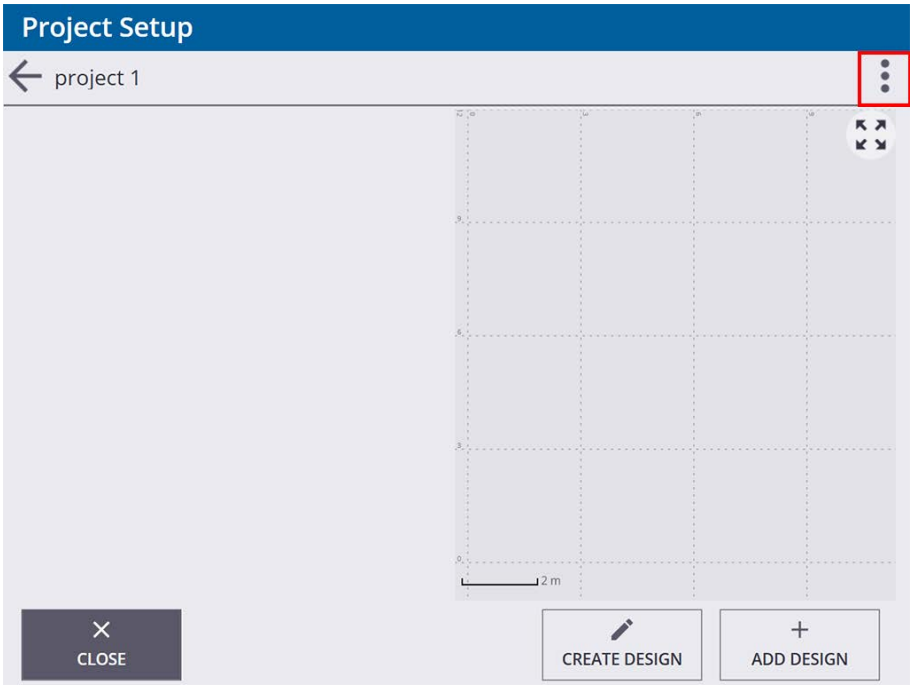
Once a project has been created, the **Project Setup** screen appears:



Working with projects

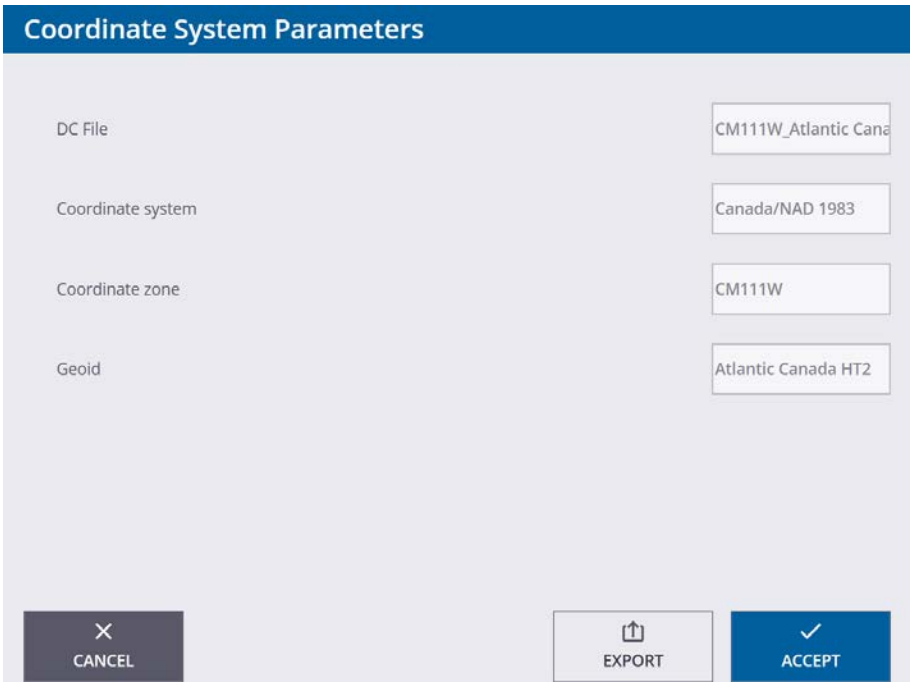
Checking for project information

On the **Project Setup** screen, tap the three dot icon on the top right corner.



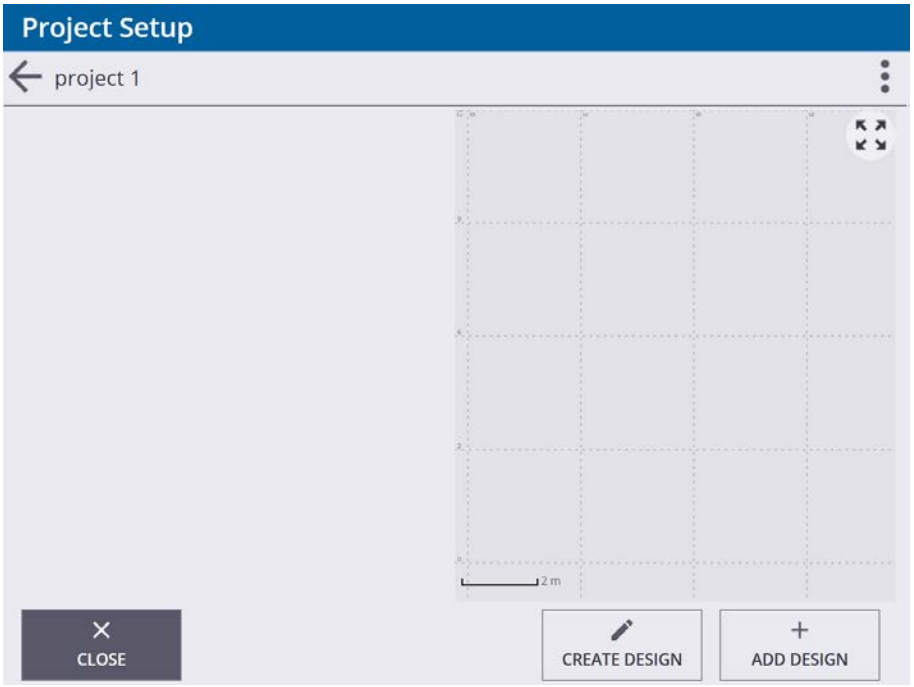
This opens a new screen that shows:

- DC file name
- Coordinate system
- Coordinate zone
- Geoid

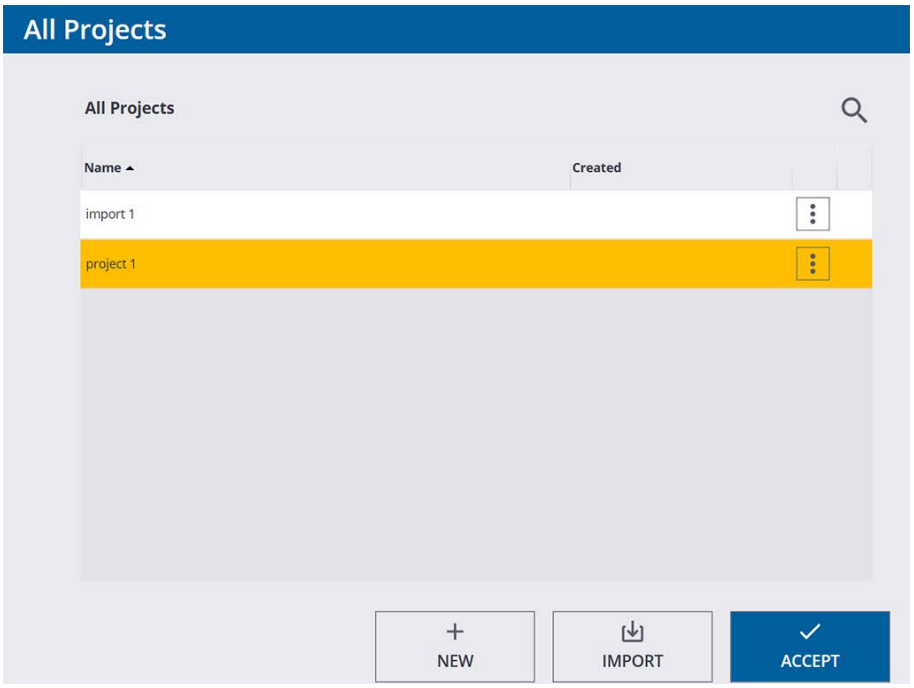


Creating a new project

1. On the **Project Setup** screen, tap the back arrow to reveal selection of other projects or creating a project.



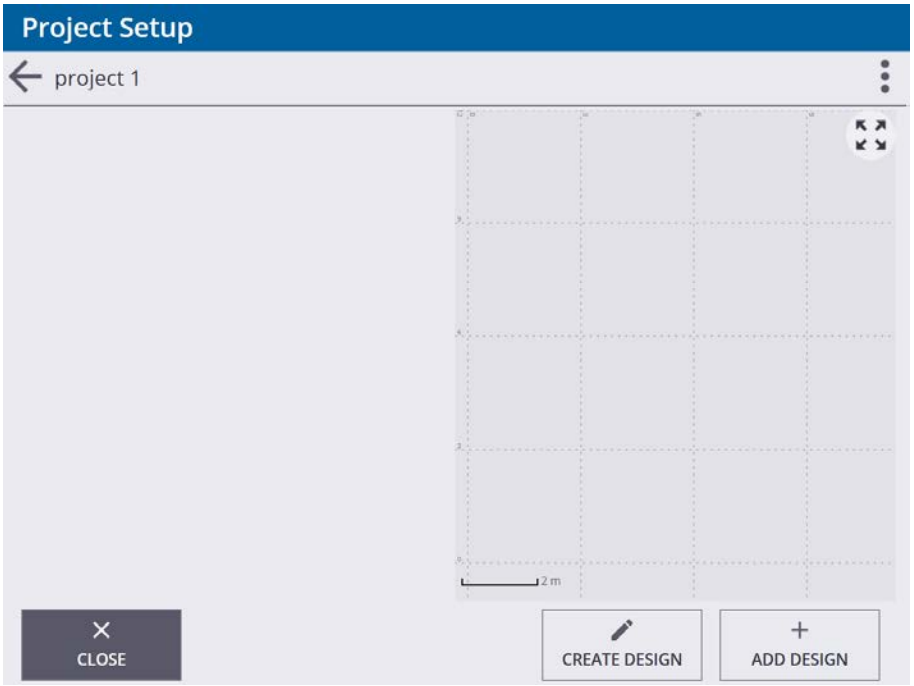
2. Tap **NEW**.



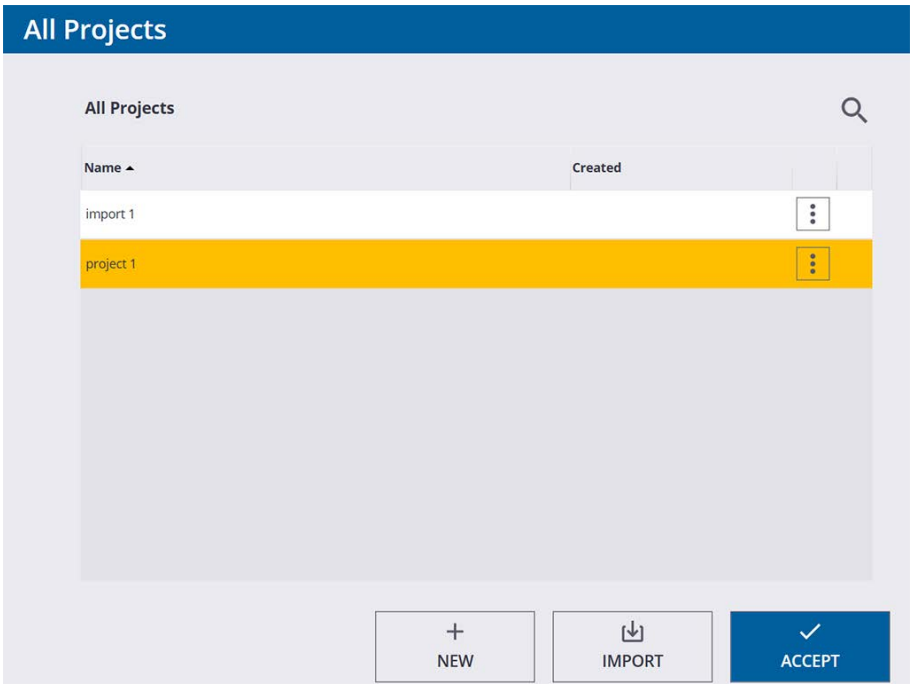
3. Follow the prompts to enter a project name and select a published coordinate system or import a site calibration (.DC file) to create the new project.

Importing a project

1. On the **Project Setup** screen, tap the back arrow next to **Project**.



2. Tap **IMPORT**.

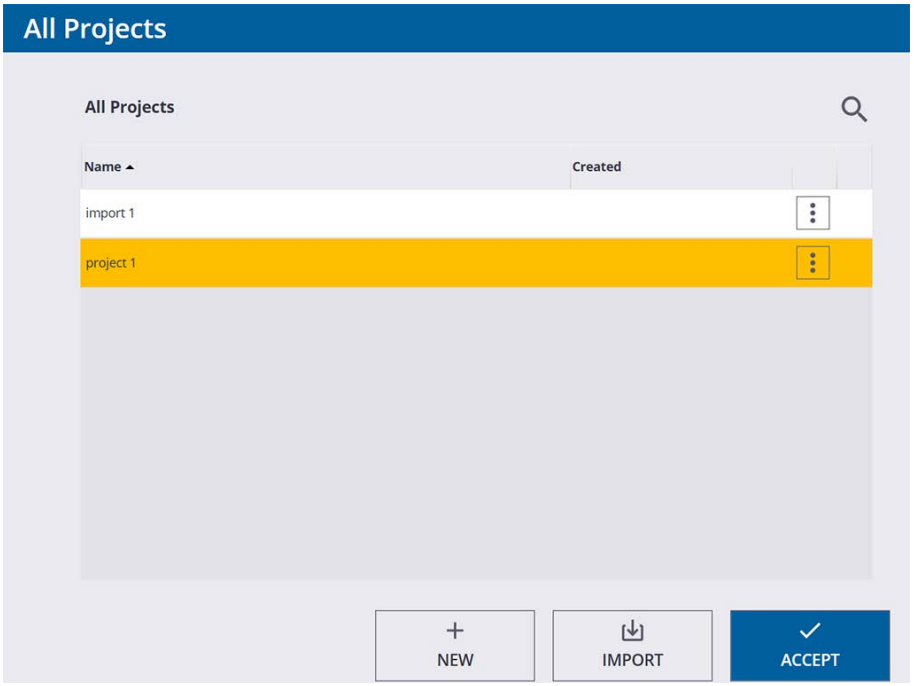


3. Browse your computer or USB drive for the project folder and tap **ACCEPT** to import it.

> **NOTE –** Groundworks imports the selected folder regardless if it is in the correct folder structure or contains usable data.

Selecting a project to make it the active project

1. On the **Project Setup** screen, tap the back arrow next to **Project**.
2. Select the correct project from the list and tap **ACCEPT** to make it active.



Adding a design

> **NOTE –** Starting from Groundworks v2.0, design and drill/pile plans no longer have to be separated but can be contained in one single VCL file.

Supported filed types:

- VCL – Trimble proprietary file from Trimble Business Center
- .xml – IREDES standard files from other software
- LandXML – CAD drawings
- .CSV – must follow a specific guideline (refer to support note: CSV support for drilling, piling, and CFA)

ID;X,Y;Z;Orientation;Inclination;Rotation;Length
1;1;7;9;1.23;1.23;1.23;9.99
2;2;6;10;1.23;0;1.23;9.99
3;3;5;11;1.23;1.23;1.23;9.99

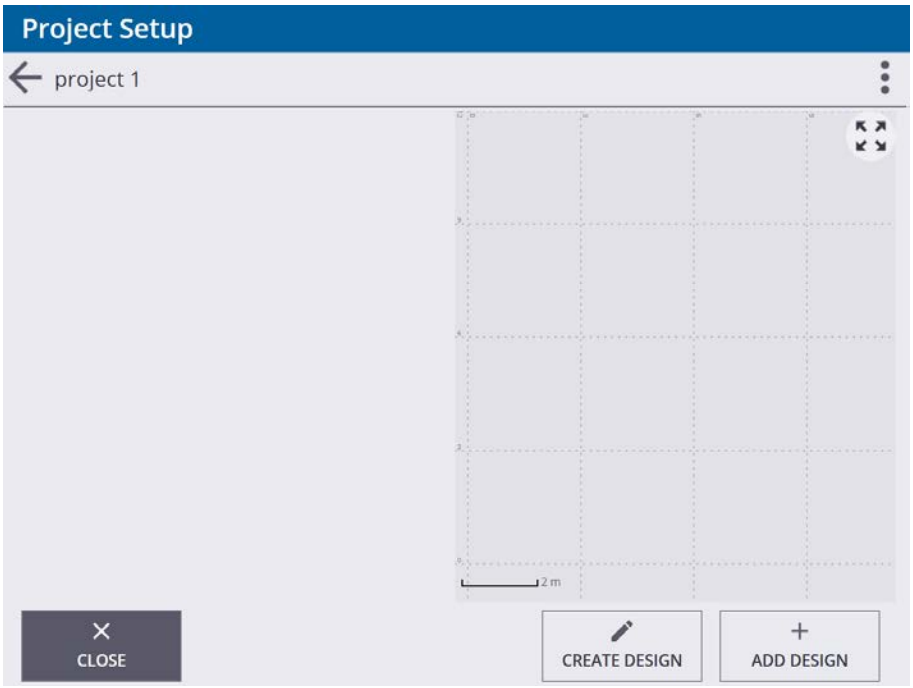
1. Refer to the screenshot below and remove all items highlighted in red in the example.
2. Open the CSV file using Notepad.
3. Go to the **Edit** menu and click **Select All** to highlight the entire content of the file.
4. Open the **Replace** dialog from the **Edit** menu.
5. In the "Find what" field, delete any content and enter a comma (,).
6. In the "Replace with" field, enter a semicolon (;).
7. Click **Replace All** to change all commas to semicolons.
8. **Save** the modified file and **Exit** Notepad.

You should now be able to import the CSV design into Groundworks.

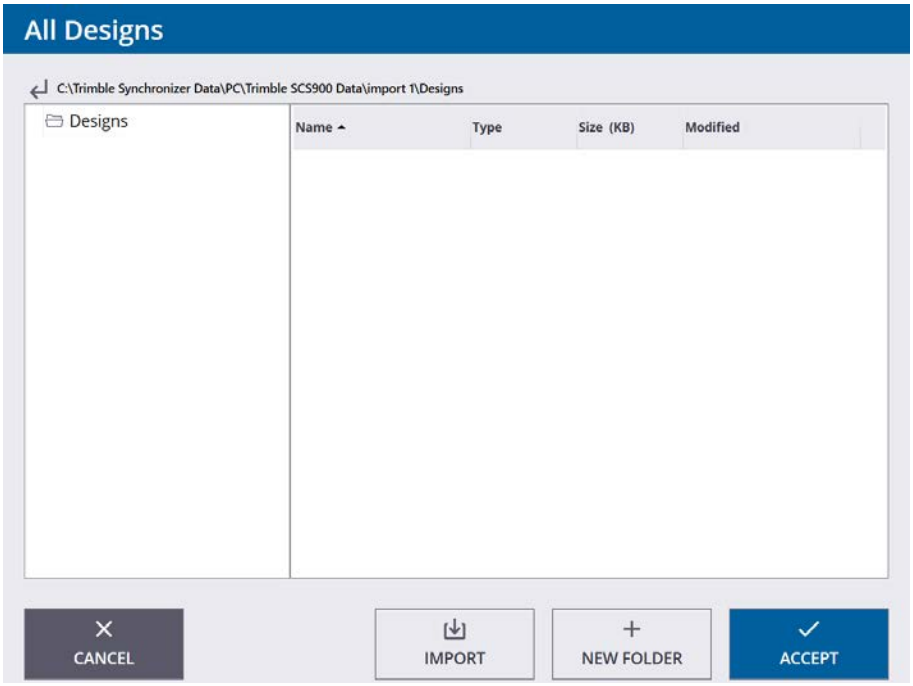
H14

	A	B	C	D	E	F	G
1	Point Num	Northing	Easting	Top of Pos	Point Type		
2	1	1571352	1613934	993.17	Start Post		
3	2	1571337	1613934	993.16	Post		
4	3	1571322	1613934	993.14	Post		
5	4	1571307	1613934	993.13	Post		
6	5	1571292	1613934	993.11	Post		
7	6	1571267	1613934	993.09	Post		
8	7	1571251	1613934	993.07	Post		
9	8	1571236	1613934	993.06	Post		
10	9	1571219	1613934	993.04	Post		
11	10	1571206	1613934	993.03	End Post		
12	11	1571167	1613934	993.89	Start Post		
13	12	1571152	1613934	993.84	Post		
14	13	1571137	1613934	993.8	Post		
15	14	1571121	1613934	993.75	Post		
16	15	1571107	1613934	993.71	Post		
17	16	1571082	1613934	993.64	Post		
18	17	1571066	1613934	993.59	Post		
19	18	1571051	1613934	993.55	Post		
20	19	1571034	1613934	993.5	Post		
21	20	1571021	1613934	993.46	End Post		
22	21	1571352	1613965	992.42	Start Post		
23	22	1571337	1613965	992.43	Post		
24	23	1571322	1613965	992.43	Post		
25	24	1571307	1613965	992.44	Post		
26	25	1571292	1613965	992.44	Post		
27	26	1571267	1613965	992.45	Post		
28	27	1571251	1613965	992.45	Post		
29	28	1571236	1613965	992.46	Post		
30	29	1571219	1613965	992.46	Post		
31	30	1571206	1613965	992.47	End Post		
32	31	1571167	1613965	993.28	Start Post		
33	32	1571152	1613965	993.29	Post		

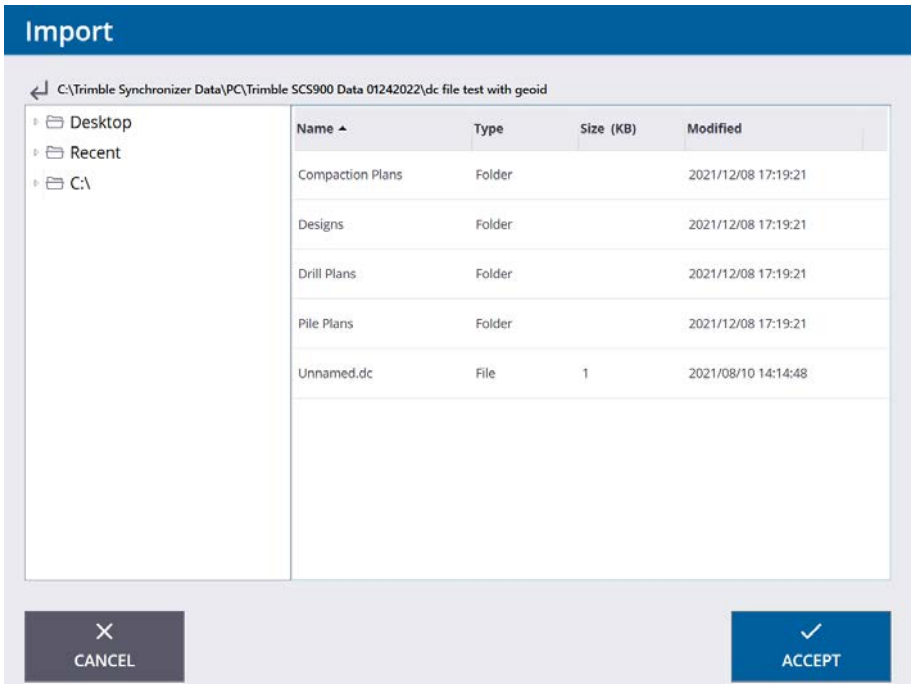
1. On the **Project Setup** screen, tap **ADD Design**.



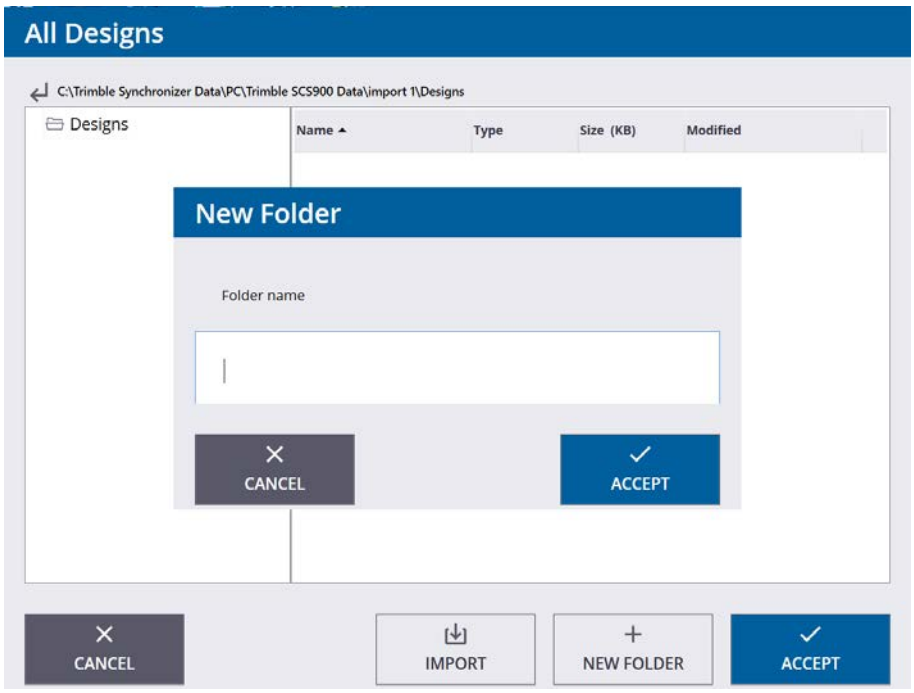
2. In the dialog that appears, select the required option:

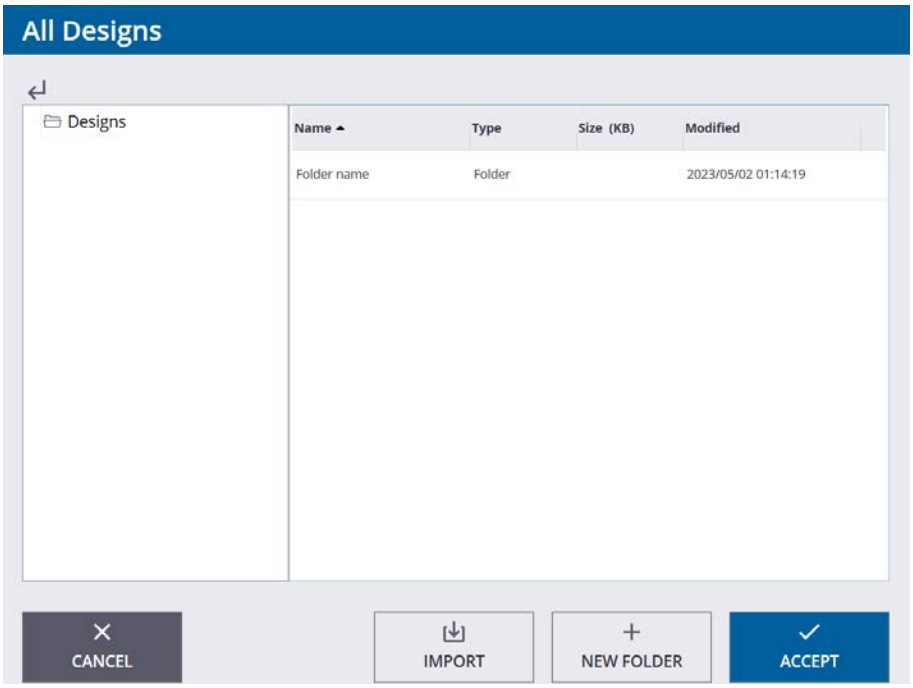


- **Import** – Browse your PC or USB drive and highlight the design. Then tap **ACCEPT** to import it.

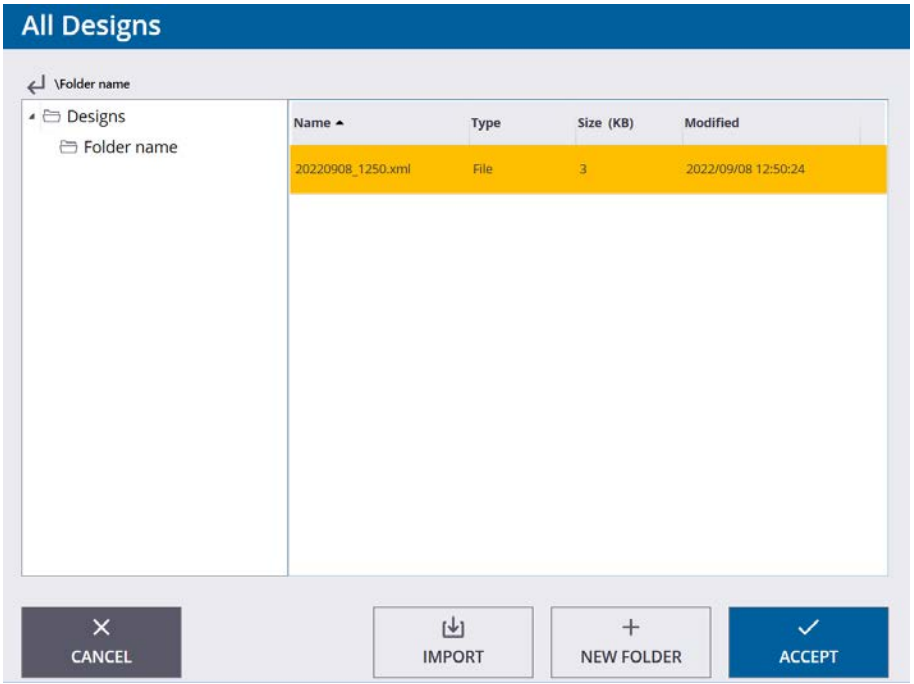


- **New Folder** – creates a new folder to keep all designs in a single folder structure. Otherwise it would be part of the list.





3. Select the design from the list and tap **Accept** to make it active.

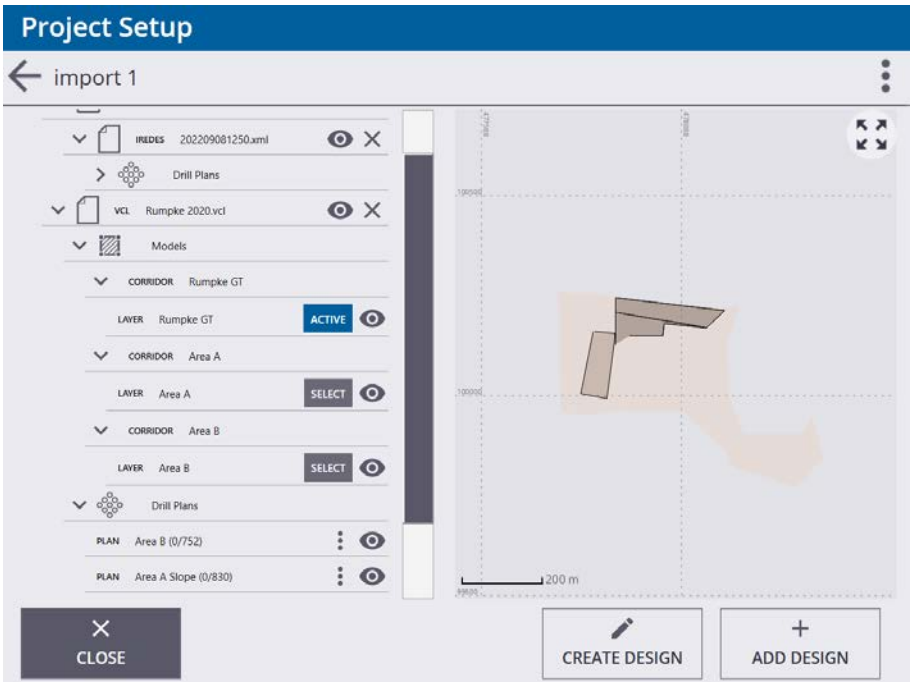


NOTE – Tap ✕ next to Design to deselect it if you are not using a design.

Selecting a design/layers/drill plans

1. On the **Project Setup** screen, tap .

   You can view multiple layers, designs at once.



2. To hide unwanted drill plans or layers, tap .

   NOTE – Tap ✕ next to Drill Plans to deselect it if you are not using a drill plan.

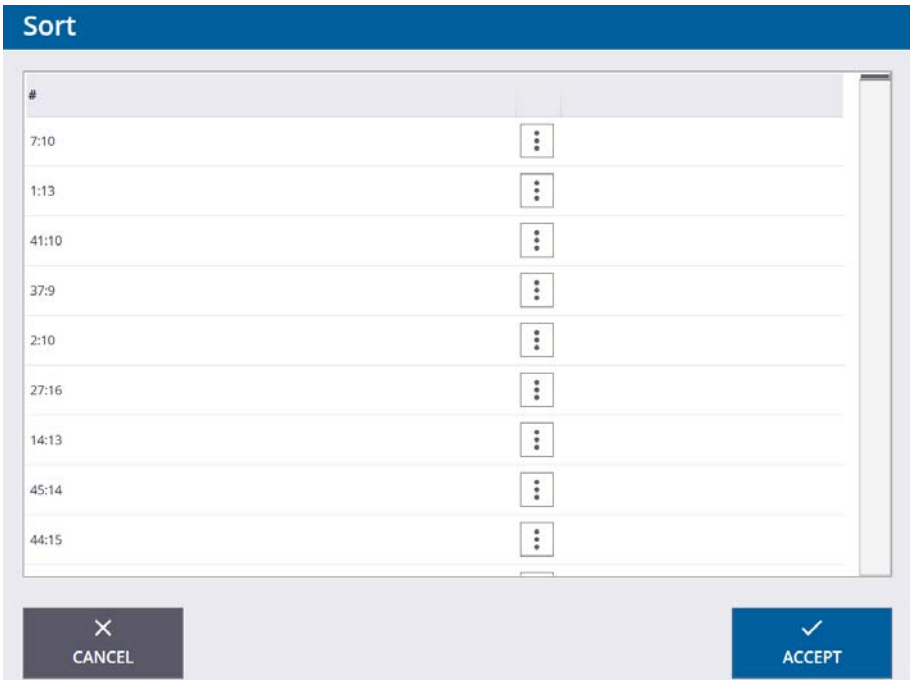
Deleting/exporting data

When you have selected a project or design, tap ⋮ next to the data to see options to delete or export:

export – exports data as a vcl file to a desired location

Push to TCC – pushes the design to a TCC location

sort– sorts the automatic selection of the drill hole to target



NOTE – To sync files using the Trimble Connected Community (TCC) software, see page 74.

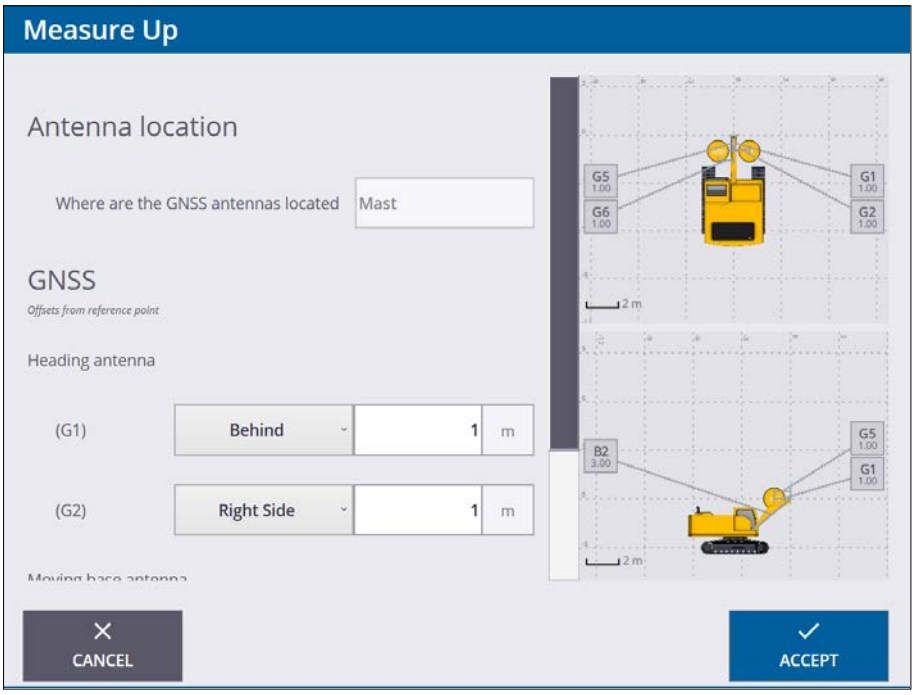
4

Measure-Up Values

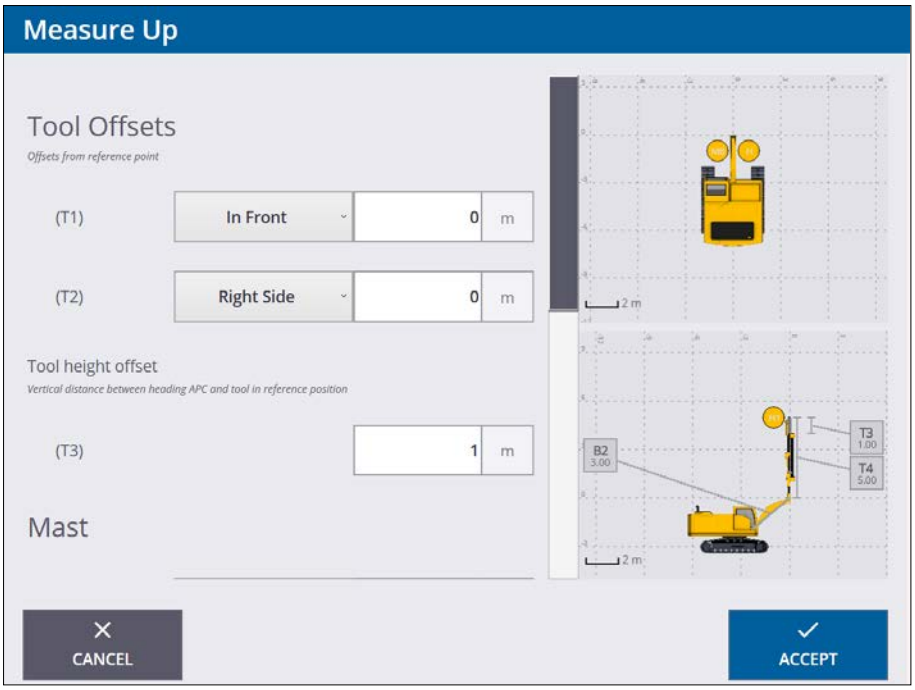
The **Measure Up** menu is located in **Settings** and allows you to enter measure-up values for the machine. For step-by-step instructions, please refer to the *Groundworks Measure Up Guide*.

1. Tap ☰ / **Settings** / **Measure Up**.
2. Enter the appropriate values and tap **ACCEPT** to save the values.

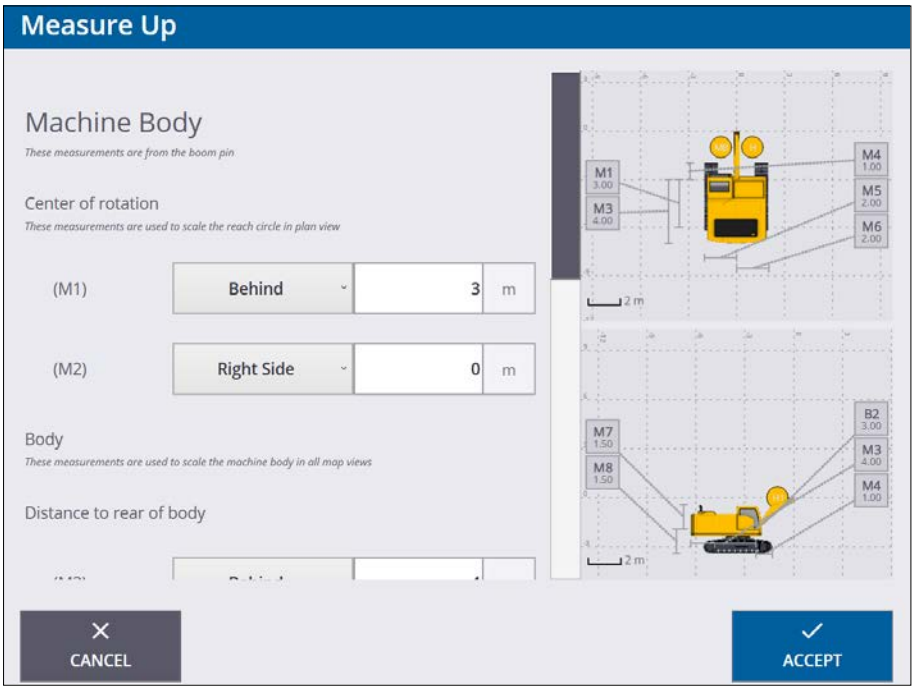
- **GNSS** – Measure-up values related to GNSS antennas.



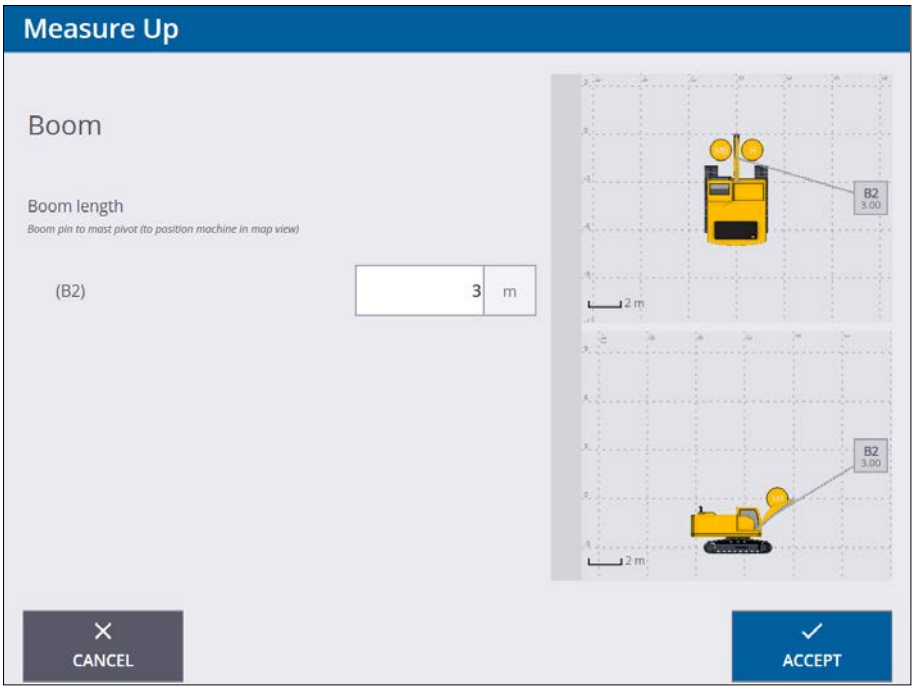
- **Tool** – Measure-up values related to tool offsets and mast information.



- **Body** – Measure-up values related to the body; it does not affect the Groundworks software calculation. The measure up of the body is mainly used for avoidance zone and visualization of the graphics.

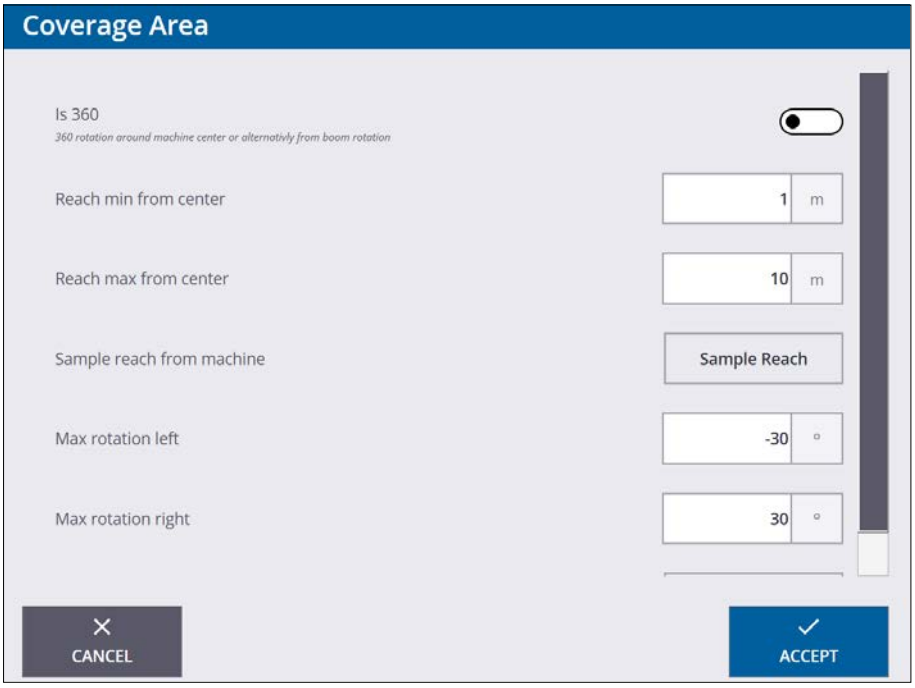


- **Boom** – Measure-up values related to the boom length.



- **Coverage Area** – Measure-up value to determine the minimum and maximum distance and rotation of the machine. This shows in the Groundworks software the area the machine can reach from the current location.

  The operator can manually enter the distance or use the **Sample reach from machine** / **Sample rotation from machine** to determine the maximum distance by moving the machine to min and max reach and/or rotation value to automatically populate the min and max values.



5

Sensor Setup

There are many sensor combinations that can be used, but only the sensors that have been installed must be enabled and calibrated.

All sensor calibration requires that CAN is connected on the Connections screen.

Enabling a sensor tells the Groundworks software that the sensor should be present in the CAN sensor chain. If an enabled sensor stops communicating or is not present, the software displays a lost connection notification and will not allow normal operation.

The **Sensor Setup** menu is located in **Settings** and allows sensor setup and calibration.

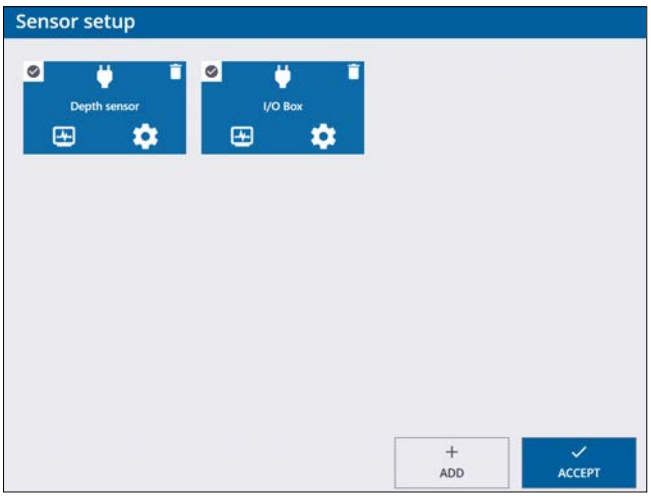
To access the **Sensor Setup** menu, tap ☰ / **Settings** / **Sensor Setup**.

Configuring sensor setup for drilling, piling, and CFA piling machines

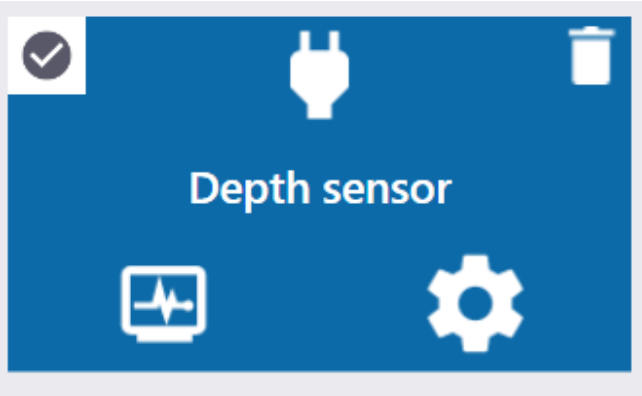
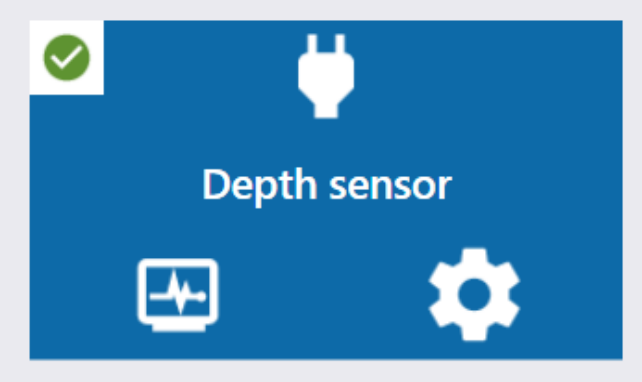
Follow these steps to correctly configure the **Sensor Setup** screen for drilling, piling, and CFA piling machines.

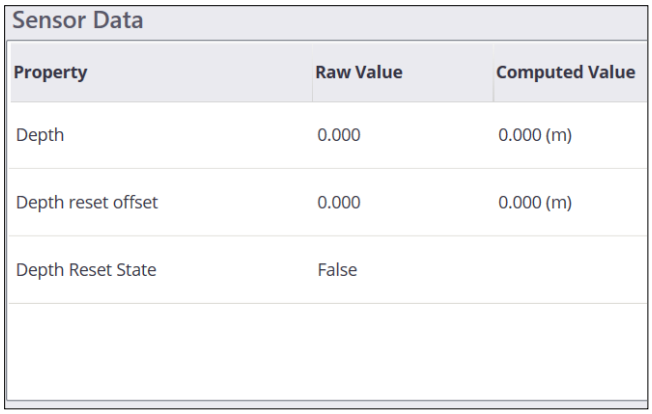
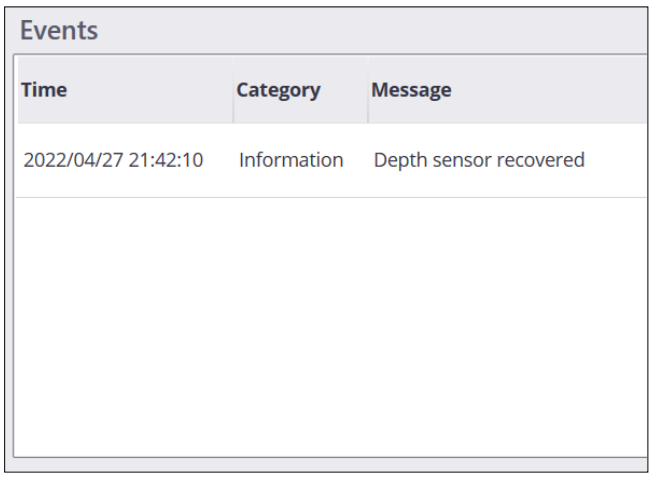
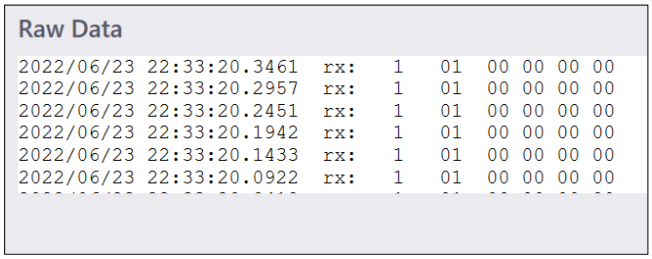
Configuring a sensor

Starting from Version 1.6, the sensor setup has been modified. You can now add the sensors used on the machine using the **ADD** button located on the bottom of the **Sensor setup** screen.



Based on the machine selected, the selection of sensors in the **Add** button can change.

Action	Description
Add	Press **+ Add** to add additional sensors. You can select the following sensors: • I/O box • Tilt sensor (mast/leader) • Depth Sensor (CAN, Acuity, SICK) • Boom extension 1 • Boom extension 2 • Pile Rotation • Energy • Downforce For Body solution: • Tilt sensor (body) - only applied when machine selection is a body mount • Boom Joint • Boom Pivot • VA Boom Pivot • Stick Pivot
Indication	When the sensor is connected, the top left corner changes from gray to green.  

Action	Description
Delete	Press  on the top right corner to delete the sensor that is unused.
Status	Press  to see the following information: • **Sensor Data** – Raw and computed values  • **Events** – Any events related to the specific sensor selected are shown in a single location  • **Raw Data** – CAN stream 
Sensor Setup	Press  to set up the sensor. This section allows calibration of the sensor.

Sensor Data

Property	Raw Value	Computed Value
Depth	0.000	0.000 (m)
Depth reset offset	0.000	0.000 (m)
Depth Reset State	False	

Events

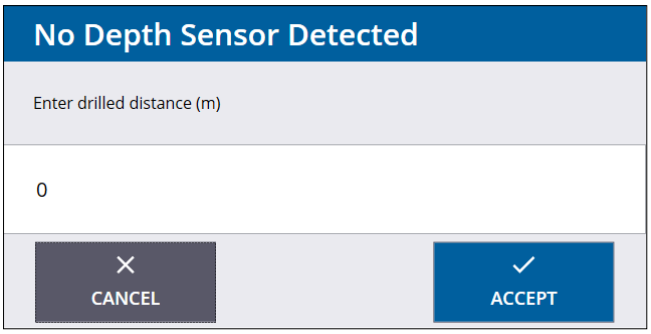
Time	Category	Message
2022/04/27 21:42:10	Information	Depth sensor recovered

Raw Data

```
2022/06/23 22:33:20.3461  rx:   1   01  00 00 00 00
2022/06/23 22:33:20.2957  rx:   1   01  00 00 00 00
2022/06/23 22:33:20.2451  rx:   1   01  00 00 00 00
2022/06/23 22:33:20.1942  rx:   1   01  00 00 00 00
2022/06/23 22:33:20.1433  rx:   1   01  00 00 00 00
2022/06/23 22:33:20.0922  rx:   1   01  00 00 00 00
```

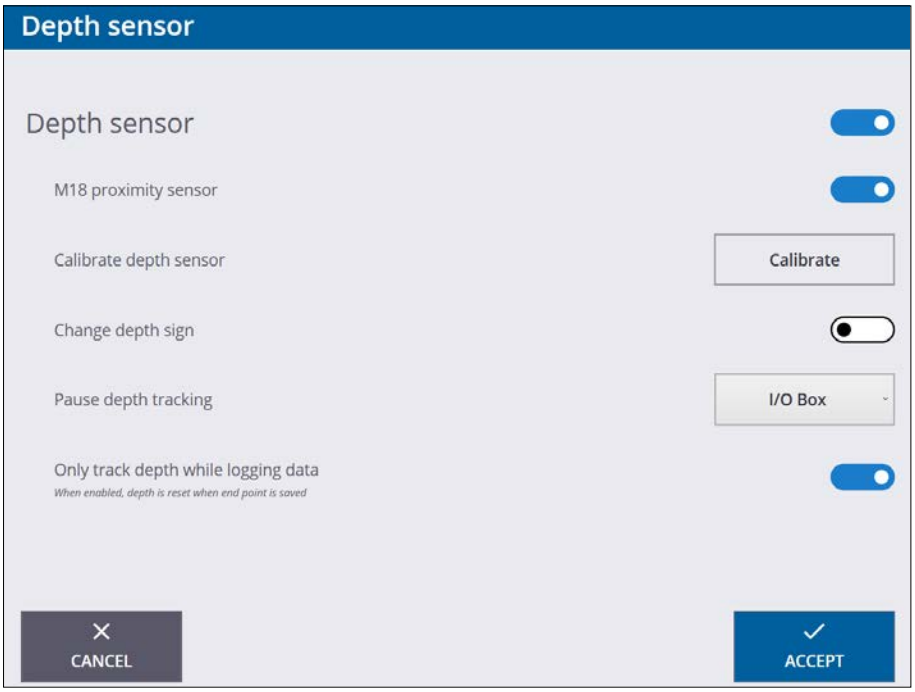
Depth sensor

Enable the depth sensor if installed. If disabled, an additional option appears to manually enter the depth value once the end point is saved.



> **TIP –** This can be useful if an existing OEM depth sensor is installed and the depth from that system will be manually entered into the Groundworks software.

To configure the depth sensor:

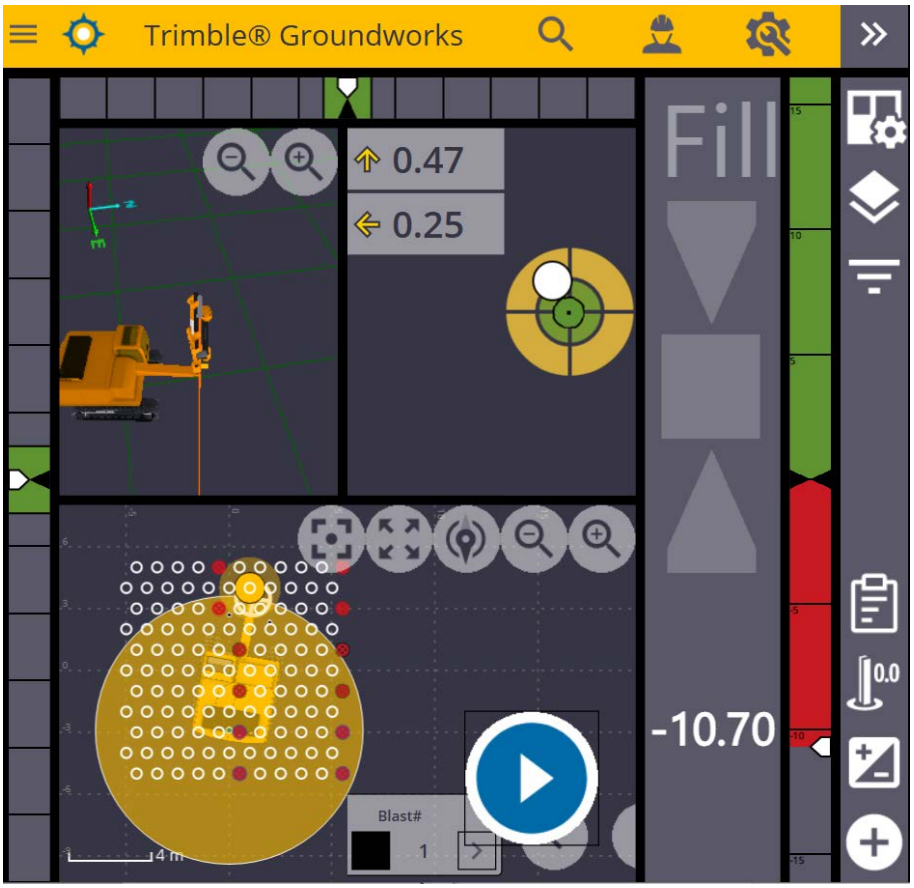


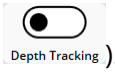
1. **M18 proximity sensor**.

   Enabled – The proximity sensor automatically resets the depth sensor at the tool in reference position. A reference position is where the depth sensor reads zero as a computed value.

   Disabled – The 

icon will appear in the toolbar and allow the operator to manually reset the depth sensor.



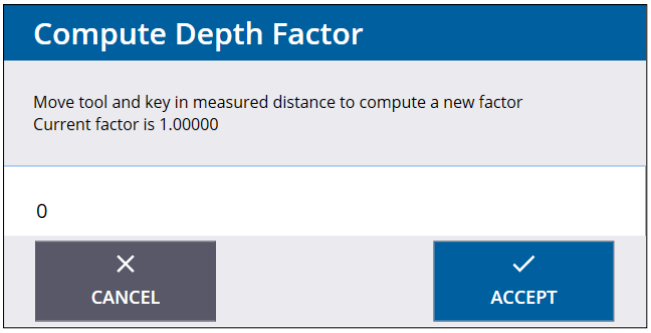
2. **Calibrate depth sensor**: Tap **Calibrate** and follow the prompts to compute a depth factor for the depth sensor. For more information, see Depth sensor calibration, page 46.
3. **Change depth sign**: Enable after depth sensor calibration if the tool elevation is increasing, but the software is showing that tool elevation is decreasing.
4. **Pause depth tracking**: The following options are available for operations that require depth tracking to be paused during operation, for example, steel changes for drilling or re-gripping pile for piling:
   - **Off** – Select for single-pass operations where depth tracking does not need to be paused/resumed.
   - **Manual** – Select if depth tracking will be paused/resumed manually using the depth tracking icon ().
   - **I/O Box** – Select if the I/O Box is installed and inputs will be used to pause/resume depth tracking. If selected, ensure that the I/O Box inputs are correctly configured on the **Sensor Setup** screen.
5. **Only track depth while logging data**: This option appears if the I/O Box is selected. When disabled, the tool elevation will be tracked at all times during operation and allows the I/O Box output Steel in ground to be used for drilling. If enabled, the tool elevation will only be tracked while logging data, and the offsets stored while pausing/resuming depth tracking will be cleared once the end point is saved.

TIP – If depth tracking is working correctly while drilling, but incorrectly tracks offsets on retraction, enabling the **Track depth while logging data** option will fix the issue.

Depth sensor calibration

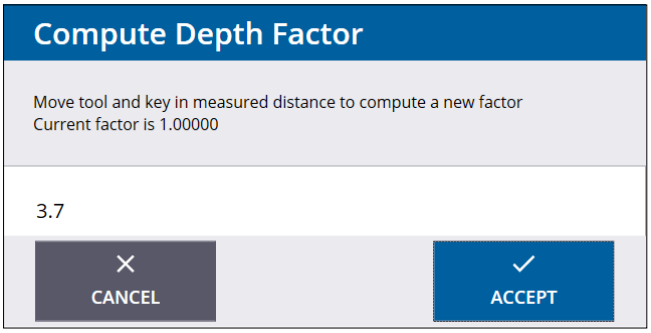
Follow these steps to calibrate the depth sensor once CAN is connected on the **Connections** screen:

1. In the **Sensor Setup** screen, tap **Calibrate** next to the **Calibrate depth sensor** option. The following screen appears:



> **NOTE –** The current factor is displayed to show what is being used. By default, the value is set to 1.0 and seeing this value indicates that a calibration has never been saved.

2. Follow the prompts to move the tool a known distance, and then enter that distance:



> **TIP –** For the most accurate calibration, use the longest distance possible.

3. Tap **ACCEPT**.

> **NOTE –** The computed depth factor is not stored in the sensor. It is stored in the Groundworks software under the machine profile, so replacing the depth sensor should not require a re-calibration.

Depth sensor calibration - Laser

Groundworks v2.0 supports the following hardware for use as a depth sensor:

Acuity AS2100E

SICK Dx100

To calibrate the Laser depth sensor:

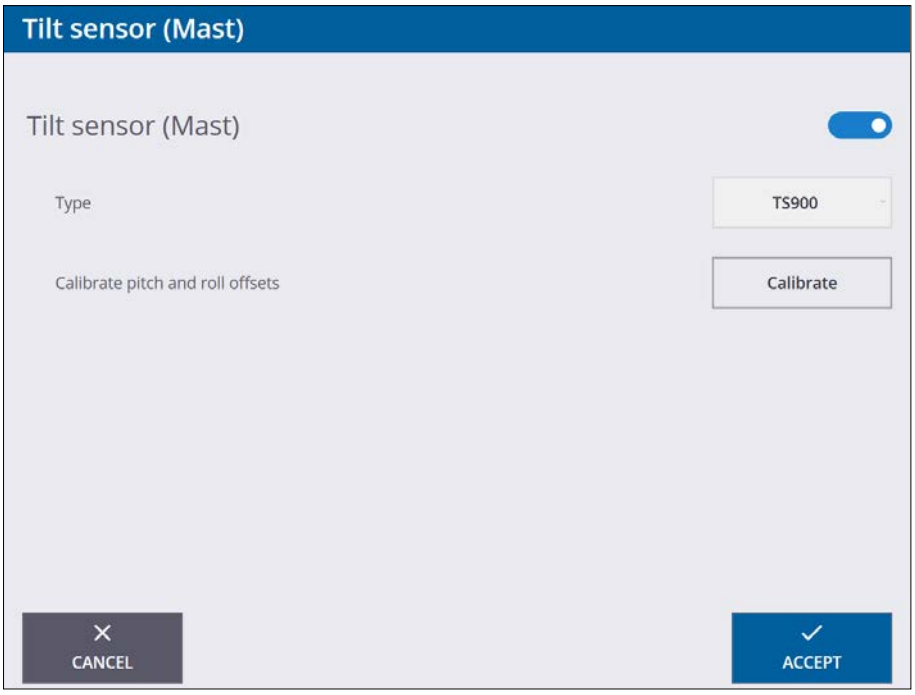
1. Change **Depth SIgn** toggle (similar to rotary encoder depth sensors).
2. Reset Laser at closest strikeplate distance.

3. Move the strikeplate as close as possible to the laser and “RESET” Laser.

Tilt sensor (mast/leader)

If installed, enable the tilt sensor (mast/leader) to track the mast/leader inclination. If disabled, the software will assume the mast/leader is plumb.

For more information, see Tilt sensor calibration, page 50.

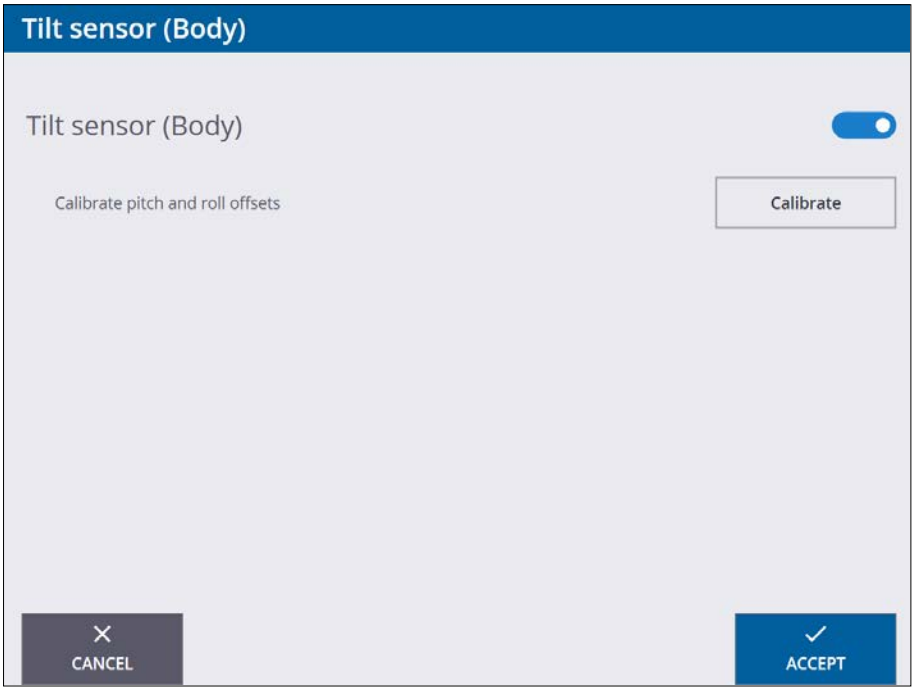


Tilt sensor (body)

Only applies for installations with antennas mounted on the body

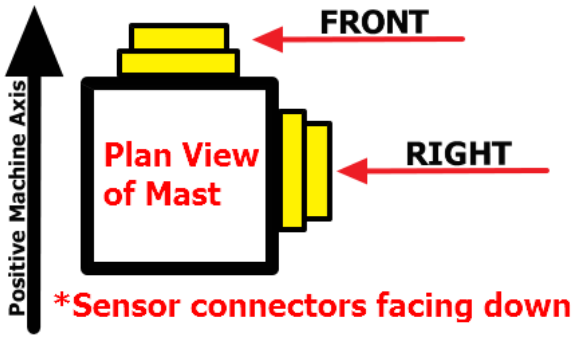
If installed, enable the tilt sensor (body) to track the machine body inclination. If disabled, the software assumes the machine body is level. By default, the tilt sensor is configured as a mast tilt sensor and if used, must be configured as a body tilt sensor. For more information, see CAN Node Configuration, page 62.

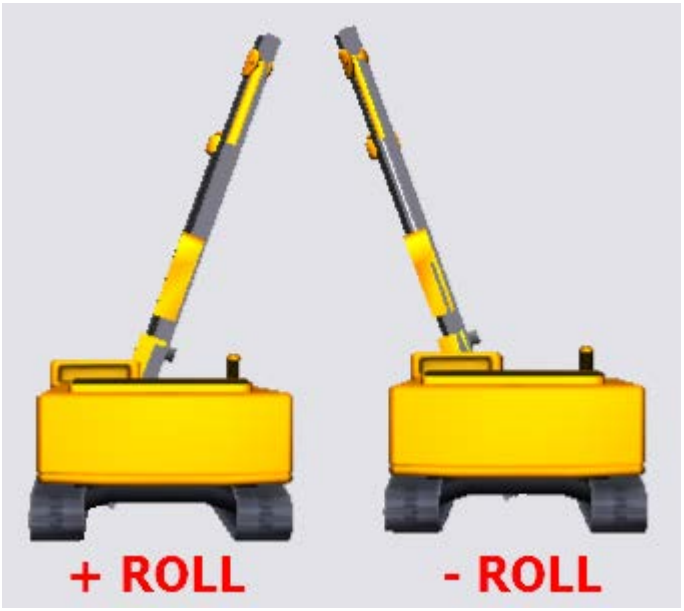
For more information, see Tilt sensor calibration, page 50.



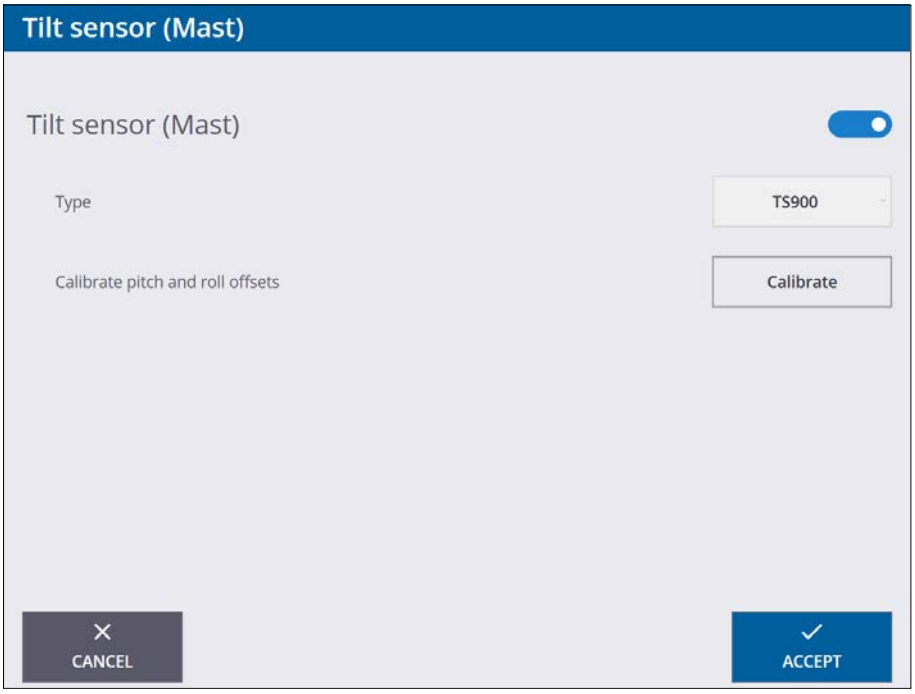
Tilt sensor calibration

Place the machine on flat ground and have a digital level ready to use. The same steps can be followed for calibrating the mast/leader tilt sensor or the body tilt sensor if applicable. See the diagrams below to understand Groundworks terminology for sensor location and ± pitch and roll angles:

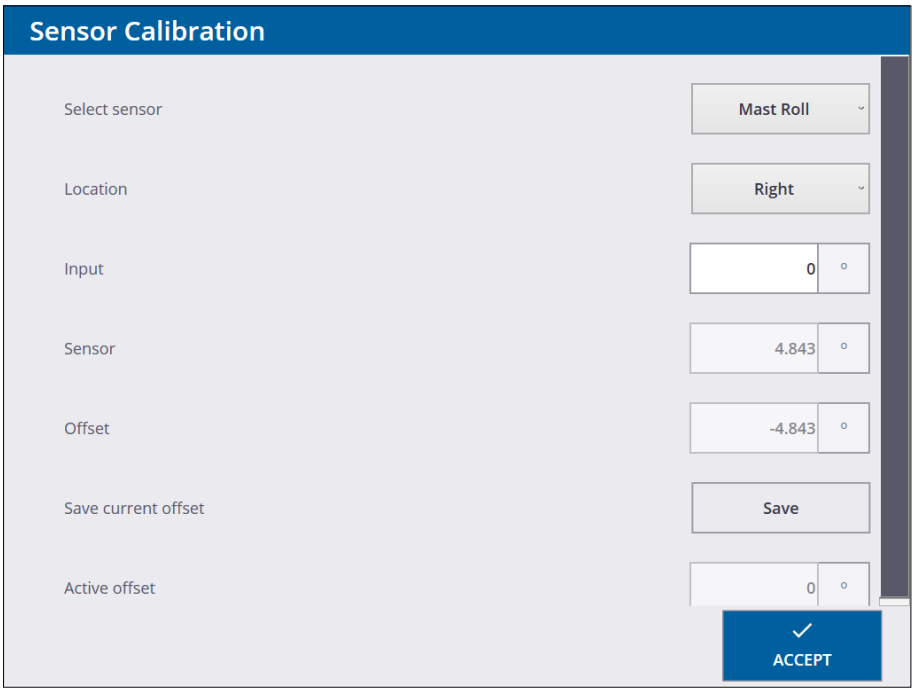




To calibrate the tilt sensor once CAN is connected, on the **Connections** screen:

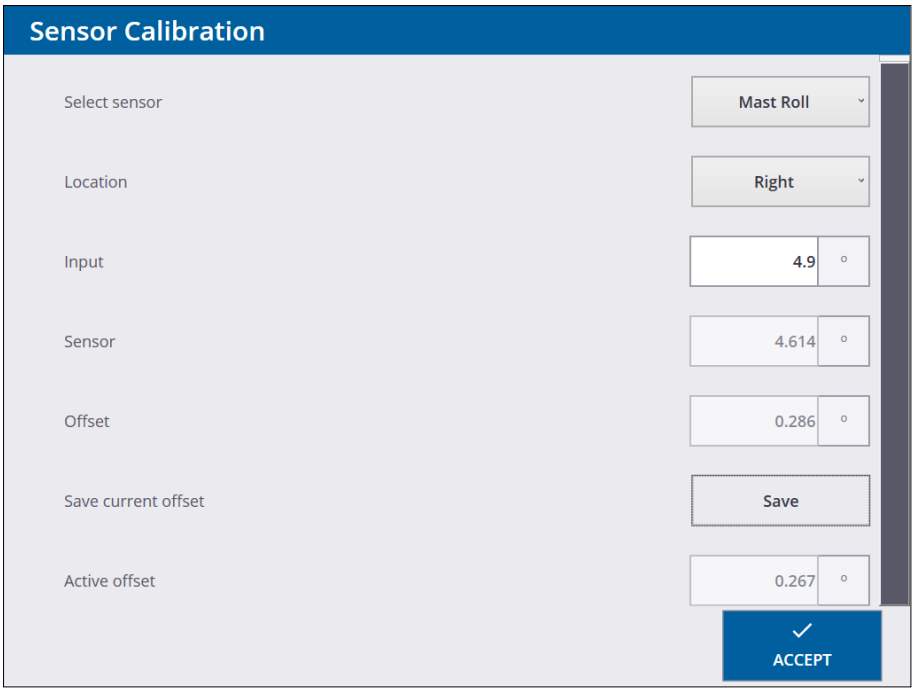


1. In the **Sensor Setup** screen, tap **Calibrate** next to the **Calibrate pitch and roll offsets** option for the tilt sensor.

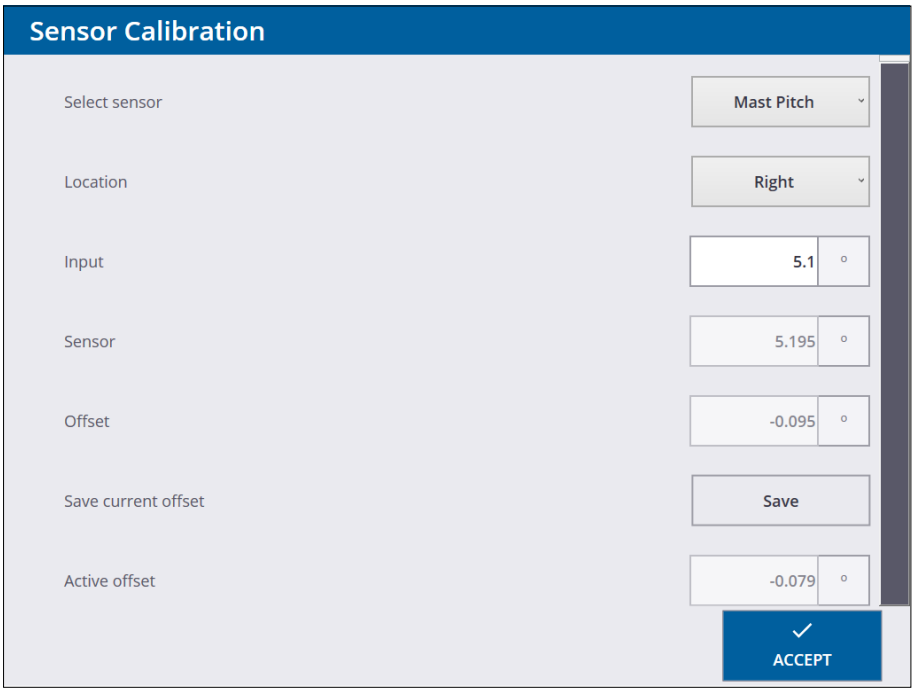


2. Select **Mast Roll**.
3. ***Before*** doing the sensor calibration, ensure that you select the correct sensor location based on the mounting location.
4. Tilt the mast roughly +5˚ in roll axis while keeping the mast roughly 0˚ in pitch axis.
5. Place the digital level against the left/right side of the mast and enter the reading as a value from plumb into the **Offset** field.

6. Tap **Save** next to the **Save current offset** option to update the active offset value.



7. Select **Mast Pitch**.
8. Tilt the mast roughly +5˚ in pitch axis while keeping the mast roughly 0˚ in roll axis.
9. Place the digital level against the front/back of the mast and enter the reading as a value from plumb into the **Offset** field.
10. Tap **Save** next to the **Save current offset** option to update the active offset value.



11. Tap **ACCEPT**.

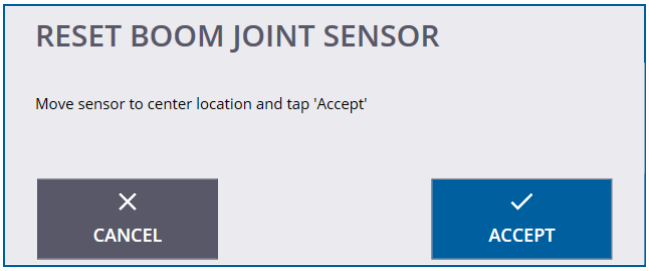
NOTE – The calibrated offset values are not stored in the sensor. They are stored in the Groundworks software under the machine profile, so replacing the tilt sensor(s) should not require a re-calibration.

Boom joint sensor

Only applies for installations with antennas mounted on the body

If installed, enable the boom joint sensor to track the boom swing. To configure the boom joint sensor:

1. **Location**: Select **Clockwise** if the back of the sensor is facing the ground.
2. Tap **Calibrate**.
3. Follow the prompts to move the boom joint to the center position.



4. Tap **ACCEPT**.

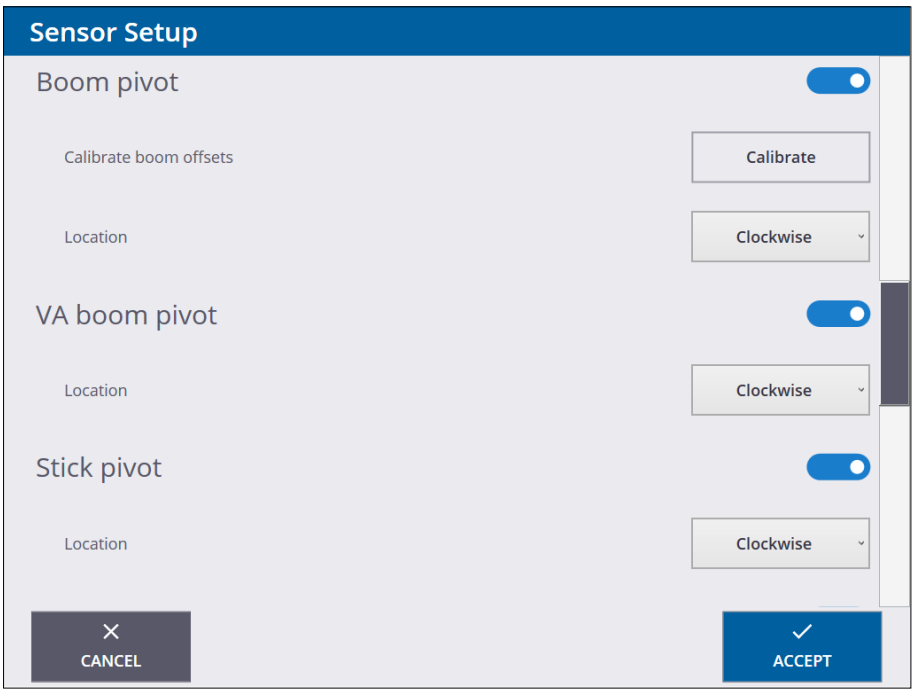
Boom/VA Boom/Stick pivot sensors

Only applies for installations with antennas mounted on the body

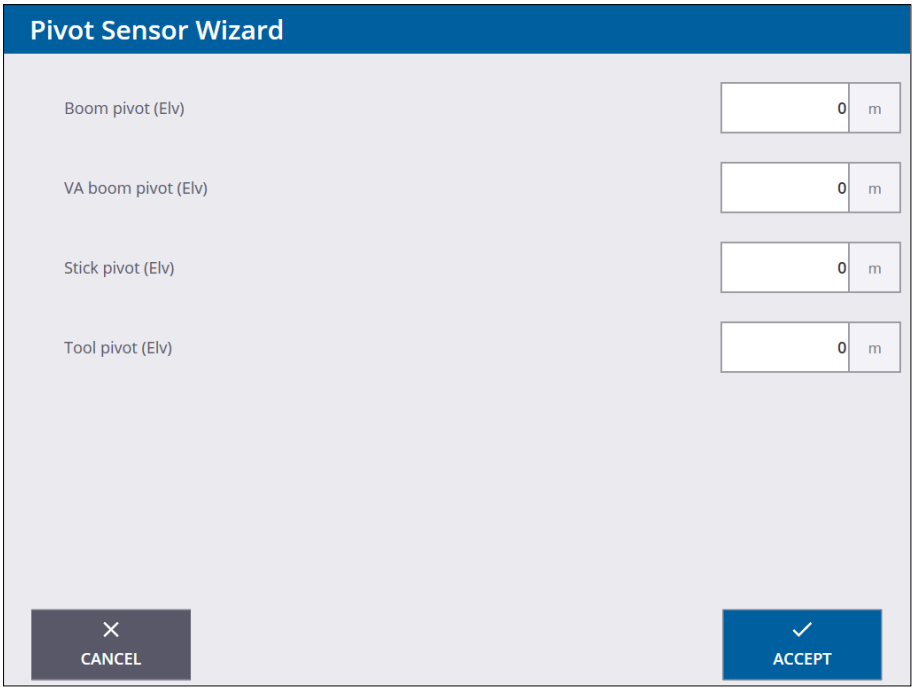
If installed, enable the appropriate sensors to track boom, VA boom, and stick angles. By default, the boom rotation sensor is configured as a boom joint sensor and must be configured as a boom pivot, VA boom pivot, or stick pivot sensor if used. For more information, see CAN Node Configuration, page 62.

To configure the boom, VA boom, and stick sensors:

1. **Location**. Select **Clockwise** if mounted on the right side of the boom with the back side of the sensor facing away from the boom.
2. Once all the installed sensors are enabled with the correct location, while the machine is on level ground, place the mast firmly on the ground and tap **Calibrate** next to the **Calibrate boom offsets** option in the **Boom pivot** section.



3. In the **Pivot Sensor Wizard** screen, enter the elevations of the boom pivot (boom pin), VA boom pivot, stick pivot, and tool pivot (mast/leader) to calibrate the pivot sensors. An alternative to entering the elevations is to enter the height of each sensor from the ground.



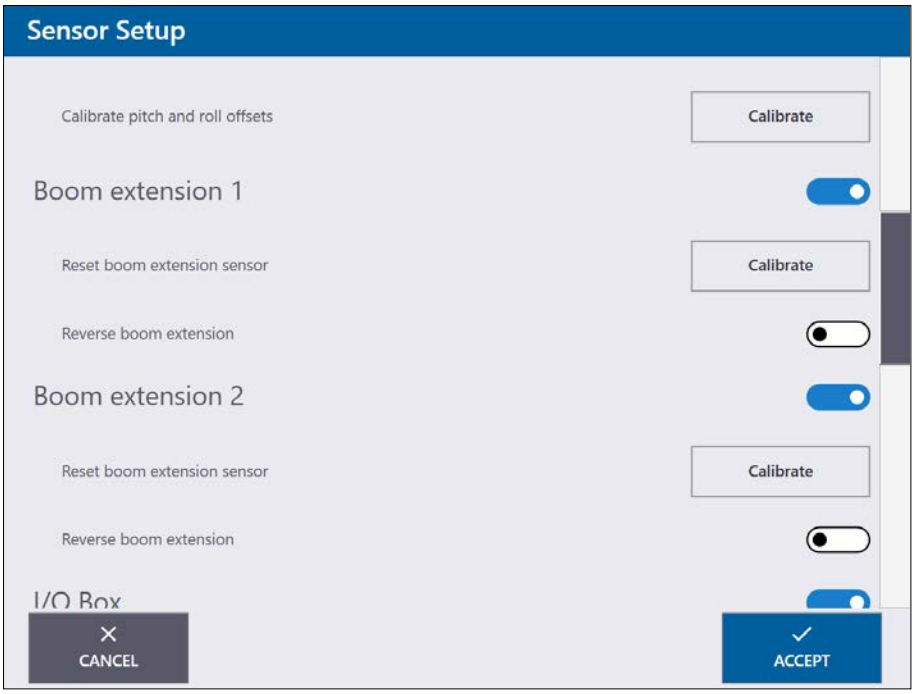
> **NOTE –** The **VA boom pivot** option only appears if a value is entered for the **VA boom length** in the measure-up for the machine.

4. Tap **ACCEPT**.

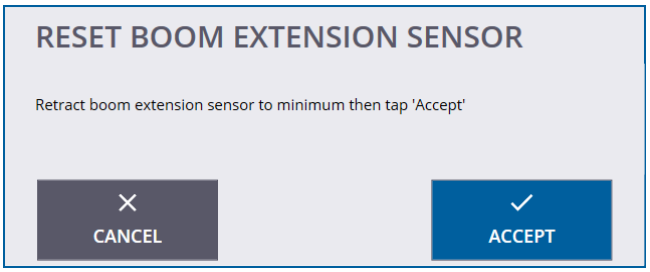
Boom extension sensor

If installed, enable the boom extension 1 sensor to track the mast/leader extension in addition to the depth sensor. To configure the boom extension sensor:

1. If you are using one extension sensor, press the toggle slider to activate **Boom extension 1**. If you require more than five meters of extension on the boom, add on the second boom extension sensor to give a total of ten meters of extension.



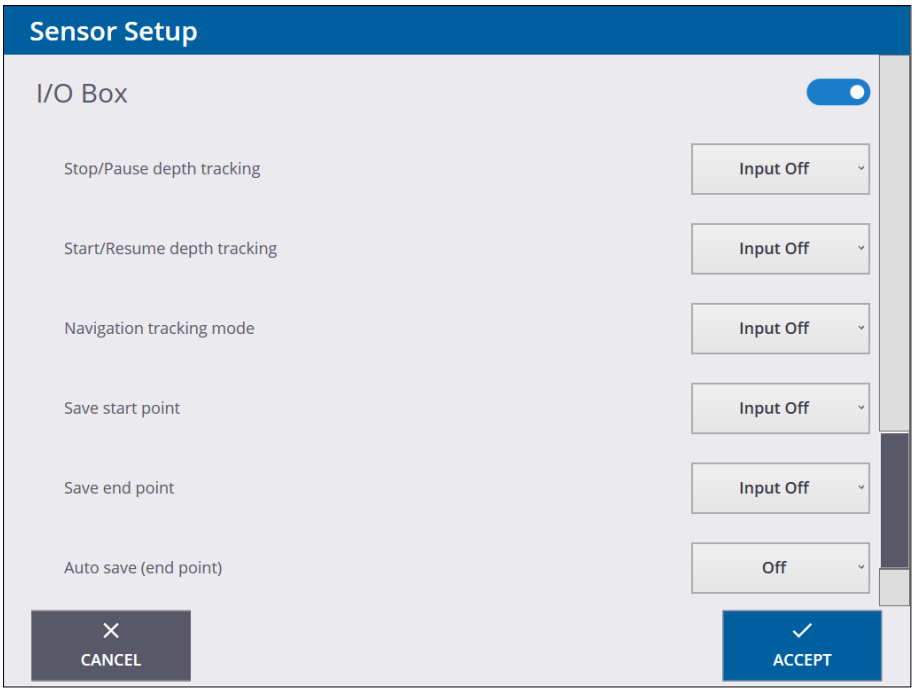
2. Tap **Calibrate**.
3. Follow the prompts to fully retract the boom extension sensor:



4. Tap **ACCEPT**.
5. Enable **Reverse boom extension** if the tool elevation is increasing, but the software is showing the tool elevation is decreasing.

I/O Box

If installed, enable the I/O Box sensor to track inputs or trigger outputs with the software. Ensure it is enabled if the **Pause depth tracking** option for the depth sensor was set to I/O Box.



I/O Box inputs

The I/O inputs can be used to track various software features with an input to the I/O Box.

- **Stop/Pause depth tracking**: Select which I/O Box input will stop/pause depth tracking.
- **Start/Resume depth tracking**: Select which I/O Box input will start/resume depth tracking. If an input is selected to start/resume depth tracking but no input is selected to stop/pause depth tracking, then the depth sensor will only be tracked while it is receiving the selected input once the start point is saved.

  > **TIP –** The most accurate way to track depth is by selecting one input to stop or pause depth tracking and another input to start or resume depth tracking. This ensures continuous tool tracking, even when data is not being logged. For example, in the Trimble DPS900 software (the predecessor to Groundworks), input 2 was wired to the unthreading signal from the drill, pausing depth tracking when a steel change began. Similarly, input 3 was wired to the steel grip open signal from the drill, resuming depth tracking once the steel change was complete.

- **Navigation tracking mode**: Select the I/O Box input that will trigger the software to track the time spent navigating. If this feature is disabled, navigation time will be tracked automatically.
- **Save start point**: Select the I/O Box input that will trigger the software to save the start point instead of tapping .
- **Save end point**: Select the I/O Box input that will trigger the software to save end point instead of tapping .

- **Auto save (end point)**: Select an option to enable the software to automatically save the end point, eliminating the need for manual saving. This action is triggered at different times depending on the selected mode:
  - **Depth Bar** – the end point will be saved once the target elevation is reached.
  - **Blow Count Refusal (piling only)** – the end point will be saved once the blow count refusal has been met.

I/O Box outputs

The I/O Box outputs 1 and 2 can be used to switch the IO/ Box output relays. Select from the available options for output 1 or 2:

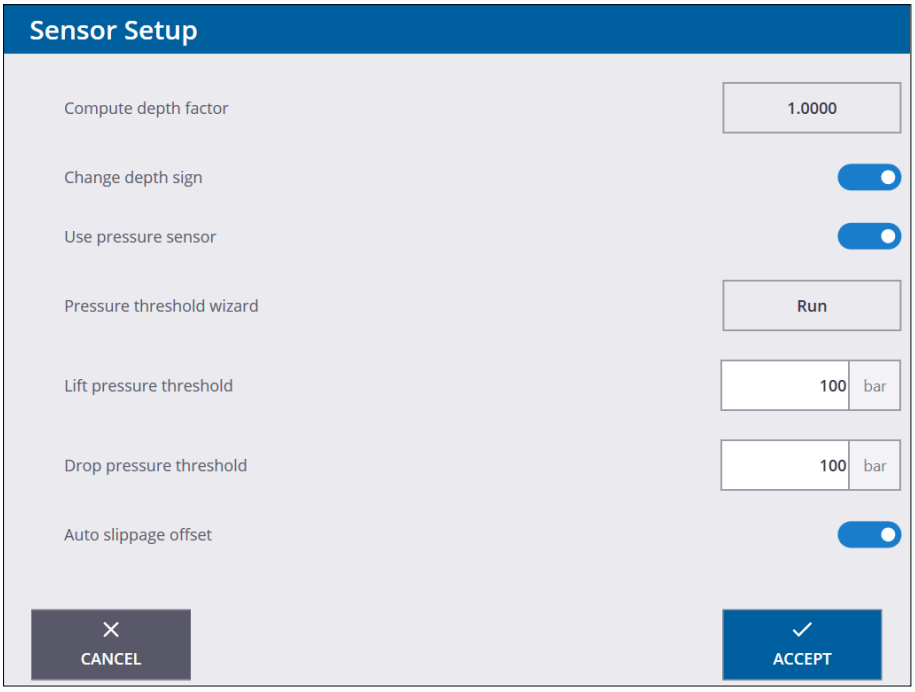
- **Auto Stop**: The relay is activated when the target elevation is reached. Raise the tool 5 cm to deactivate the relay.
- **Avoidance Zone**. The relay is activated when the machine has entered an avoidance zone. Leave the avoidance zone to deactivate the relay.
- **Steel in ground (drilling only)**. The relay is activated when the tool is below the mast foot. Raise the tool above the mast foot to deactivate the relay.

  > **NOTE –** This option will only work if the depth sensor option **Only track depth while logging data** is disabled.

- **Blow Count Refusal (piling only)**. The relay is activated when the blow count refusal has been met. Tap the  icon to deactivate the relay.

Configuring sensor setup for dynamic compaction machines

Follow these steps to correctly configure the **Sensor Setup** screen for dynamic compaction machines.



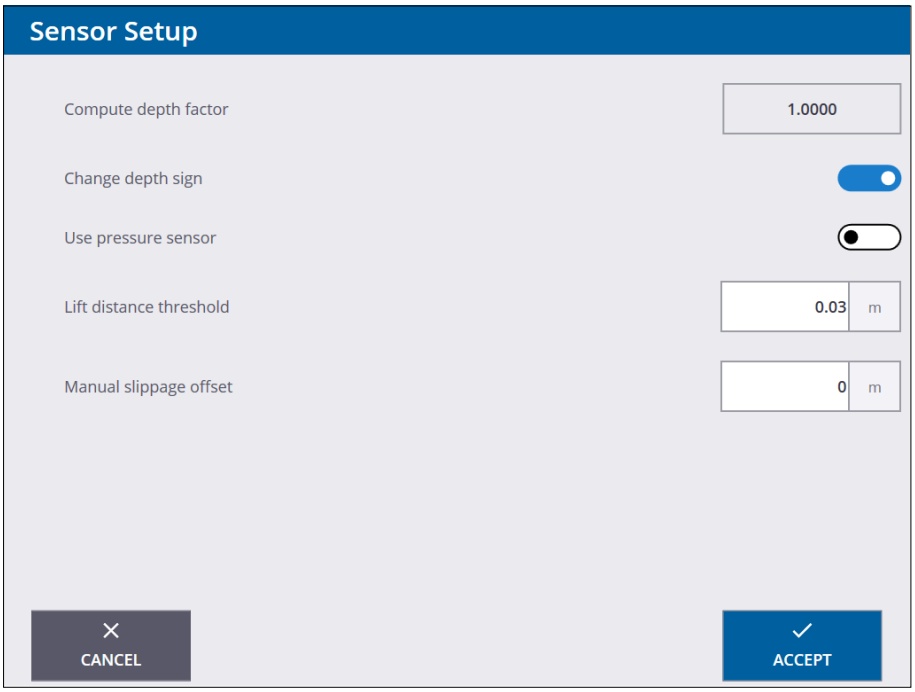
1. **Compute depth factor**: The dynamic compaction machine requires a depth sensor so there is no option to disable it. Tap the box and follow the prompts to calibrate the depth sensor. The current factor will be shown in the box. For more information, see Depth sensor calibration, page 46.
2. **Change depth sign**: Enable after depth sensor calibration if the tool elevation is increasing, but the software is showing that the tool elevation is decreasing.
3. **Use pressure sensor**: Enable if a pressure sensor is installed to track lifts/drops. The pressure sensor must be configured as a cable drum tension pressure sensor before it can be used. For more information, see CAN Node Configuration, page 62.

   When using a pressure sensor, the lifts and drops are detected when specified pressure thresholds are exceeded. Tap **Run** next to the **Pressure threshold wizard** option and follow the prompts to automatically calculate the pressure thresholds.
4. **Lift pressure threshold**: If you are not satisfied with values from the Pressure threshold wizard, manually enter the required pressure to trigger a lift.

5. **Drop pressure threshold**: If you are not satisfied with values from the Pressure threshold wizard, manually enter the required pressure to trigger a drop.
6. **Auto slippage offset**: Enable this option for the software to automatically detect the amount of slippage occurring after each drop to compensate for differences between the actual depth value and the depth sensor value. If disabled, the **Manual slippage offset** option will appear.
7. **Manual slippage offset**: If no pressure sensor is installed or the **Auto slippage offset** option is disabled, this option can be used to offset the vertical offset related to consistent depth sensor slippage.

If no pressure sensor is being used, the lifts/drops are detected when the heading antenna elevation exceeds the **Lift distance threshold** from the GNSS plane. This occurs when the boom deflects as the weight is lifted or dropped. The GNSS plane is set at the elevation of the heading antenna when the operator saves the start point. In order for the GNSS plane to be calculated correctly, the start point must be saved while the weight is on the ground, with no tension on cable so there is no boom deflection.

> **NOTE –** The **Lift distance threshold** option should be adjusted until lifts/drops are being triggered at the correct locations and no lifts/drops are being missed. Decreasing the value results in less accurate lift/drop points and has a higher chance of lifts/drops being falsely triggered. Increasing the value results in more accurate lifts/drop points but has a higher chance of lifts/drops being missed.



6

CAN Node Configuration

For drilling/piling installs where antennas are mounted on the body, drilling installs logging MWD data, or dynamic compaction installations using a pressure sensor, there are sensors that must have their node ID changed from their default node ID. The Trimble CAN Config tool to configure the CAN node ID is installed with the Trimble Groundworks software from the Trimble Installation Manager and is found in: C:\Users\User\Documents\Trimble Groundworks Data folder.

CAN node IDs

The following table shows the CAN sensors with their default node ID and potential node IDs that could be used depending on the installation.

P/N	Description	Default Node ID	Change to Node ID ...
92303-10	Tilt sensor	2 (Mast Tilt sensor)	6 (Body Tilt sensor)
98494 or 98495	Pressure sensor	1 (Main Depth sensor)[1]	13 (Cable Drum Tension Pressure)
			50 (Feed Forward Pressure) [2]
			51 (Feed Back Pressure) [2]
			52 (Percussion Pressure) [2]
			53 (Rotation Pressure) [2]
			54 (Flush Pressure) [2]
			55 (Damp Pressure) [2]

TIP – Trimble recommends labeling the sensors after changing their node ID to ensure that they are installed in the correct location.

Changing the CAN Node ID

Before changing the CAN Node ID of a sensor:

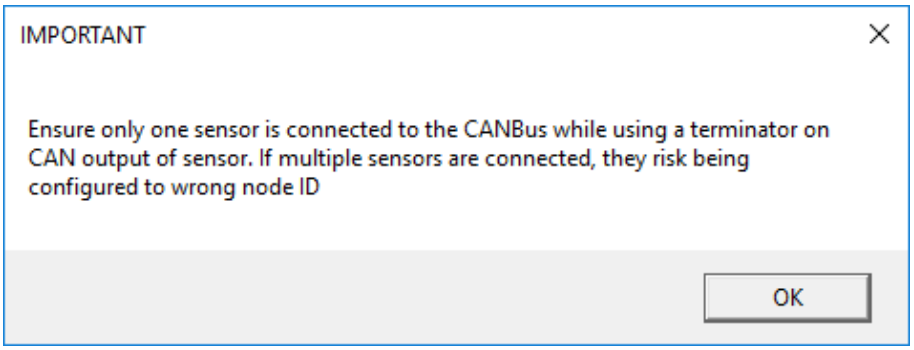
1. Connect the VERSO 12 display to the CAN-to-ETH adapter so the Trimble CAN Config tool can use the configure node ID (C:\Users\Username\Documents\Trimble Groundworks Data.
2. Use a short CAN cable (less than 1 m) to connect only one sensor to the CAN 1 port of the CAN-to-ETH adapter.
3. Add a CAN terminator in the CAN Out port of the sensor.

To change the node ID of a CAN sensor:

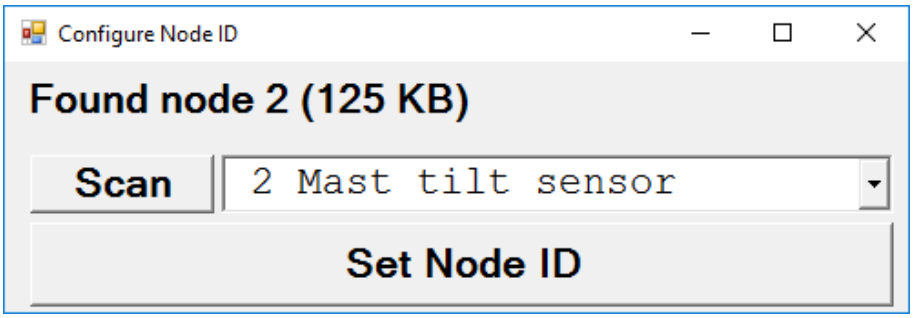
1. From the VERSO 12 display, go to C:\Users\User\Documents\Trimble Groundworks Data folder and double-tap Trimble CAN Config.exe.

[1]Pressure sensors (P/N 98494 and P/N 98495) are shipped with default settings of node ID 1 with a baud rate of 20 KB. These ***must be*** configured to node 13 (Cable Drum Tension Pressure) with a baud rate of 125 KB in order for the Groundworks system to use them for dynamic compaction installations.

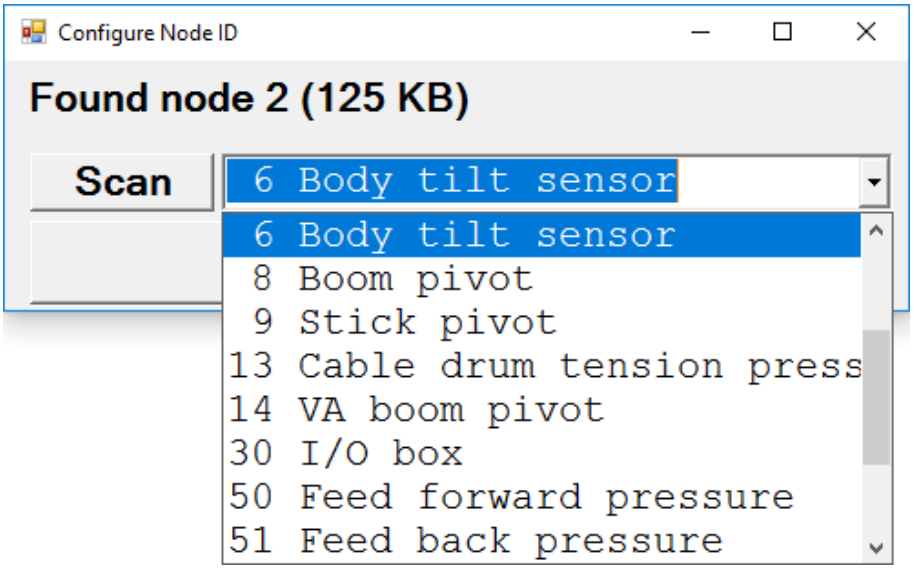
[2]For MWD (Measure While Drilling) data logging.



2. Ensure that only one sensor is connected to the CANbus and then tap **OK**.
3. Tap **Scan** to find the connected sensor:

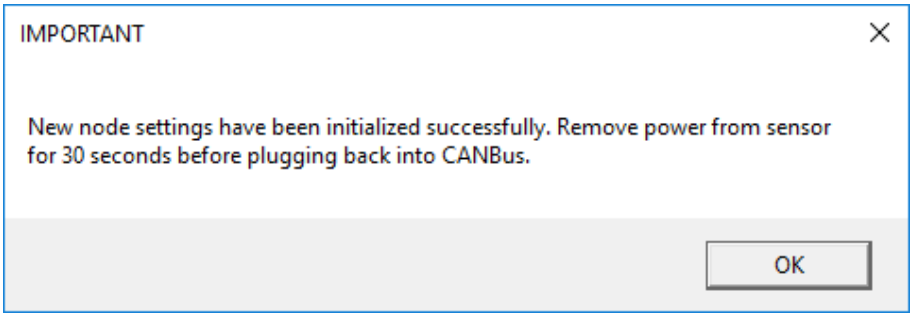


4. Select the new Node ID from the list:

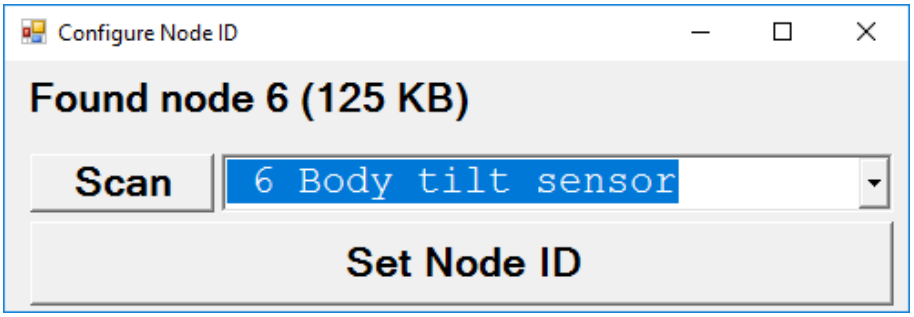


5. Tap **Set Node ID**.

6. Follow the prompts by removing the power to the CAN-to-ETH adapter, disconnect the sensor, wait for 30 seconds, reconnect sensor, and then replace the power to the CAN-to-ETH adapter before tapping **OK**.



7. Tap **Scan** to ensure the sensor is recognized with the new node ID.



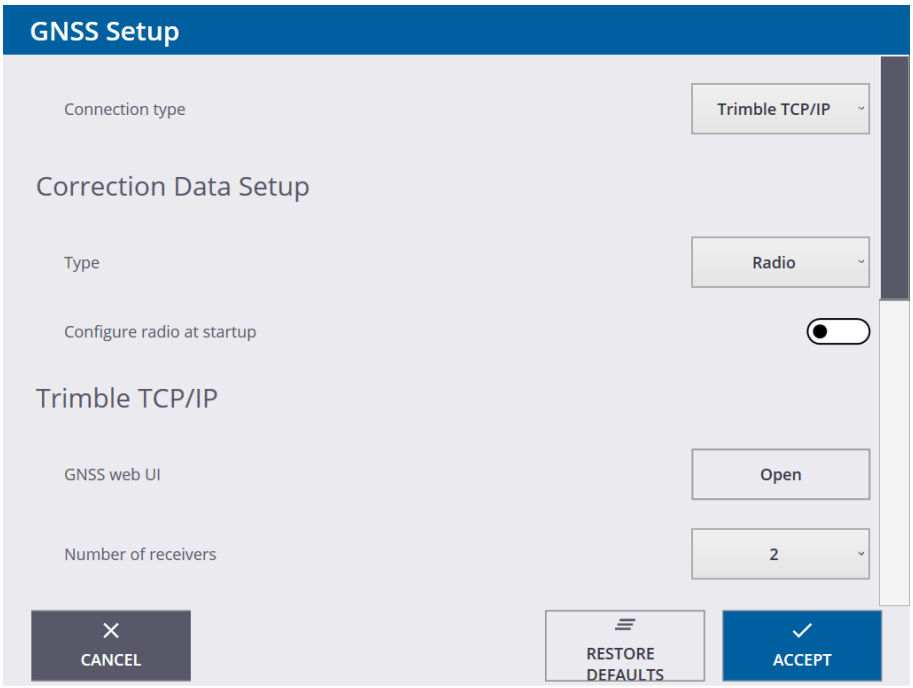
8. Close the window.

7

GNSS Setup

The **GNSS Setup** menu is located in **Settings** and allows configuration of the correction sources to be used. To access the **GNSS Setup** menu:

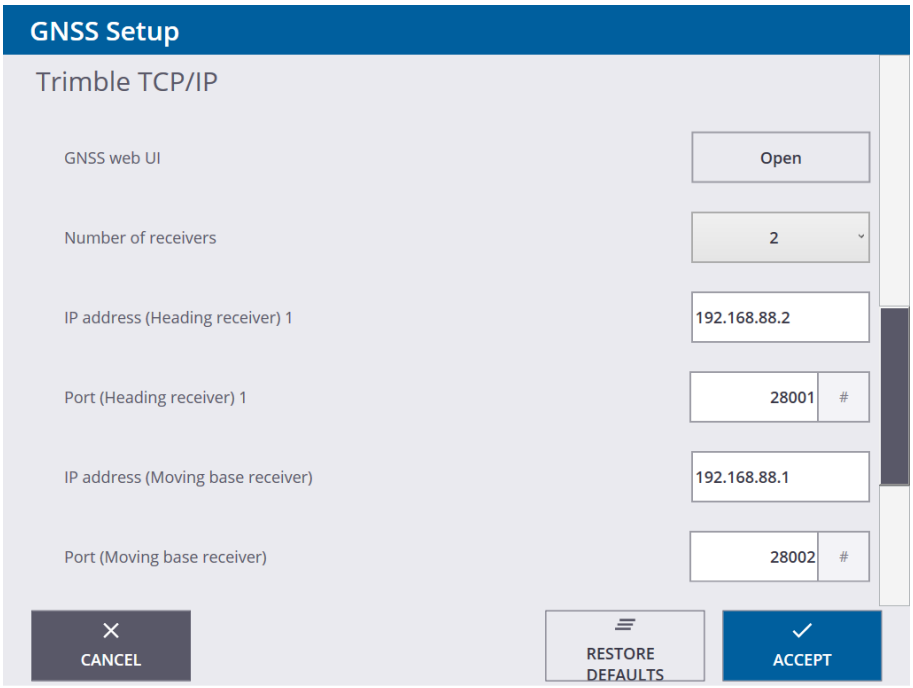
- Tap ☰ / **Settings** / **GNSS Setup**.



Setting up corrections

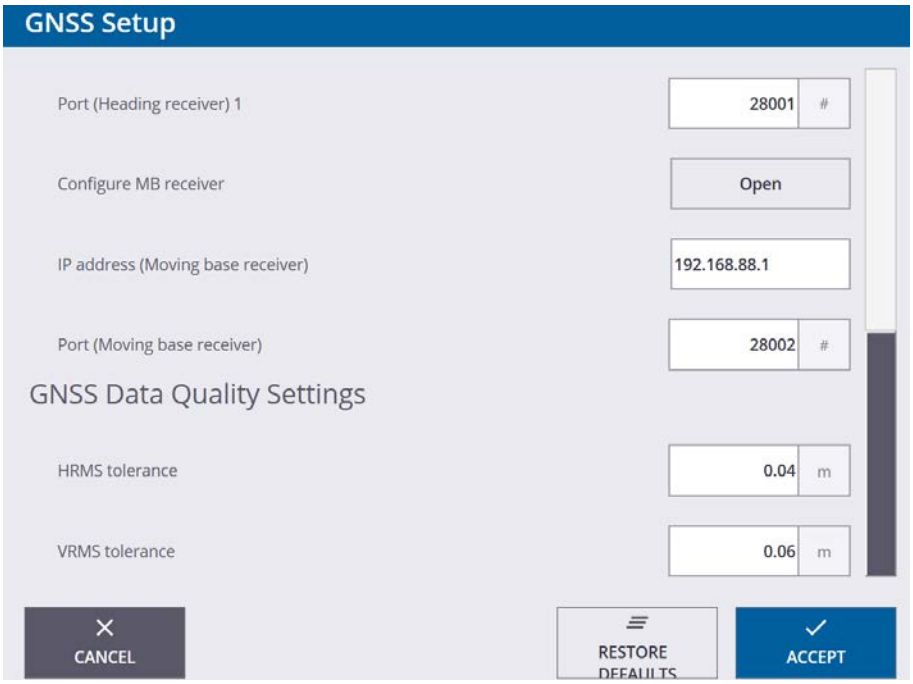
1. In **Connection type** field, select **Trimble TCP/IP**.
2. In **Correction Data Setup**, select the correction data type you will be using and complete the credentials where appropriate:
   - **Radio**: Use the internal radio of the receiver for corrections. Enable the **Configure radio at startup** option to be prompted to select the radio network/frequency each time GNSS is connected.
   - **IBSS**: Use IBSS base for corrections. Enable the **Ask for IBSS base list** option to be prompted to select the IBSS base each time GNSS is connected.

     NOTE – This option is using the Device ID of the display for credentials.
   - **Internet**: Use internet corrections. Enable the **Ask for data stream list** option to be prompted to select the data stream each time GNSS is connected.
   - **Off**: Turn off if corrections is streamed into the receiver from a third-party radio.
3. When using two receivers, verify that the **Trimble TCP/IP values** are completed as shown below:



NOTE – The number of receivers can be set to 1 or 2, depending on the installation. Two receivers make up the majority of installations.

4. Verify that the **GNSS Data Quality Settings** are within your expected HRMS/VRMS tolerances.



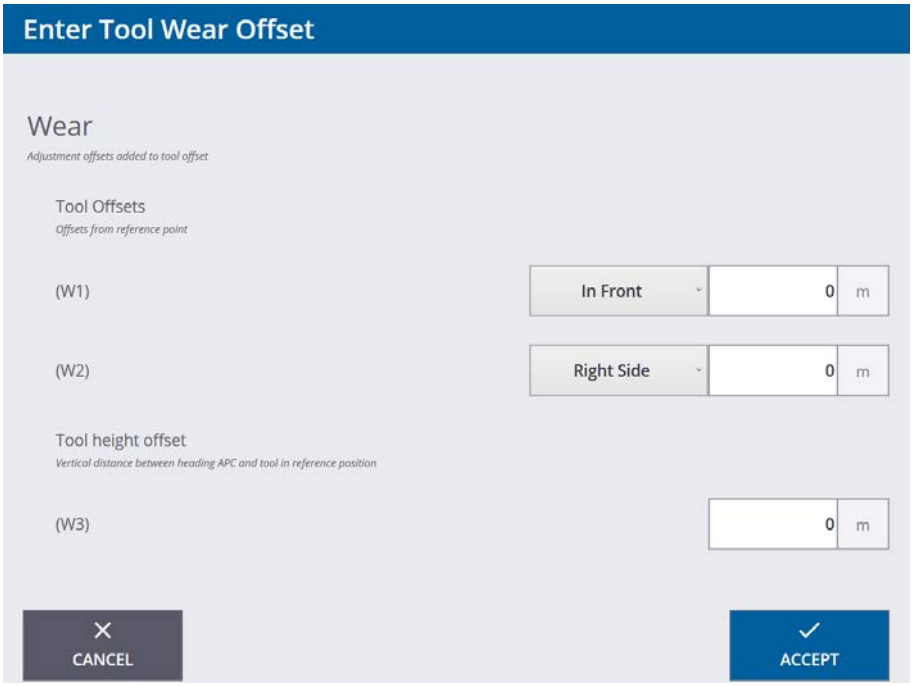
NOTE – If the HRMS and VRMS tolerances are set too low, the software will trigger numerous on-screen warnings. If they are set too high, inaccurate positioning of the tool in poor GNSS environments will occur. If on-screen warnings are happening often, increase the values slightly to create a precision threshold that you can tolerate for the operations being carried out.

8

Tool Wear Setup

The **Tool Wear** menu is located in **Settings** and allows offsets to the tool location to be applied in addition to the original measure-up values. The tool wear offsets can also be used to account for different attachments, for example, a starter rod length, if the original measure-up is measured to the location where all the attachments are connected.

To access the **Tool Wear** menu, tap ☰ / **Settings** / **Tool Wear**.



9

System Setup

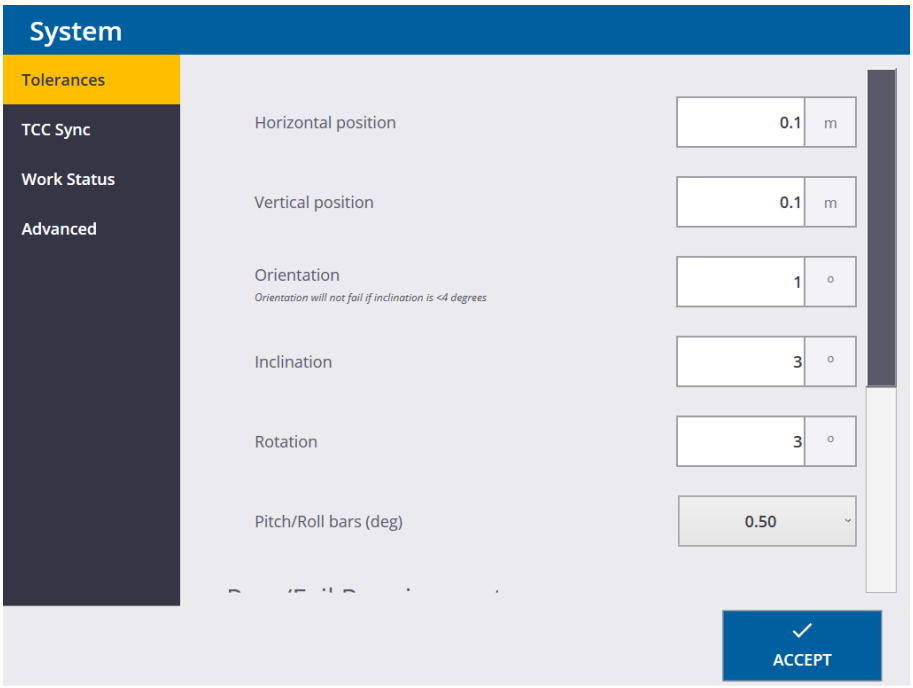
The **System** menu is located in **Settings** and allows the configuration of tolerances, the Trimble Connected Community (TCC), advanced settings, and other additional features.

To access the **System** menu, tap ☰ / **Settings** / **System**.

Tolerance settings

The tolerance settings affects the way the as-built info is flagged as pass (**green**) or fail (**red**) in the software. From the **System** menu, select **Tolerances**.

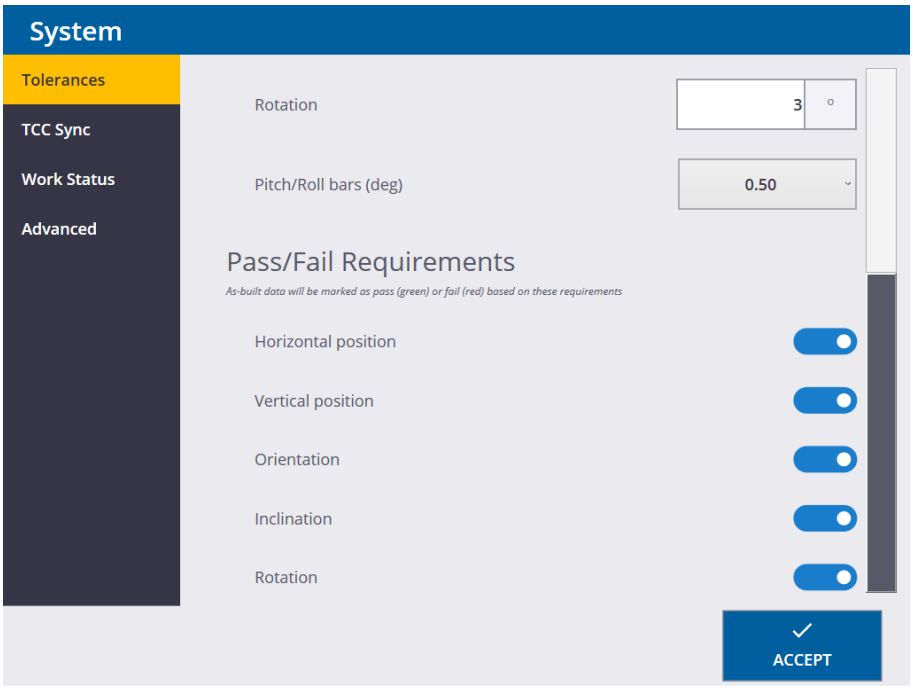
Tolerance settings for drilling, piling, and CFA piling machines



- **Horizontal position**: Enter the required 2D tolerance. This affects the behavior of the bull's-eye view.
- **Vertical position**: Enter the required vertical tolerance.
- **Orientation**: Enter the required orientation tolerance.
- **Inclination**: Enter the required inclination tolerance.
- **Rotation**: ***Piling only.*** Enter the required rotation tolerance.
- **Pitch/Roll bars**: Select the appropriate size of the green tolerance area of the pitch/roll bars.

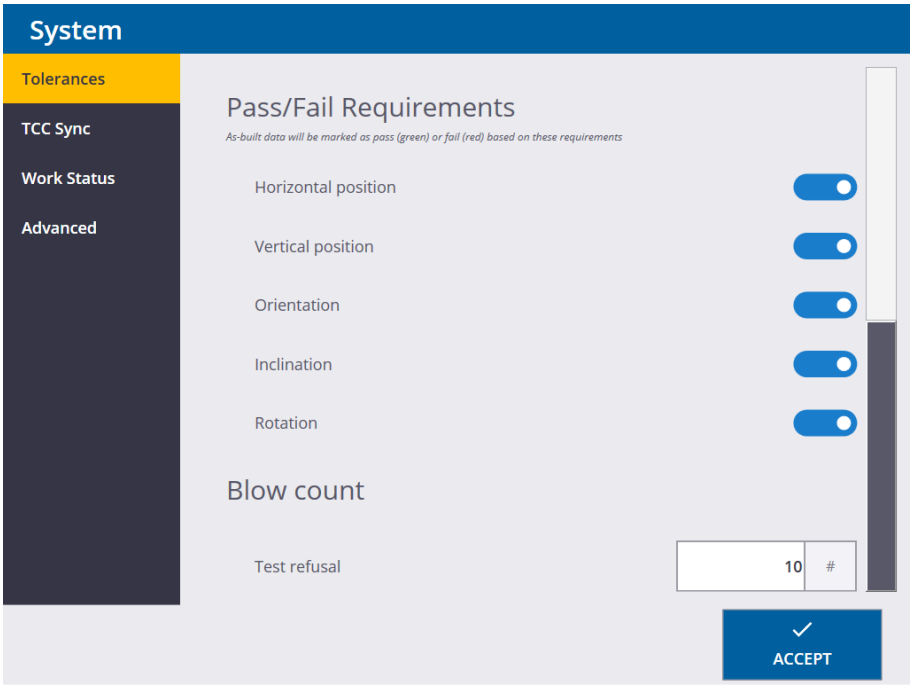
Pass/Fail requirements

The enabled tolerance items are used to mark the hole/pile as pass or fail. If an item is disabled, the software shows that the item has met tolerance when determining if a hole/pile has passed or failed.



Once the appropriate tolerances have been configured, tap **ACCEPT** to apply changes.

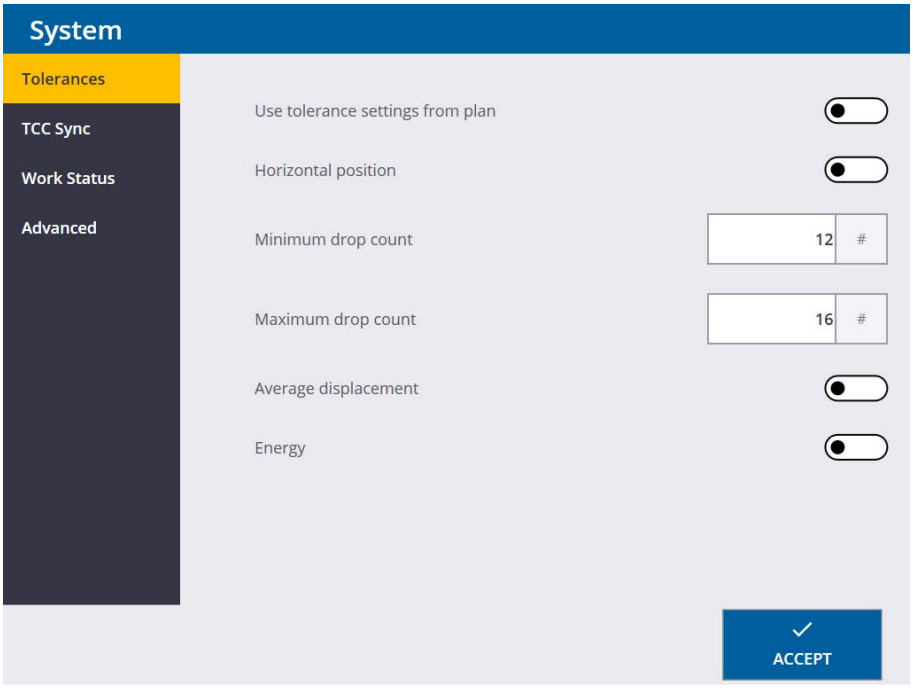
Blow count (piling only)



If blow counts are tracked to determine refusal, the operator has the option to test refusal once the blow count requirements have been met. Enter the number of blows for each test refusal here. This value is used to auto-increment to a new test each time the number of blows has met the test refusal value.

Once the appropriate tolerances have been configured, tap **ACCEPT** to apply changes.

Tolerance settings for dynamic compaction machines



- **Use tolerance settings from plan**: Enable this field to use tolerance settings as defined when the compaction plan was created in the Trimble Business Center software. Disable this to customize the tolerance settings. All items can be disabled except for minimum/maximum drop count.
- **Horizontal position**: Enter the required 2D tolerance. This affects the behavior of the bull's-eye view.
- **Minimum drop count**: Enter the required minimum drop count.
- **Maximum drop count**: Enter the required maximum drop count.
- **Average displacement**: Enter the required average displacement. This represents the average displacement of the last two drops.
- **Energy**: Enter the required energy for the first drop. This is calculated using as Mass × Gravity × Drop Height.

Once the appropriate tolerances have been configured, tap **ACCEPT** to apply changes.

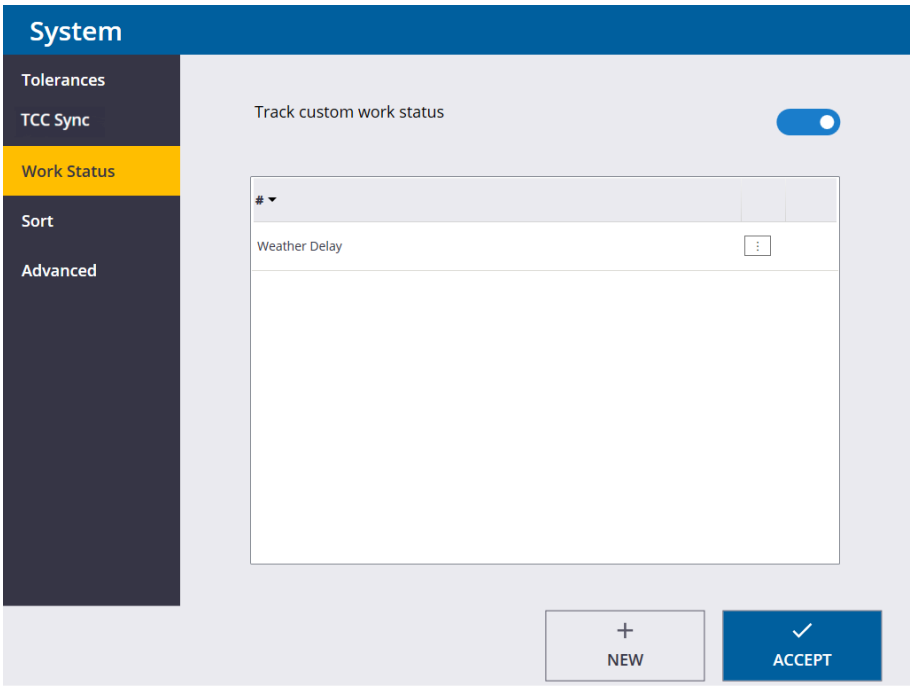
Trimble Connected Community (TCC) Sync

TIP – To check that the Trimble Connected Community (TCC) software can correctly sync, go to **Settings / Systems / Trimble Connected Community (TCC) Sync**:

1. Tap ☰ / **Transfer Files**. The following screen appears:
2. Tap **TCC** (Trimble Connected Community). The following screen appears:
3. Select the project to sync to the Trimble Connected Community (TCC) and then tap **Accept**.

Work Status

The Groundworks software automatically tracks operation data for time spent drilling, changing steel, piling, compacting, idling, and navigating. From the **System** menu, select **Work Status**.

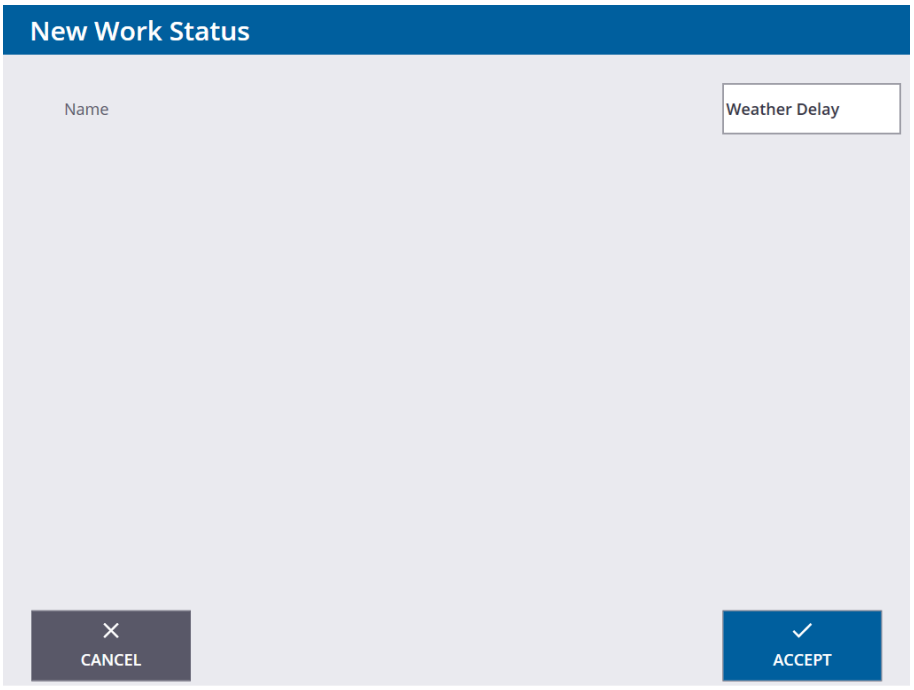


Creating a custom work status

The operator can manually track custom work statuses to track time associated with other operations by tapping from the toolbar.

To configure a custom work status items:

1. Enable the **Track custom work status** option.
2. Tap **NEW** to create a new work status:

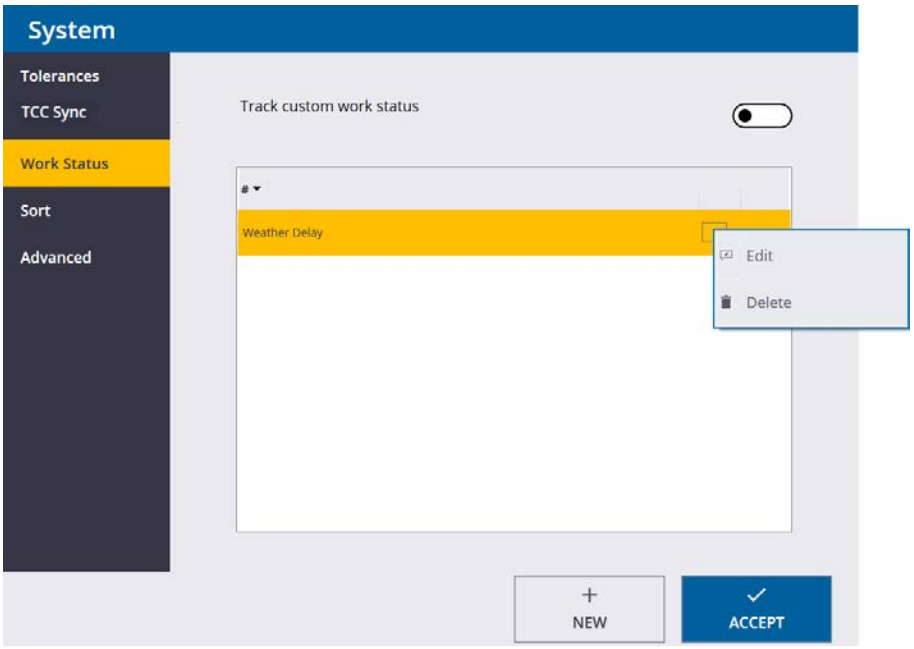


3. Enter a name for the custom work status and tap **ACCEPT**.
4. The custom work status can now be selected from the list when the operator taps from the toolbar.

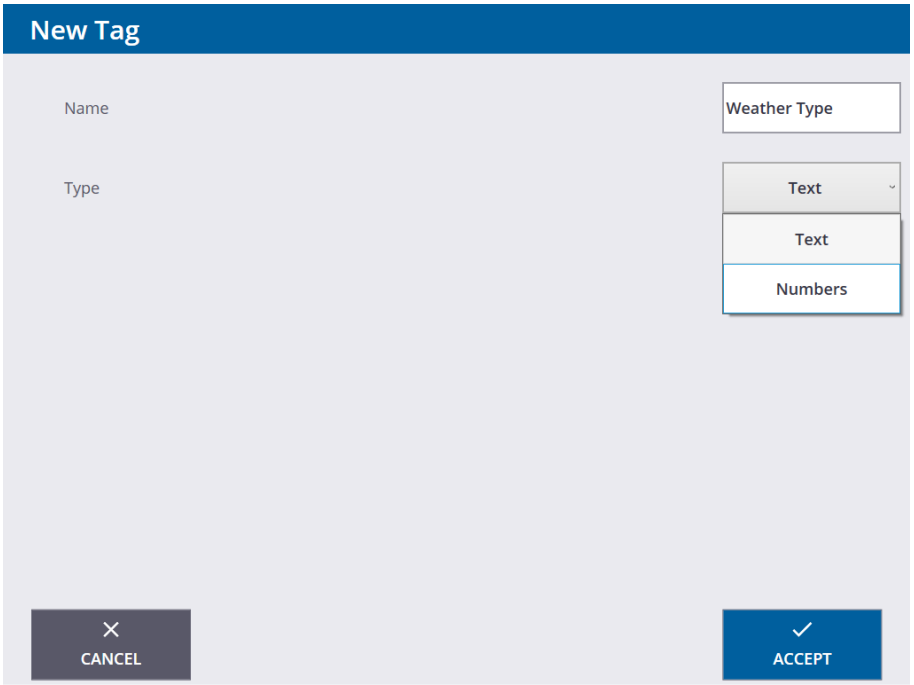
Creating tags for a custom work status

Tags can be added to a custom work status that prompts the operator to enter additional information when that work status is selected. To add custom tags:

1. Tap ⋮ next to the work status and select **Edit**:



2. Tap **NEW** to create a new tag:



3. Enter a name for the custom tag.

4. Select the correct type based on the format the operator is expected to enter information. Select **Text** to allow a combination of numbers/letters to be entered or select **Numbers** to only allow numerical entries.
5. Tap **ACCEPT**.
6. Repeat Step 1 through 5 to add additional tags.
7. Tap **ACCEPT** to return to the **Work Status** settings.

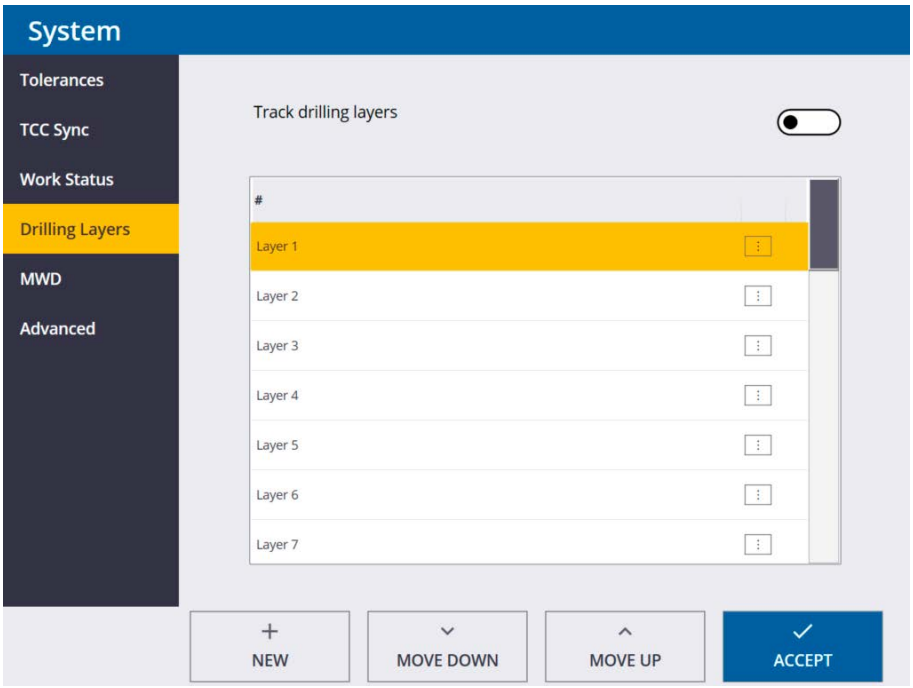
Work status logic

- If the machine has no position (missing sensor or GNSS data), it is tracked as idling time.
- If the machine has moved >1 meter in the last 10 seconds, it will switch from idling to navigation.
- If the machine has moved <1 meter the last 10 seconds, it will switch from navigation to idling.

Drilling Layers *(drilling only)*

The operator can manually log the layers they encounter while drilling each hole. These layers can be used to calculate material thickness for estimating blasting requirements; the Trimble Business Center software can use the data to create a surface model of the drilled layer formations.

From the **System** menu, select **Drilling Layers**.



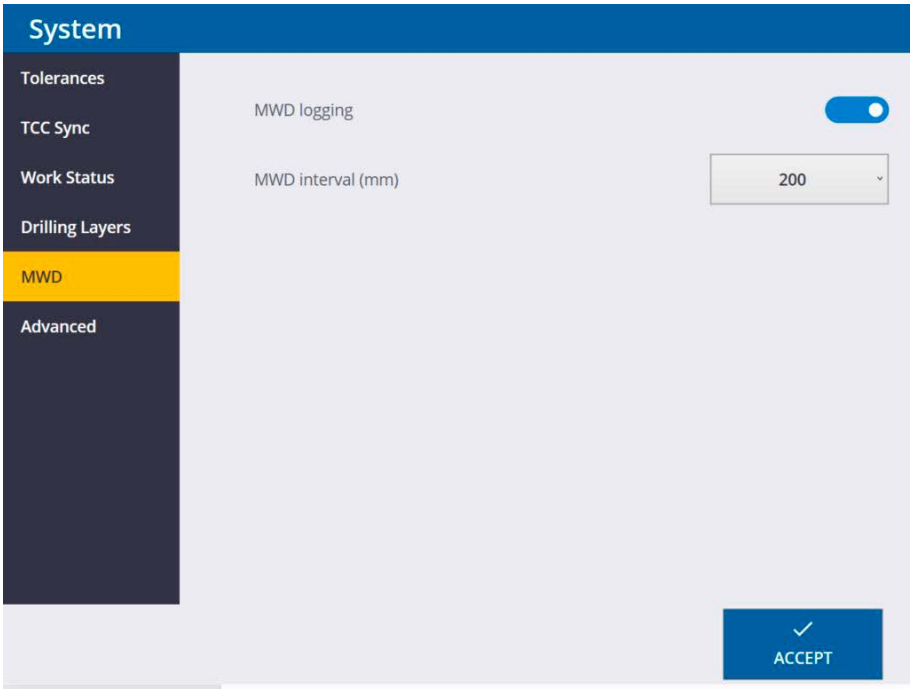
To configure the Drilling Layers feature:

1. Enable the **Track drilling layers** option.
2. Tap **NEW** and enter a name to create a new layer.
3. Highlight a layer and tap **MOVE UP** or **MOVE DOWN** to modify the order the layers are displayed to the operator.
4. Tap next to a layer and tap **Edit** to change the layer name.
5. Tap next to a layer and tap **Delete** to delete a layer.
6. Tap **ACCEPT** to apply changes.

MWD

The Groundworks software can log MWD (Measure While Drilling) data for each hole in IREDES (International Rock Excavation Data Exchange Standard) format. The following parameters will be logged if the sensors are installed and configured correctly: penetration rate, percussion pressure, feed pressure, damp pressure, rotation pressure, and flush pressure. For more information, see CAN Node Configuration, page 62.

From the **System** menu, select **MWD**.

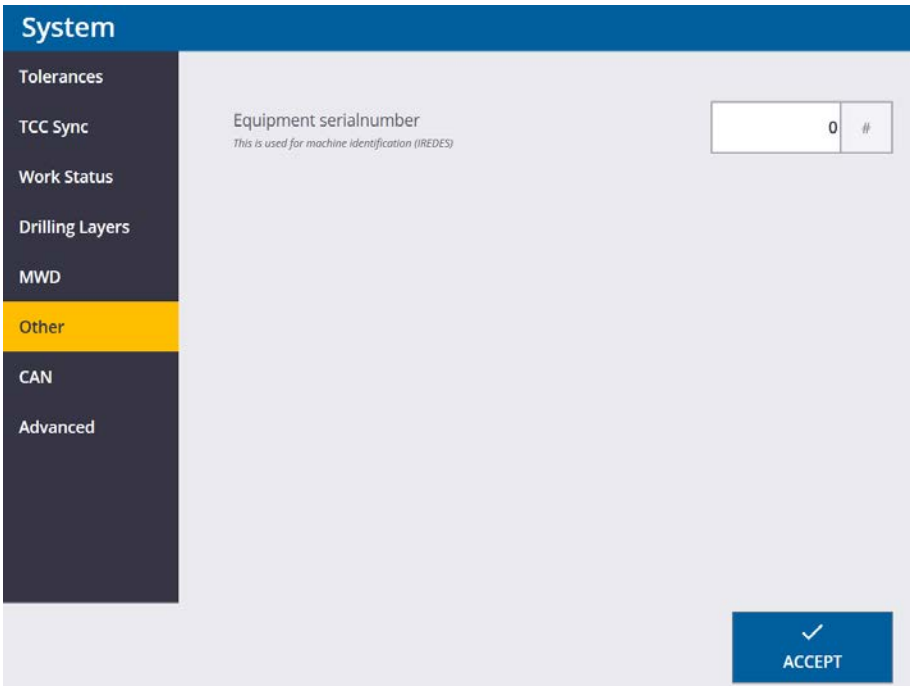


To configure MWD settings:

1. Enable **MWD logging** to log MWD data for each hole drilled.
2. Select the appropriate **MWD interval** to define the rate that data will be sampled while drilling.

Other

The **Other** setting is to add an equipment serial number to add into the IREDES file, which can be exported using transfer files.

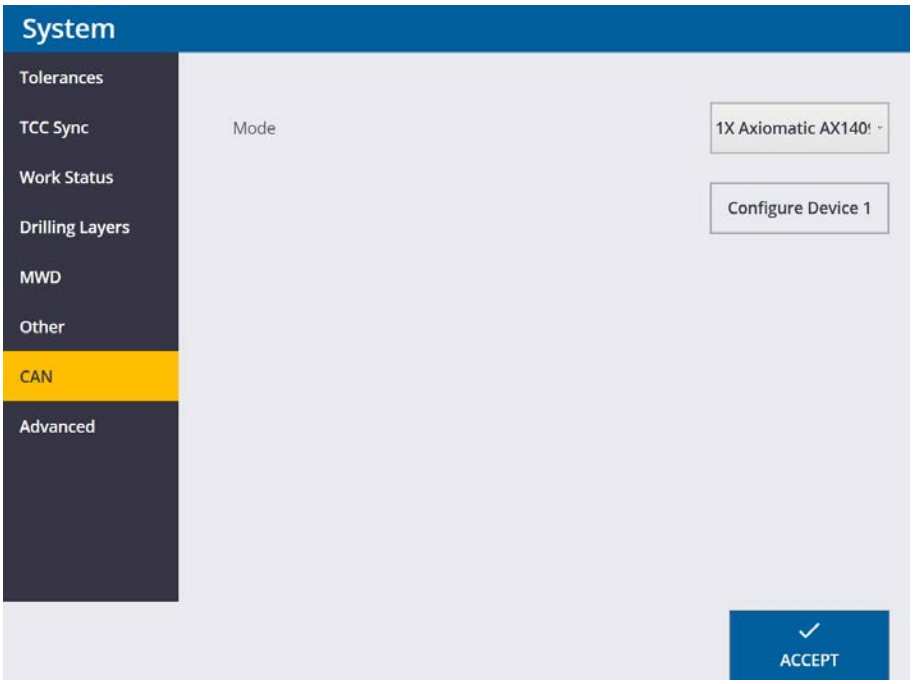


CAN

The **CAN** setting allows you to select which kind of device is used on the system.

From the **Mode** field, select the required option:

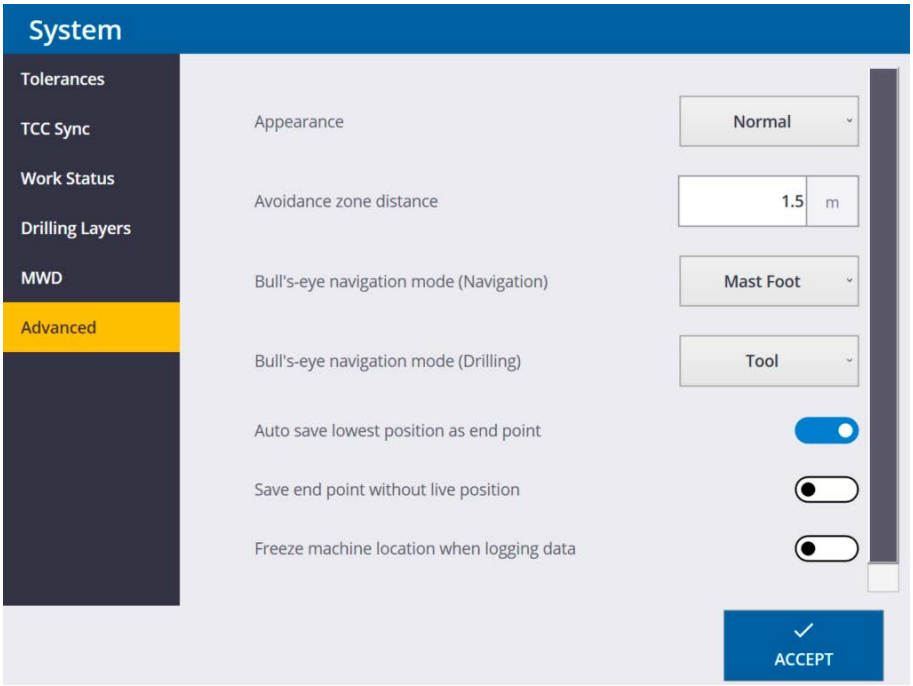
- **IXXAT CAN to USB** – if the GW system installed is using the JB900 junction box (now obsolete)
- **1 x Axiomatic** – if the GW system is using only one CAN-to-ETH device
- **2 x Axiomatic** – if the GW system is using two CAN-to-ETH devices
- **Configure device** – opens the web UI default IP address 192.168.0.34 of the CAN-to-ETH device


System
Tolerances
TCC Sync
Work Status
Drilling Layers
MWD
Other
CAN
Advanced
Mode
1X Axiomatic AX140
Configure Device 1
ACCEPT

Advanced

The **Advanced** setting contains various options which may apply to specific applications.

From the **System** menu, select **Advanced**.



NOTE – Dynamic Compaction only contains the following options: **Appearance**, **Avoidance zone distance**, and **Backup all settings**.

- **Appearance**: Select **Full Screen** to make Groundworks software the only available screen while using the software. Select **Normal** to resize the screen to allow the Windows Taskbar to be seen, so that the software can be minimized to gain access to other Windows applications while using the Groundworks software.

  NOTE – The Groundworks screen can only be minimized from the main working screen.

- **Avoidance zone distance**: Can provide the operator an additional buffer to warn them when they get within the specified distance from an avoidance zone. If it is set to 0, the avoidance zone must be breached to trigger a warning.
- **Bull's-eye navigation mode (Navigation)**: Select the location that the center of bull's-eye represents while navigating depending on the preference of the operator. Select **Tool** to use the tool elevation or select **Mast Foot** to use the mast foot elevation.
- **Bull's-eye navigation mode (Drilling)**: Select the location that the center of bull's-eye represents while logging data depending on the preference of the operator. Select **Tool** to use the tool elevation or select **Mast Foot** to use the mast foot elevation.
- **Auto save lowest position as end point**: Enable to automatically save the lowest point as the end point when the end point is saved.

Disable to save the current position when the end point is saved, even if the current position is above the lowest known location. When disabled, another option called **enter Sampling seconds** will appear. Enter the number of seconds that Groundworks software will count down after saving the end point to average the current position. If the tool moves while sampling, the timer will restart until a stable position can be saved.

> **NOTE –** This option is not available for CFA Piling.

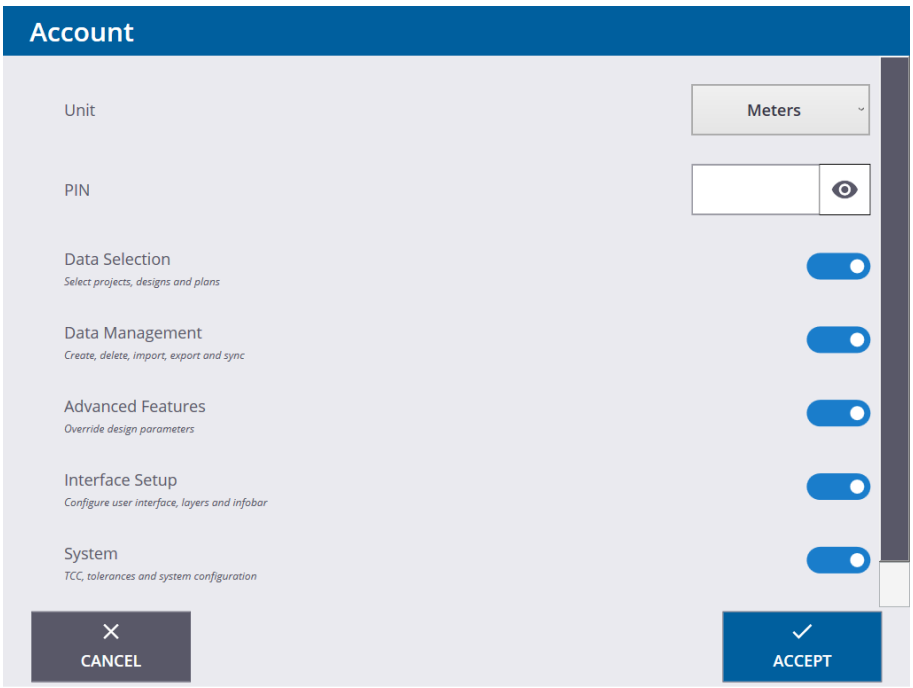
- **Save end point without live position**: Enable to allow as-built data to be saved in situations where the GNSS signal is lost after the start point has been saved. This uses the last known GNSS data along with CAN sensor data to allow the end point to be saved when GNSS is out of tolerance. This can be useful when the machine is working in a poor GNSS environment.
- **Freeze machine location when logging data**: Enable to freeze the last location of the machine and allow the depth to be recorded.
- **Auto save (end point)**: Select from the options for **Auto save (end point)** to enable the software to automatically save the end point instead of manually saving it. This action is triggered at different times depending on the selected mode:
  - **On retract** – This feature was made for piling machines. When the hammer is moved up or in opposite direction to the hammering direction by more than 30 cm, the software will automatically save the point.
  - **Depth bar** – End point will be saved once the target elevation is reached.
  - **Blow Count Refusal (piling only)** – End point will be saved once the blow count refusal has been met.
- **Allow 2D mode**: Enables the operator to use the 2D and 2.5D features. Can record the depth of drill holes or top of the pile without using GNSS. This feature is mainly used for vertical piling or drilling.

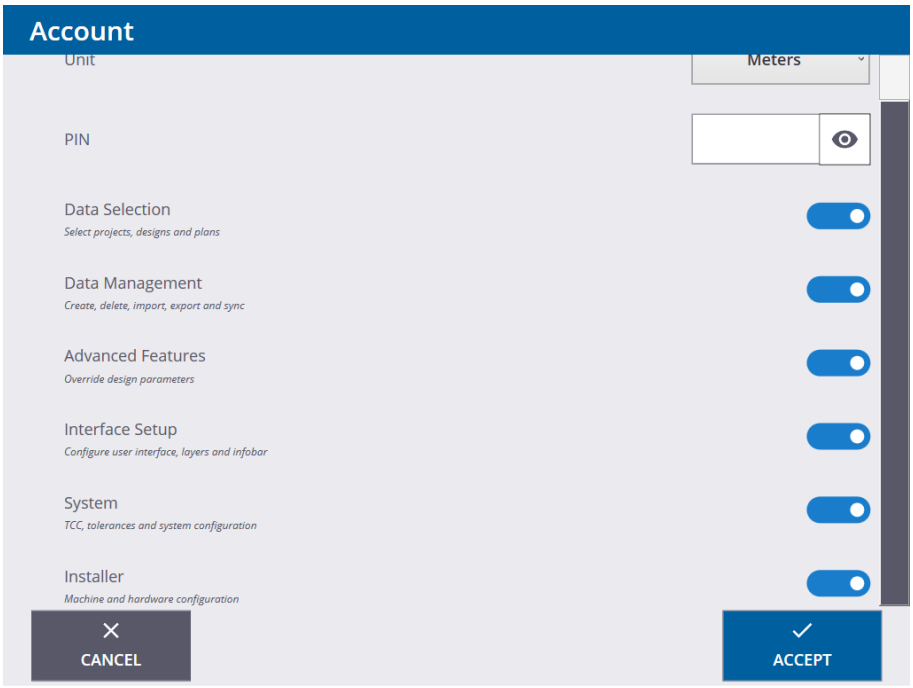
10

Account Settings

The **Account** menu is located in **Settings** and enables you to modify units, PIN, and user permissions while in Admin mode. To access the **Account** menu:

- Tap ☰ / **Settings** / **Account**.





Setting account permissions

The following permissions are shown on the **Account** screen and can be modified while in Admin mode:

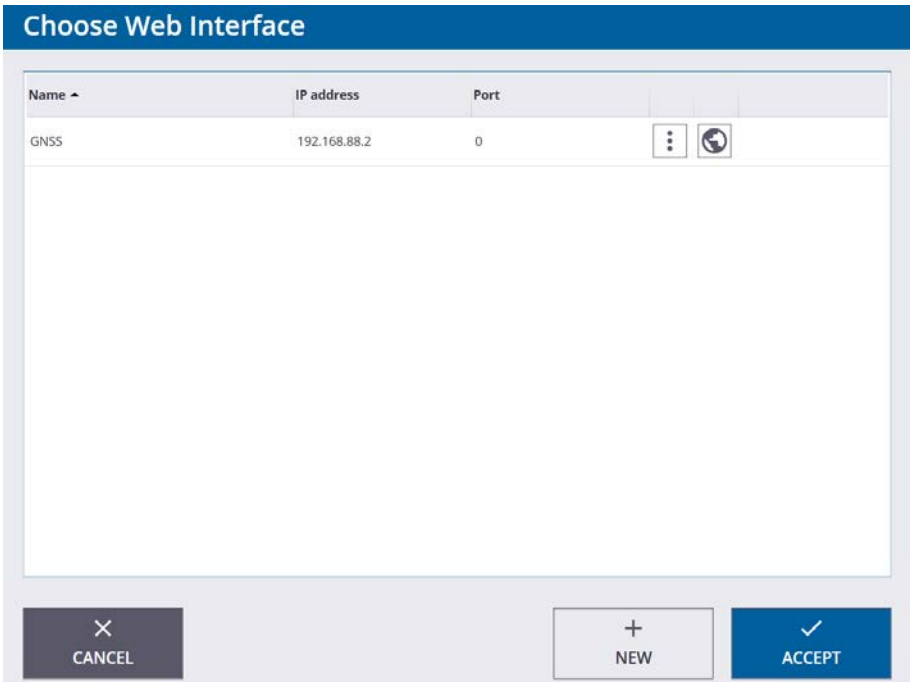
- **Unit**: Select the correct units to be displayed based on the operator preference.
- **PIN**: Enter a four-digit PIN if none exists, or modify the existing PIN.
- **Data Selection**: Enables you to select between available projects, designs, and plans in **Project Setup**.
- **Data Management**: Allows the operator to create, delete, import/export, and sync project data from TCC in **Project Setup**.
- **Advanced Features**: Allows the operator to override drill/pile plan parameters in the field. Disable to hide the icon in the toolbar.
- **Interface Setup**: Allows the operator to customize the infobox items, interface settings, and layer settings. Disable to hide the and icons from the toolbar.
- **System**: Allows the operator to customize the system settings. Disable to hide these settings from the **Settings** menu.
- **Installer**: Allows the installer to customize GNSS setup, sensor setup, measure-up, and barge settings. Disable to hide these settings from the **Settings** menu.

Once the appropriate permissions have been enabled/disabled, tap **ACCEPT** to apply the changes.

> **NOTE –** System and Installer permissions should always be disabled once the system is correctly configured to prevent the operator from accidentally changing settings.

Web interfaces

Web interface is a new tool in Groundworks software v2.0. This setting allows the operator to add specific web interfaces that should be opened from the Groundworks software. The operator can add third-party addresses to open up from the browser or even specific CAN-to-ETH web interfaces.



Once the appropriate permissions have been enabled/disabled, tap **ACCEPT** to apply the changes.

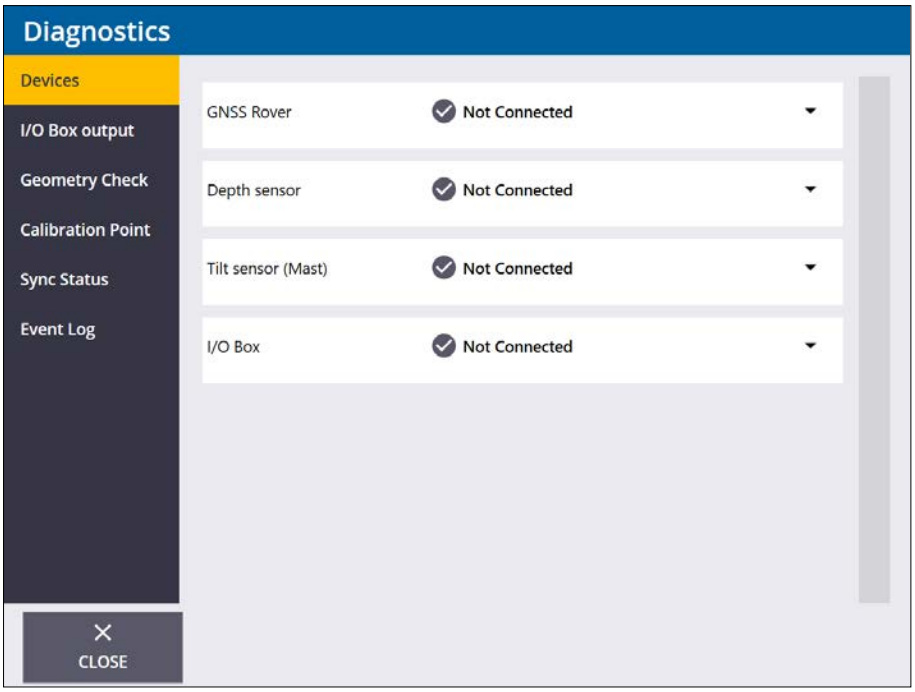
11

Diagnostics

Accessing the Diagnostics section

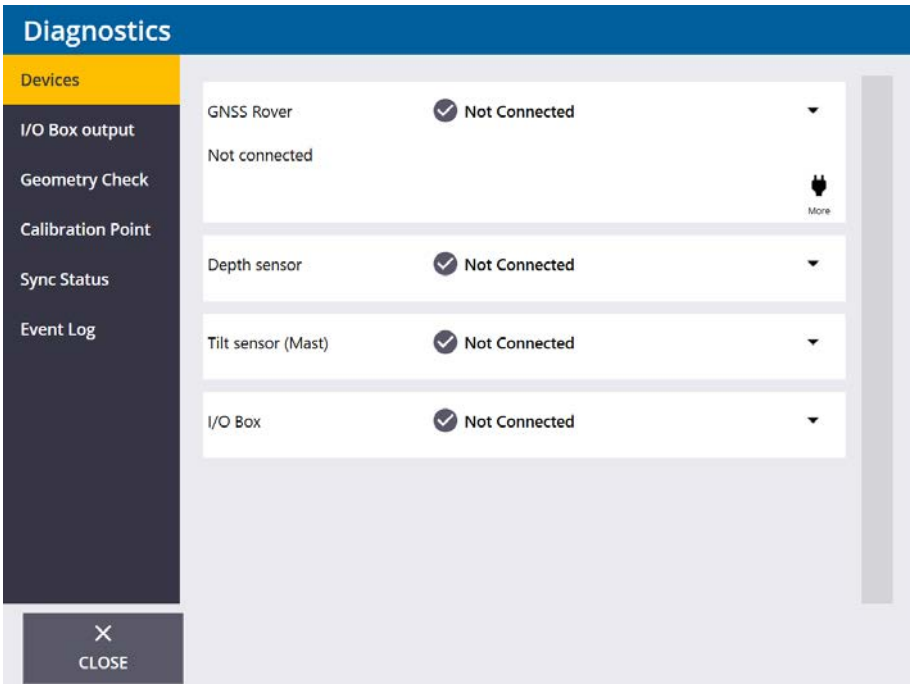
The software has a Diagnostics section that can help diagnose system issues and check measure-up values.

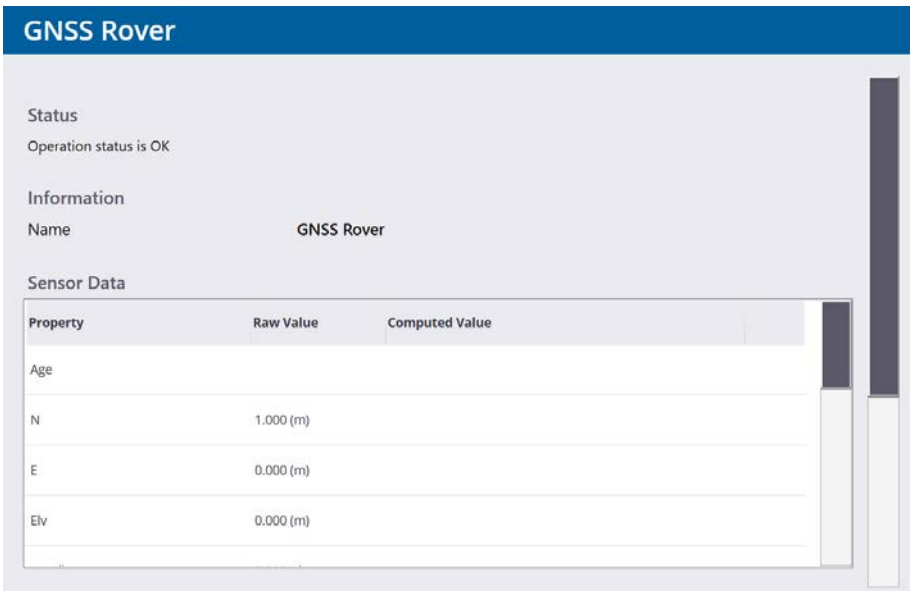
To access the **Diagnostics** section, tap ☰ / **Diagnostics**.

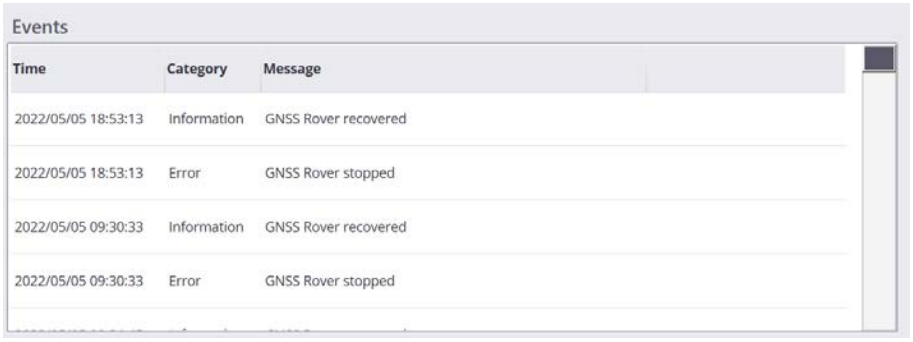


Devices

From the Diagnostics dialog, tap **Devices** / More to see GNSS and CAN sensor information to check the current status of the device and the event messages associated with the hardware.

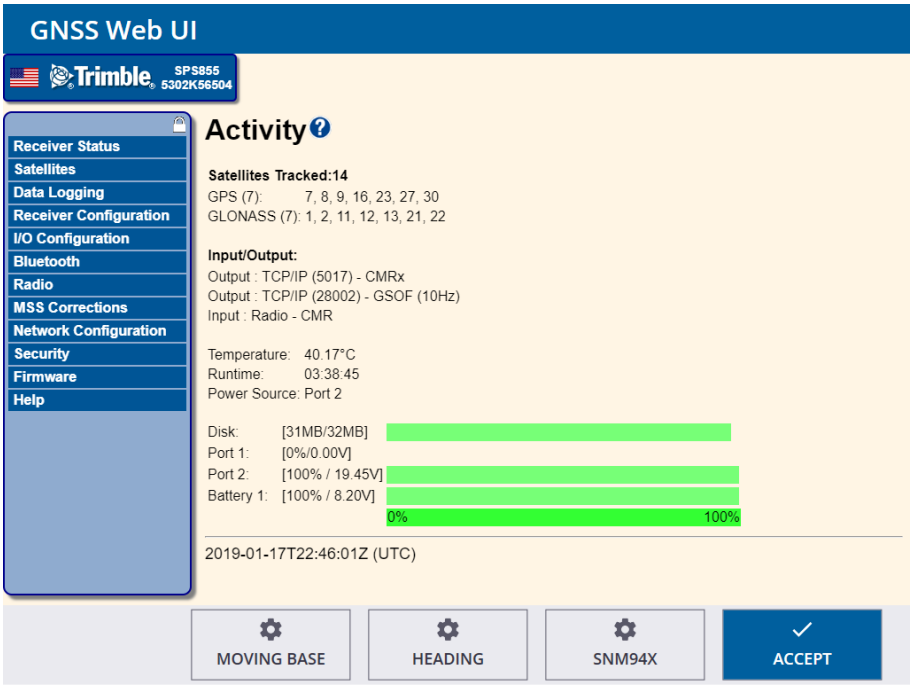




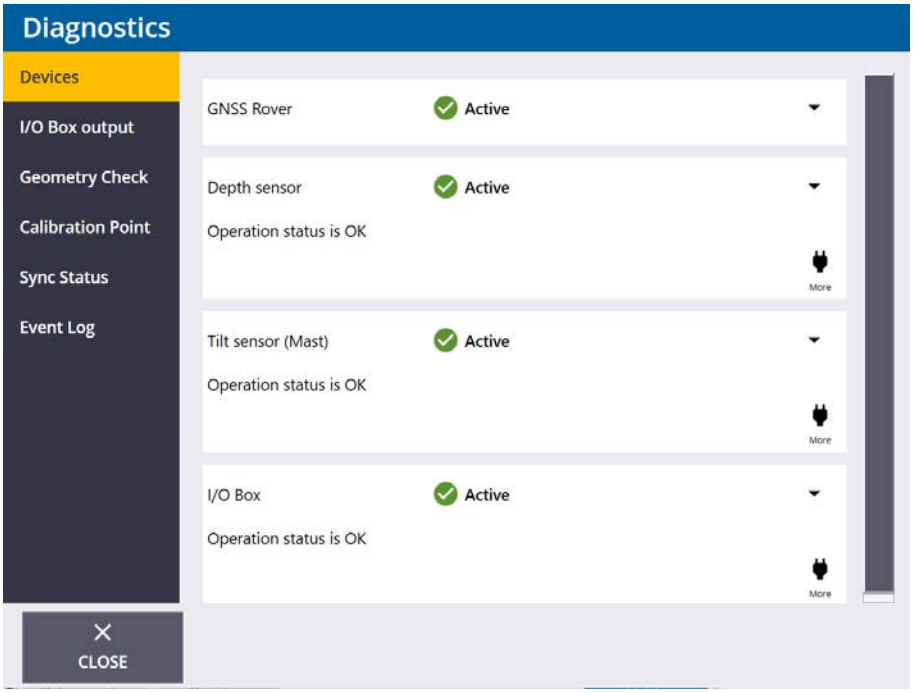


For advanced GNSS troubleshooting, you can access the web interface of your Moving Base receiver, Heading receiver, and SNM94x while inside the Groundworks software. To do this,

1. Tap ☰ / **Settings** / **GNSS Setup**.
2. Tap **Open** next to GNSS web UI.

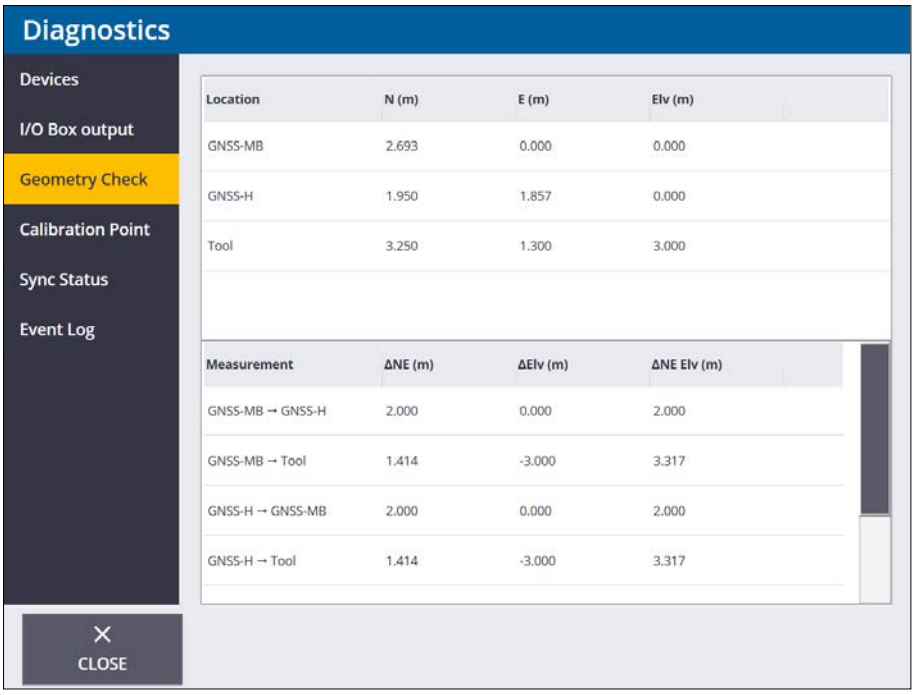


The Devices screen displays all the raw and computed values for your connected sensors. For example, when setting up the I/O Box, inputs 1 to 6 and outputs 1 to 2 can be checked to ensure they show as TRUE when the I/O Box relay is active.



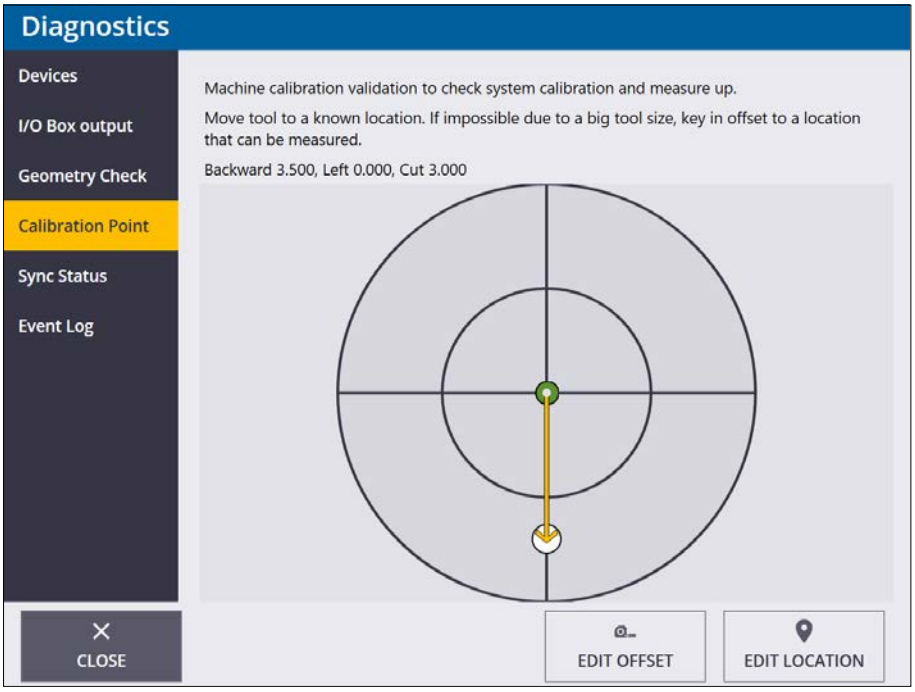
Geometry Check

Shows GNSS information for the moving base and heading antenna with distances to the actively selected hole/pile along with calculated positions of the tool and boom/VA boom/stick pivot sensors to troubleshoot measure-up/calibration issues.



Calibration Point

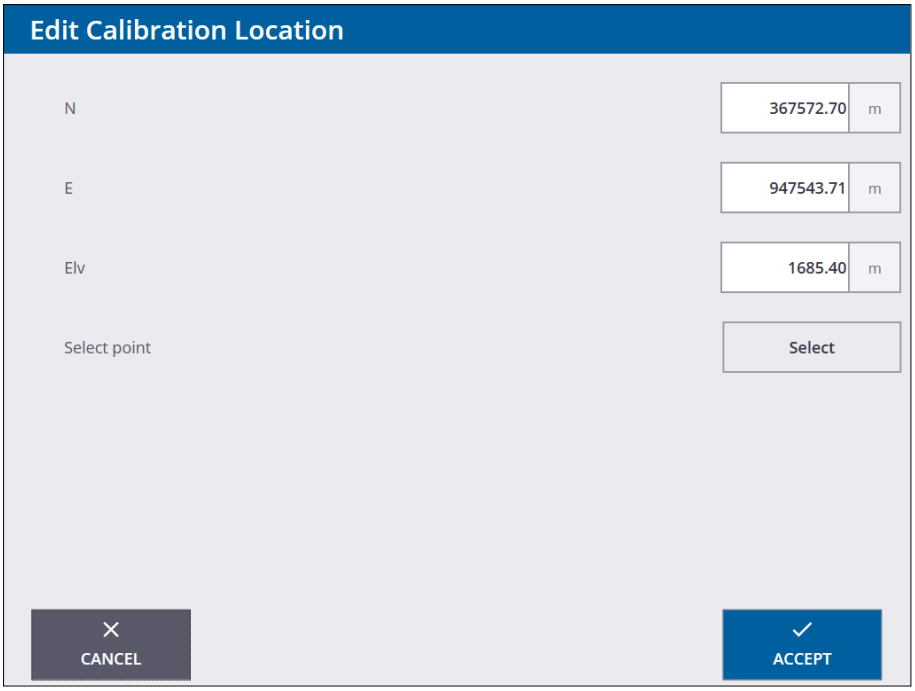
Displays delta values from the tool to a measured point to check system accuracy.



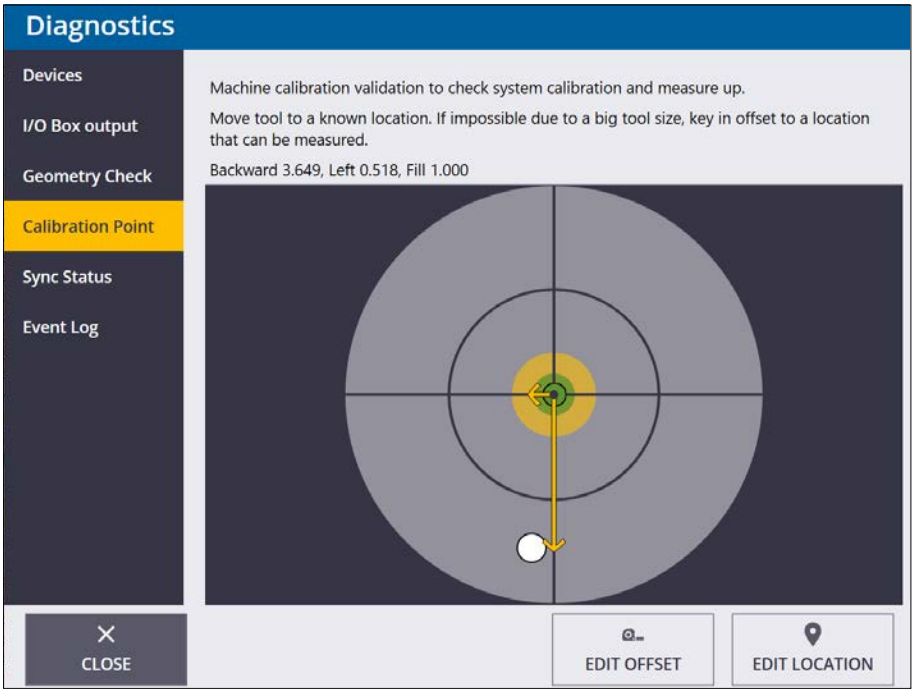
To use the calibration point:

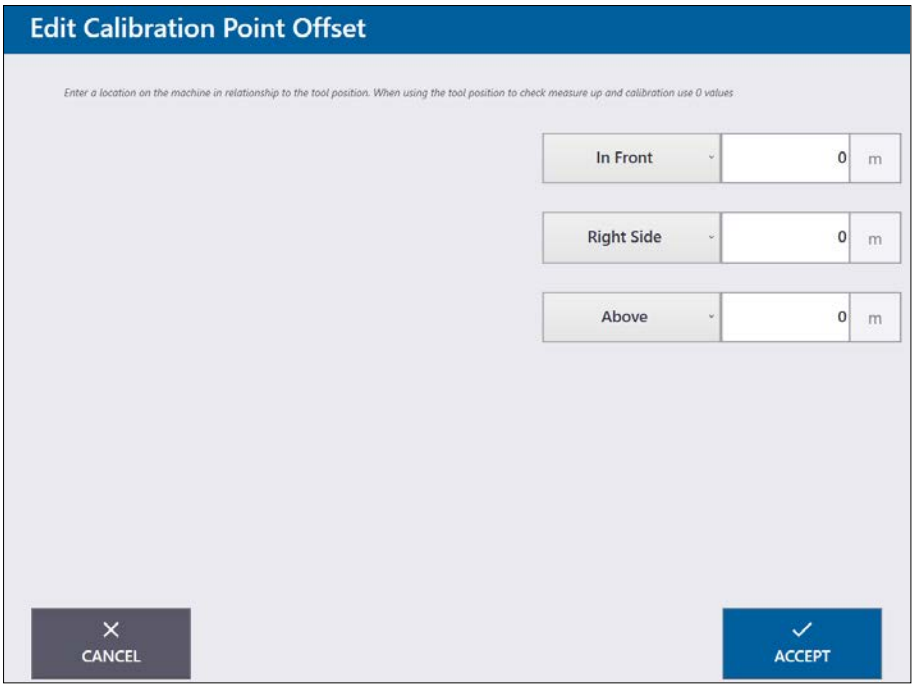
1. Tap **EDIT LOCATION**.
2. Enter the coordinates of a point that was measured by a rover using the same .dc file as the machine to be used as the calibration point.

> **TIP –** An alternative to manually entering a point is to select a point that exists in the active design by tapping **Select** next to the **Select point** option and then selecting the correct point:



3. Tap **ACCEPT**.
4. Place the tool on the calibration point and check the delta values.





- **In Front/Behind**
- **Left Side/Right Side**
- **Above/Below**

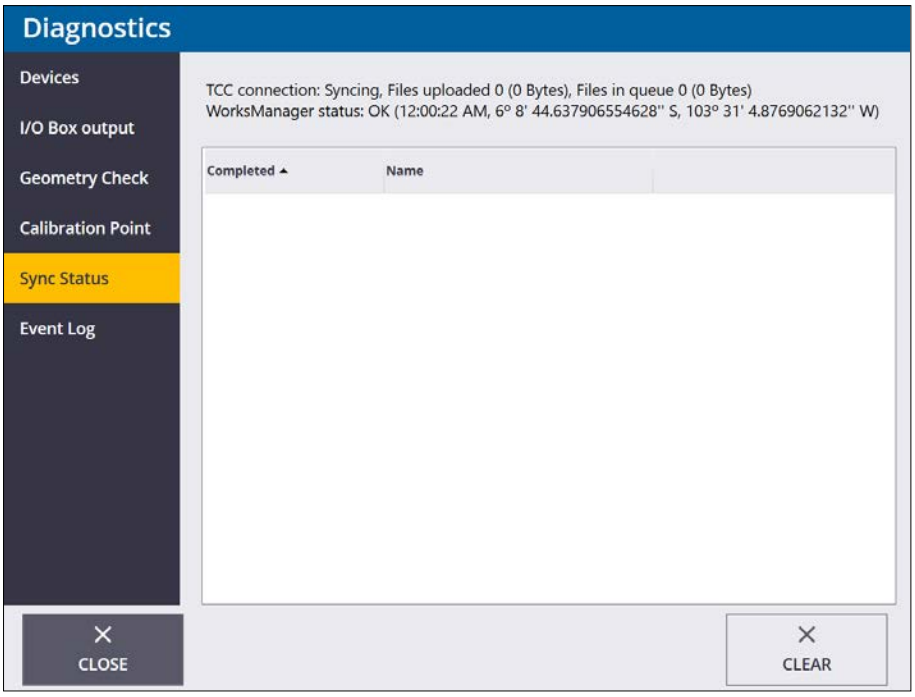
> **TIP –** If the calibration point states backward 0.03 m and left 0.04 m. Enter these values; you no longer need to know the positive or negative values.

5. Tap **ACCEPT** if all values are within expected tolerance.

> **TIP –** For large machines where it is difficult to place the center of tool on the calibration location, an offset can be used to accurately position a bracket attached to the tool. Tap **EDIT OFFSET** and enter the offset from the tool to get deviations from that offset location.

Sync Status

The software can automatically sync as-built data, which is performed in the background. Check the **Sync Status** screen to see if files have been uploaded or are in the upload queue:



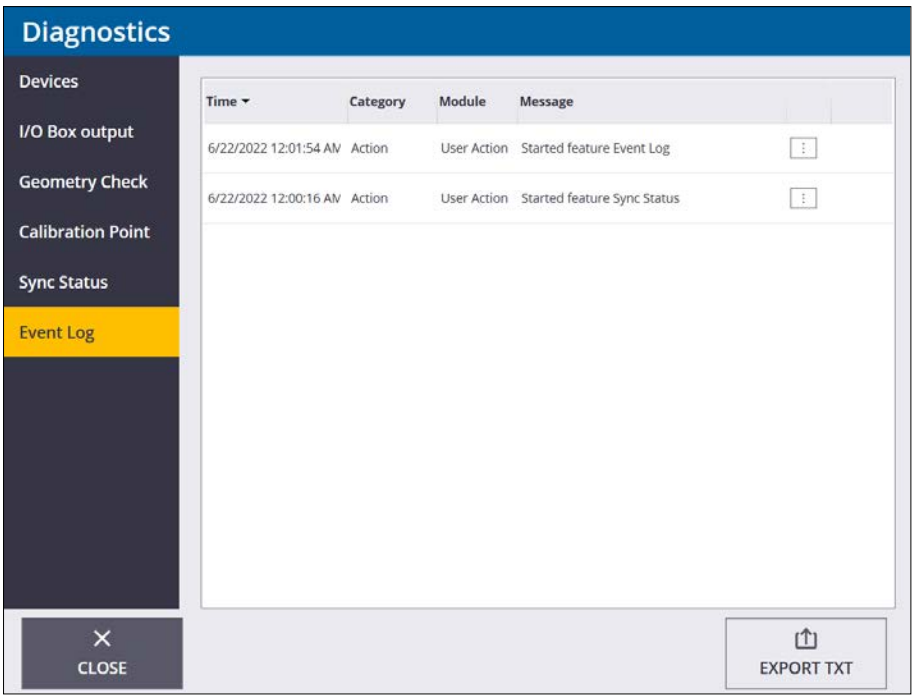
The list of available status messages are:

- NO_SYNC: Syncing did not occur.
- SYNCING_FILES: Syncing is in progress.
- NO_INTERNET: No access to the Internet.
- LOGIN FAILED: The credentials for the Trimble Connected Community (TCC) connection is wrong.
- TIMEOUT: Attempted multiple times and failed to sync. Possibly the Internet connection is poor.
- IDLE: Waiting for other files to be uploaded.

TIP – If files are stuck in the queue, tap **CLEAR** to remove them from queue, and then do a manual sync to retry syncing that file.

Event Log

The software logs system events and displays the last 1,000 records in the event log.



Scroll to the right side of the **Event Log** and tap ⋮ to see additional information for a specific record.

12

Troubleshooting Common Issues

When the software encounters an issue that will cause invalid data to be used, the software displays error messages to notify the operator. The error messages contain information to diagnose the cause of the issue.

GNSS issues

If a GNSS related issue arises, the most likely cause of the error is related to loss of power to GNSS receivers, loose cable connections (receivers, controller, GNSS antennas, and radio antennas, or a base station related issue (which would affect all machines on site).

Message	Possible causes
GNSS no response in xx seconds	**GNSS no response in xx seconds** appears anytime there is a GNSS related issue. It could mean that you have lost power to the GNSS receivers. It could also mean that while the receiver may be connected and communicating, it has no valid positioning data that meets the GNSS setup criteria for the software.
GNSS HRMS: x.xx (0.05) **GNSS VRMS: x.xx (0.05)**	**GNSS HRMS: x.xx (0.05)** means that the horizontal positioning accuracy estimate that the GNSS system is providing is not meeting the HRMS tolerance value that is shown in parenthesis (0.05). **GNSS VRMS: x.xx (0.05)** means that the vertical positioning accuracy estimate that the GNSS system is providing is not meeting the VRMS tolerance value that is shown in brackets (0.05). The HRMS and VRMS values will change depending on the measurement conditions that the GNSS receiver antennas are in. These values will increase from 0 as the conditions worsen. Examples of worsening conditions are proximity to lateral, vertical, and overhead obstructions such as high walls, tree canopy, building structures, etc. The HRMS and VRMS tolerances can be adjusted in the **GNSS Setup** screen.
GNSS Base: QI (MB): x.xx (RTK Fixed)	**GNSS Base: QI (MB): x.xx (RTK Fixed)** means that the moving base quality is not RTK Fixed. The xxxx can be Unknown, Autonomous, SBAS, RTK Fixed, or Location. If the moving base quality is set to RTK Fixed, it will be displayed in parenthesis. The first value x.xx is the current moving base quality. This could mean: • The moving base receiver is no longer tracking satellites (GNSS antenna is disconnected or obscured). • The base station has stopped transmitting corrections (loss of power). • The radio communication between the base and the moving base has been lost (Frequency/Network ID has been changed, radio antenna disconnected, out of radio range).

CAN sensor issues

If a CAN sensor related issue arises, the most likely cause of the error is lost connection to the sensor, damaged cables, or loss of power to the CAN-to-ETH adapter.

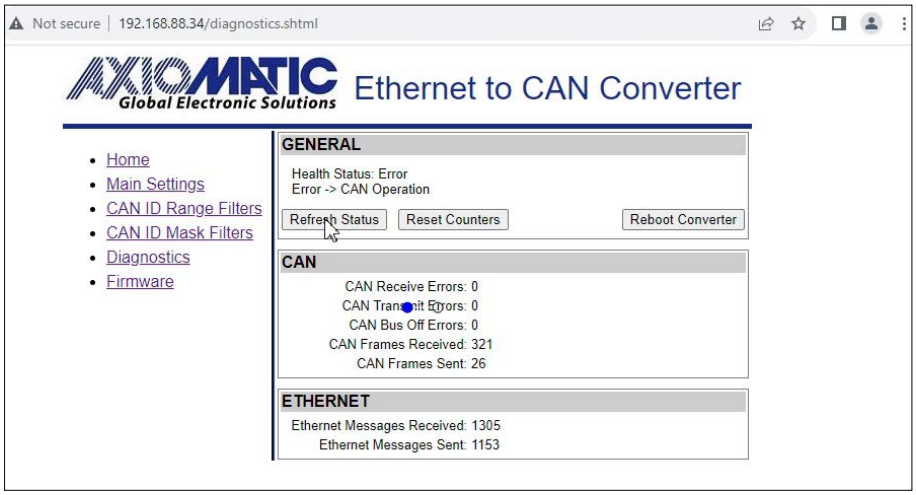
Messages	Possible causes	Solution
xxxxx sensor no response in xx seconds	The xxxxx sensor has failed to respond, indicating that the sensor or cable connection to the sensor is likely the cause.	see Troubleshooting CAN sensor issues, page 99
CAN sensors Failed to find any nodes on the CANBus	The configuration of the Groundworks setup is wrong and you must follow steps to determine if CAN-to-ETH adapter is visible in webUI. If not, most likely the cause is related to the sensor or the configuration.	see Troubleshooting CAN sensor issues, page 99

Troubleshooting CAN sensor issues

Determine if the error is related to hardware or software.

If it is software related:

1. Close out of Groundworks software if it is running.
2. Check to see if you have access to the CAN-to-ETH adapter webUI (IP address is what was set in the webUI during the initial setup. If you followed the Groundworks setup steps, it should be 192.168.88.34.
   A. If the IP address is incorrect, you have one of the following issues:
      - you have a configuration problem with the display and setting up the unit
      - the cable between the CAN-to-ETH adapter and the ethernet switch is faulty
      - if you do not have access to the GNSS webUI, your cable from ethernet switch to the display may be faulty
   B. If the IP address is correct, check the webUI of the CAN-to-ETH adapter under diagnostics:



Check the **Health Status**:

a. **Error**: issue with the CAN bus and will not be receiving any communication

b. **warning**: it is still working but you have experience CAN bus errors

c. **normal**: no issue with the CAN line

If **Error**, the issue lies with the CAN's daisy chain.

If **warning**, you must check the **CAN bus** line as well and determine when CAN line is losing communication to the Grounworks software.

If the error is hardware cable/sensor related, follow the steps below. The CAN sensors are connected in a chain; each sensor is connected to the prior and subsequent sensor in the chain.

1. If one sensor becomes disconnected, then all subsequent connections also become disconnected.
2. Disconnect the power from the CAN-to-ETH adapter while connecting/disconnecting the CAN sensors to avoid damaging the sensors.
3. If more than one sensor fails to respond, look at the first sensor in the chain that is failing to respond and check that the wires inside the connector are not loose and that the connections to the CAN In/Out ports are secure.
4. Try a replacement cable to see if the sensor starts to respond as a result.
5. Connect the input and output cables for the first failed sensor to bypass the sensor; check if the other sensors in the chain start to respond. If they do, the bypassed sensor is potentially defective.

Startup error of Groundworks software

Messages	Possible causes	Solution
Groundworks.exe has stopped working	Potential corrupt file	• delete the Trimble Synchronizer Data folder from C drive. • delete the existing Groundworks software via uninstall from control panel. Refer to the *Groundworks Installation and Configuration Guide*.
The .Net Framework 4.8.1 is not supported on the operating system	The Trimble Verso display is compatible only with versions up to .Net Frameworks version 4.8.	visit the .Net Framework website and search for the v.4.8 (download)

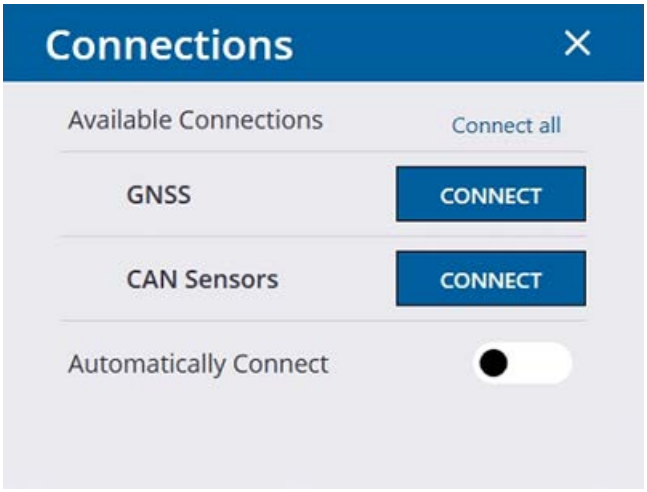
13

Machine Configuration

Connecting the GNSS and CAN sensors

To manually connect GNSS and CAN sensors:

1. Tap ☰ then tap  to open the **Connections** screen.



2. Tap **Connect all**. If a connection fails, tap **CONNECT** to retry.
3. When all connections are successful, tap ✕ to close the **Connections** screen.
4. When prompted to manually reset the depth sensor, move the tool to ground level then tap **ACCEPT**.

   If the depth sensor is reset in the wrong position, on the toolbar tap  to manually reset the depth sensor again.

TIP – Enable the **Automatically Connect** option for the software to automatically connect on startup.

Toolbar

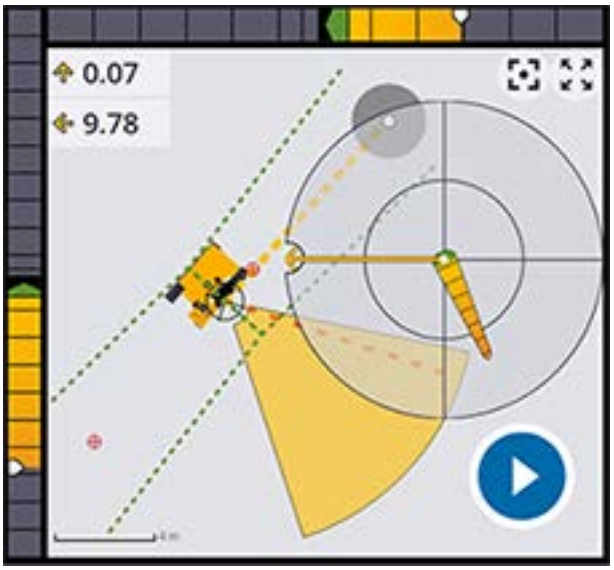
The toolbar contains features and settings to assist with daily operations. To expand or minimize the toolbar, tap « or » in the top right corner.

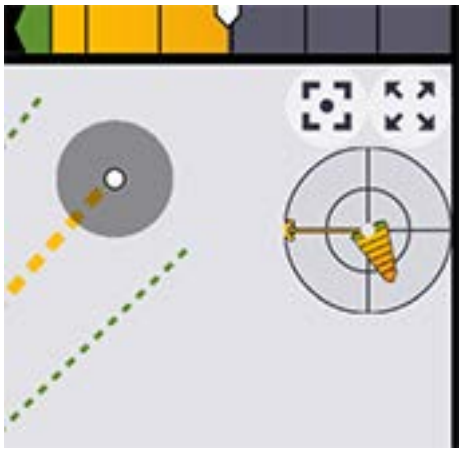
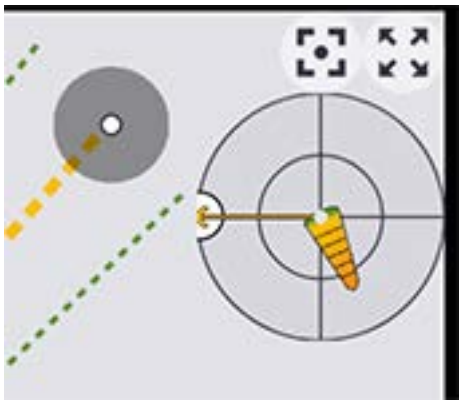
Interface Settings

From the toolbar, tap  to access Interface settings.

Item		Description
	Color mode	Select between Day/Night mode to change the color theme.
	Layout	Select from the available screen layouts to modify location and number of views.
	Views 1/2/3	Configure the map view to be used for each view (each view can only be selected once).
Infobar		
	Location	Select the location of the Infobar on the screen.
	Decimals	Select the amount of decimal places to be shown for Infobar items.
Cut/fill bar		

Item		Description
	Size	Large 
		Medium 
		Small 
	Enabled	
	Off	Do not show cut/fill map when save point has been activated.
	On	Always show cut/fill map.
	Auto	Only show cut/fill map when save point has been activated.
Bull's-eye		

Item		Description
	Show Bull's-eye inclination	Toggle on to show inclination values shown on the bull's-eye. The light bar indicates inclination and the bull's-eye also shows the direction of the clination (pitch and roll). 

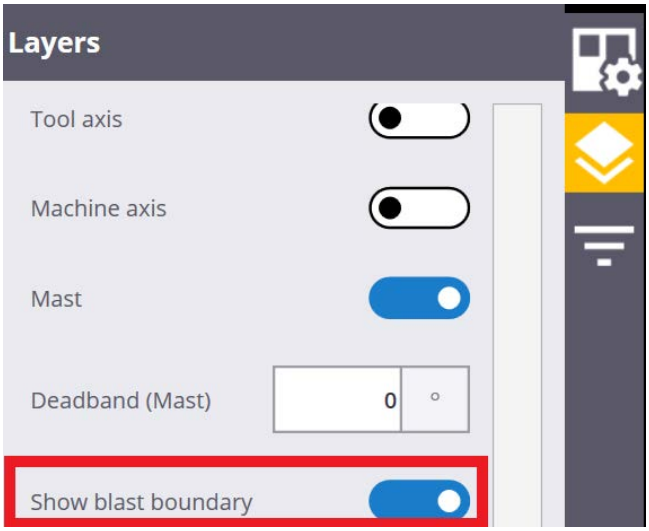
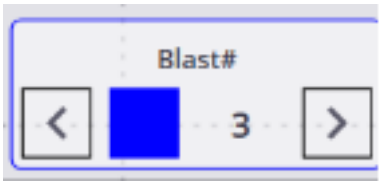
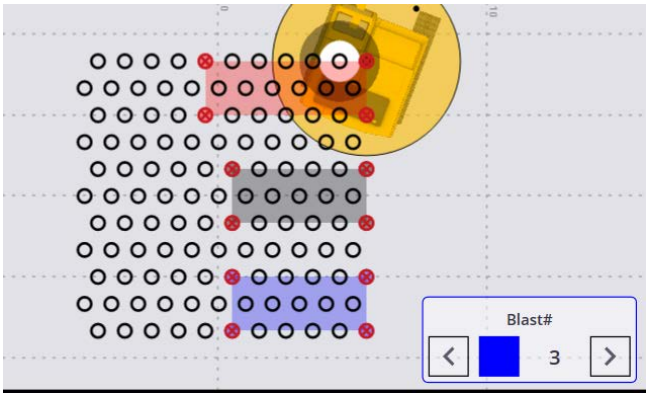
Item	Description	
Overlay	Select from small medium or large.	
	Small 	
	Medium 	
	Large 	
	Enabled	Turns on or off the overlay.
Lightbars		
	Inverse roll	Inverse the behavior of the roll bar.
	Inverse pitch	Inverse the behavior of the pitch bar.
	Top	Select from the available lightbars which will appear at top of screen.

Item		Description
	Left	Select from the available lightbars which will appear on left side of screen.
	Right 1/2	Select from the available lightbars which will appear on right side of screen.
Additional		
	Zoom buttons	Show the zoom in and zoom out buttons in map views.
	Position guidance	Show delta forward/backward and left/right arrows for position guidance to active hole.
	Selection arrows	Show arrows < > to step through the drill holes one by one.
	Start/Stop button	Show the start/stop save button in the main screen.
	Mute all sounds	Mutes all system sounds excluding the start/stop save sound.

Layer Settings

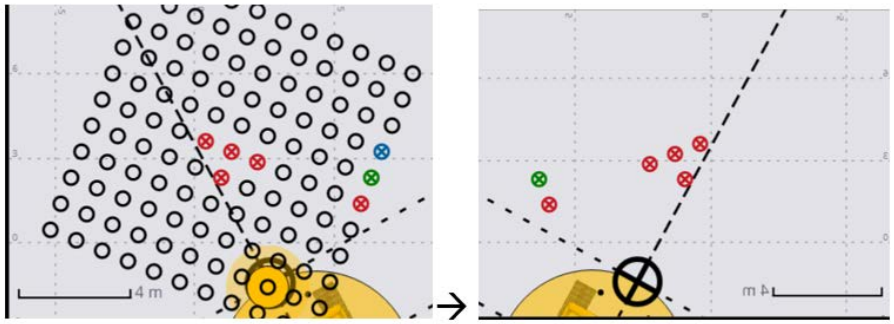
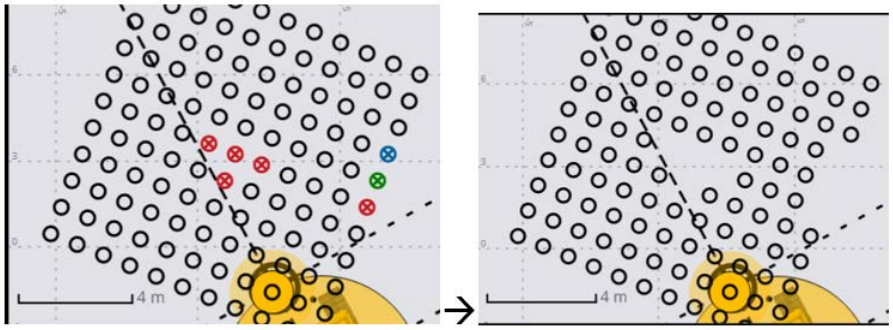
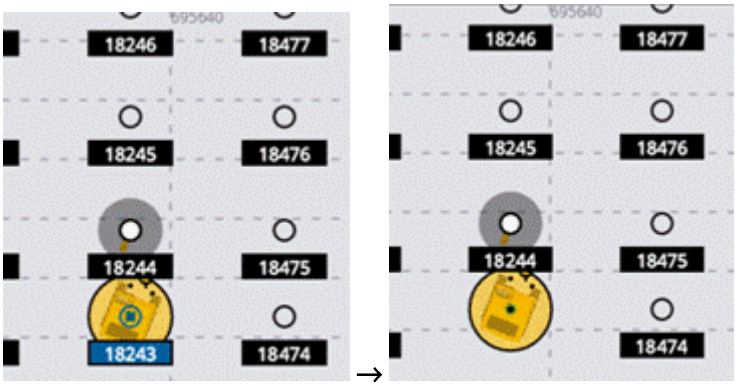
From the toolbar, tap  to access Layer settings.

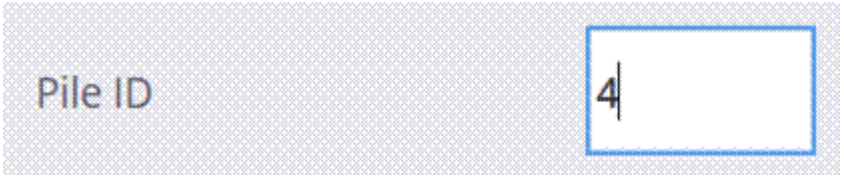
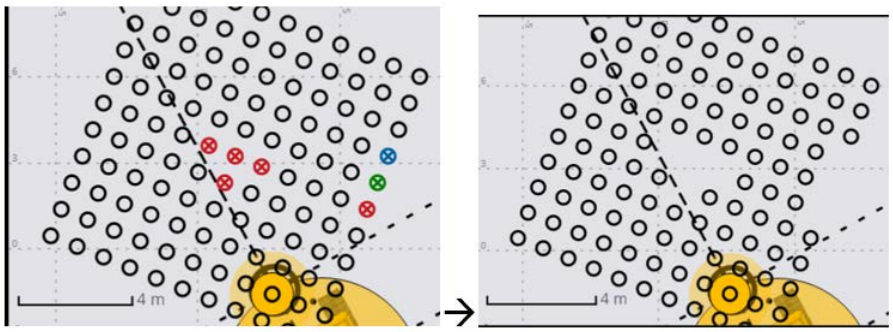
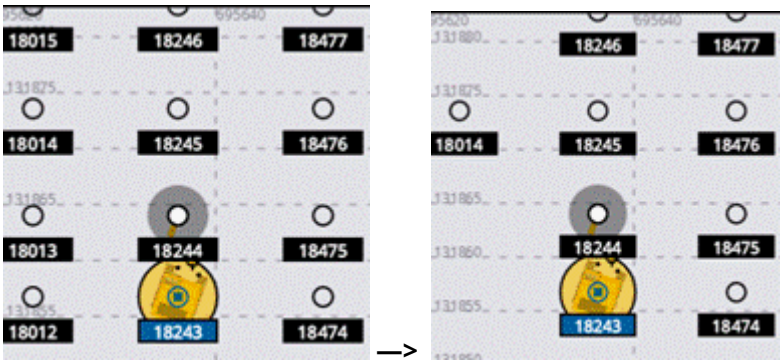
Item	Description
General	
Design	Show the active design.
Drill plan	Show the active drill plan.
Alignment markings	Show alignment information (stationing, radius, etc.).
Points	Show points.
Point names	Show point names.
Cross section names	Show cross section names.
3D View	
Show one hole	Only show the active hole.
Show triangles	Show triangles on the active design.
Use texture	Show a texture on the active design.
Texture	Select from list of available textures.
Drilling Rig	
GNSS	Show the GNSS antenna positions.
Machine	Show the machine body.
Reach circle (Only applicable for exactor type machines.)	Show the working radius of the machine based on tool distance from the machine rotation center.
Tool axis	Show a sight line through the tool location.
Machine axis	Show a sight line through the machine center of rotation.

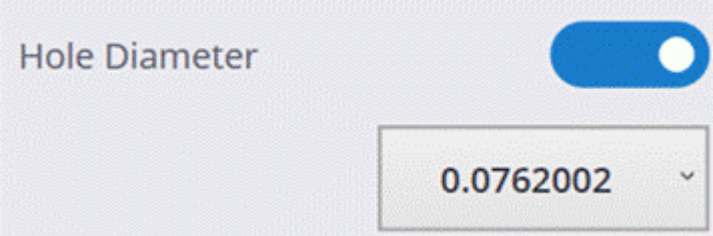
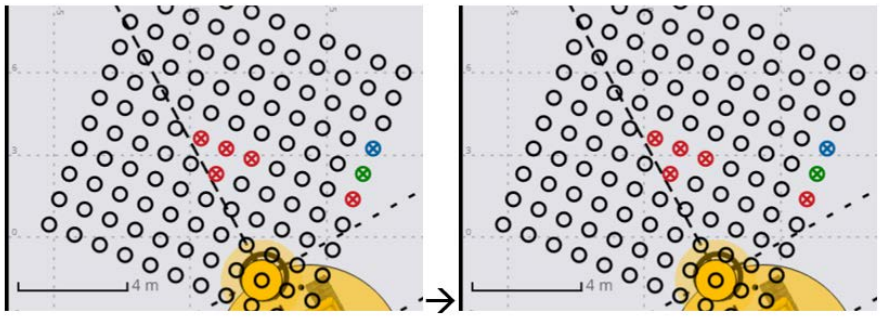
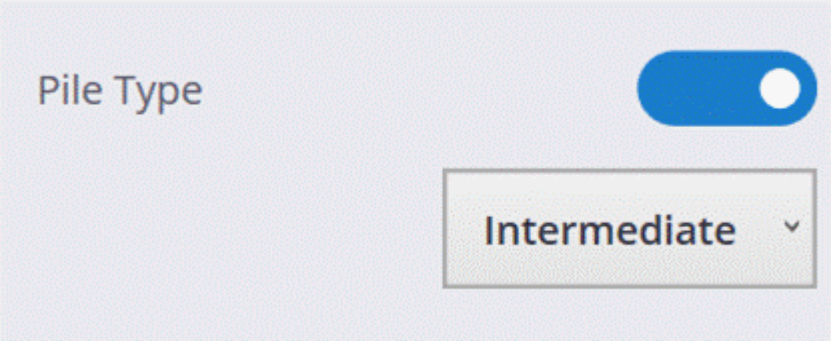
Item	Description
Mast	Show the orientation of the mast direction when inclined.
Deadband (Mast)	Threshold to show/hide the mast direction. If set to 2˚, the mast direction is not shown unless inclination is > 2˚.
Show Blast Boundary	This feature creates boundaries around selective drill holes to group them. This visually aids operators when it comes to different groups of blast pattern. To activate this feature, toggle the **Show Blast Boundary** under **Layers**.  Select the blast number with the colour coordinate on the bottom of the main UI  and begin drilling to apply the hole to the blast group. Once the the grouping is complete, select a different blast number. The result shows different colour coordinate for each blast boundary: 

Item	Description
Drill Plan	
Show IDs	Show the hole IDs in Plan view.
Show names	Show hole names in Plan view.
Show drilled depth	Show the drilled depth for all the completed holes in Plan view.
Show quality details	If disabled, the completed hole will be marked with an X with a colored ring to indicate if it's passed () or failed () the tolerance requirements. If enabled, an additional colored ring broken up into ***four*** arcs () are displayed to indicate if each of the tolerance requirements have passed (green) or failed (red). If any of the arcs have failed, the hole will be marked as failed. • Top arc: Horizontal position • Right arc: Vertical position • Bottom arc: Orientation • Left arc: Inclination

Filter settings

Item	Description
Finished	Filter Design data to display only completed holes marked as Red or Green. 
Unfinished	Filter Design data to display only unfinished holes marked as Black. 
Incomplete (changed to mark as incomplete)	Filter Design data to display only incomplete holes marked as blue, red, and green 

Item	Description
Pile ID	Filter pile plan to show the value input by operator. Example: Operator puts number 4 in **Pile ID**, the software will filter out to show all pile IDs that contain 4.  
Pile name	Filter pile plan to show the value input by operator. Example: Operator puts number 4 in **Pile Name**, the software will filter out to show all pile names that contain 4.  
Note	Only show active holes that contains the user input value for **Note**. Example: Any holes that contains "testing" will display: 

Item	Description
Hole Type	Shows active hole that has vertical or inclined hole. 
Hole Diameter	Shows active holes that has the list of diameter.  
Pile Type	Shows active pile that has the specific type of pile selected. 

Item	Description
Method of piling	Shows active pile that has the specific piling method selected. **Friction** - Select this if the pile type is to be embedded where there is no rock strata to stop the pile from deeper embedment. Friction piles are counted in the **Blow Count Report**. **End point** - Select this if the pile type is to be embedded where there is rock strata that will stop the pile from deeper embedment. **Elevation** - Select this if the pile type is to be embedded until it reaches a certain depth (such as in solar farm where panels are to be attached to the top of the piles at a consistent elevation). Only elevation piles use the 3D positional tolerance, specified in **Project Settings** / **Computations** / **Piling** and reported in the **Piling Quality Report**. **Other** - Select this if none of the other methods apply. Piles that use this method are also included in the **Blow Count Report**.

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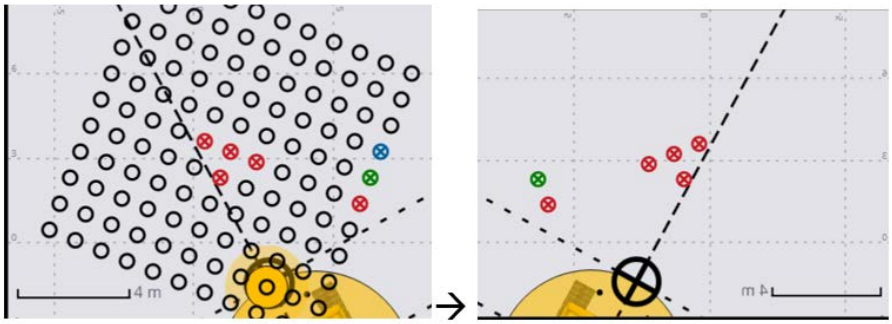
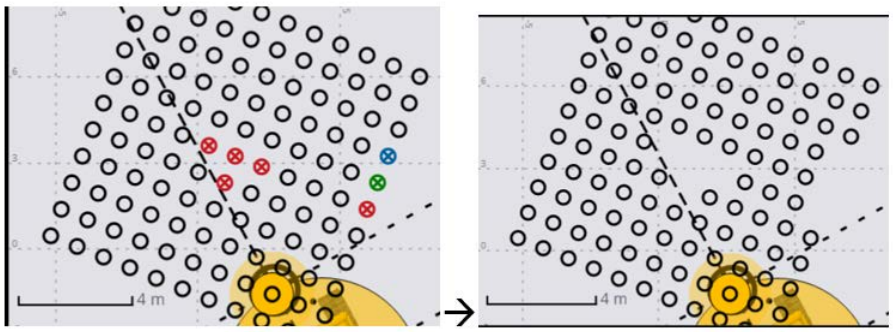
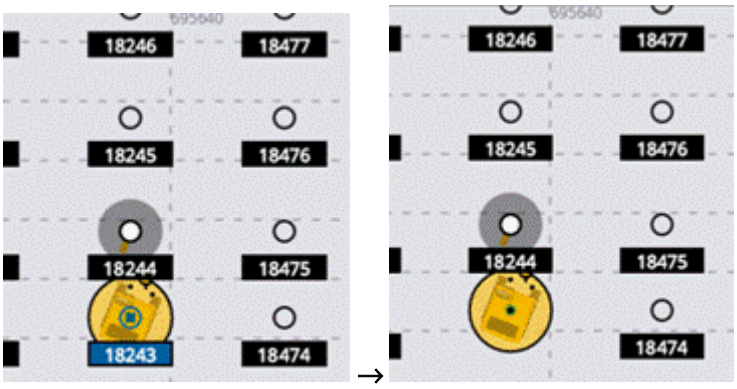
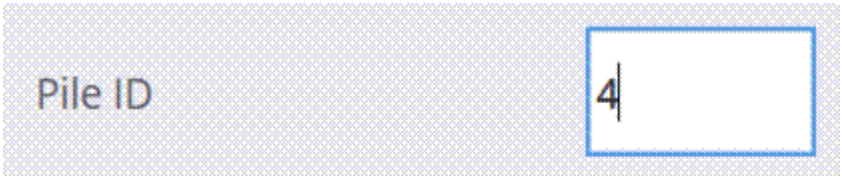
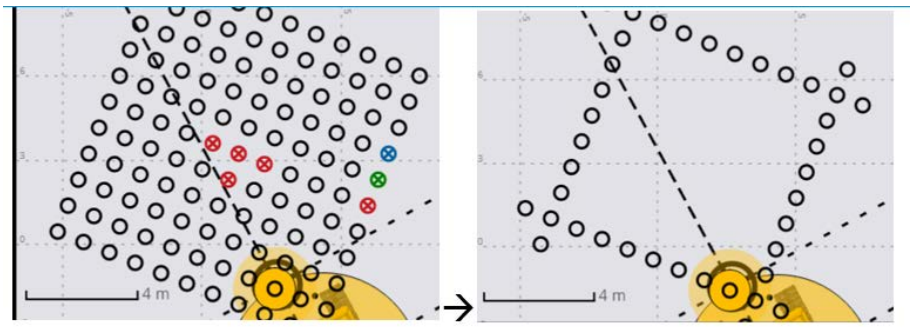
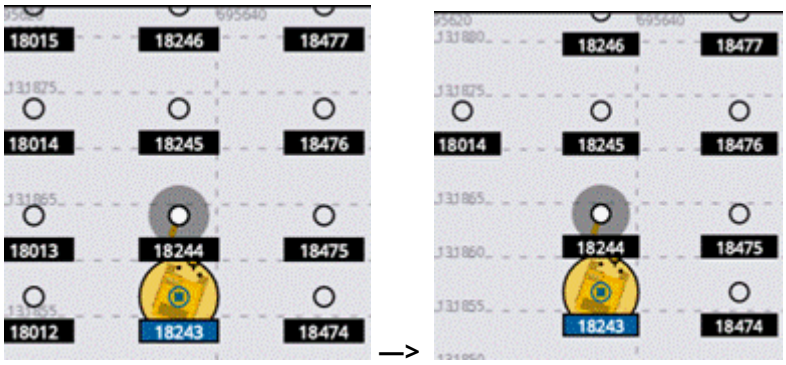
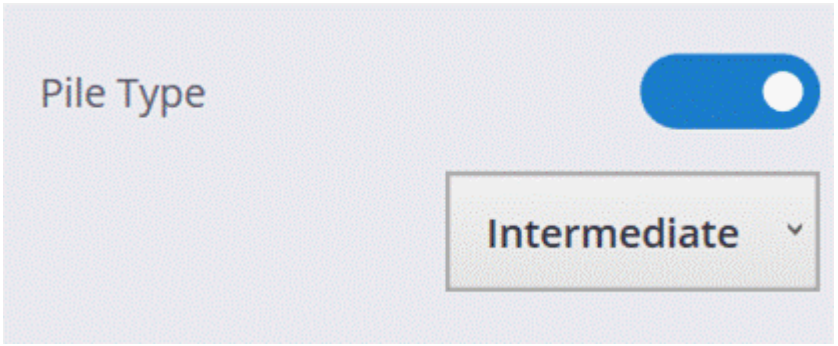
Piling Configuration

Layer settings

From the toolbar, tap  to access Layer settings.

Item	Description
Pile Plan	
Finished	Filter Design data to display only completed holes marked as Red or Green. 
Unfinished	Filter Design data to display only unfinished holes marked as Black. 

Item	Description
Incomplete (changed to mark as incomplete)	Filter Design data to display only incomplete holes marked as blue, red, and green 
Pile ID	Filter pile plan to show the value input by operator. Example: Operator puts number 4 in **Pile ID**, the software will filter out to show all pile IDs that contain 4.  

Item	Description
Pile name	Filter pile plan to show the value input by operator. Example: Operator puts number 4 in **Pile Name**, the software will filter out to show all pile names that contain 4.  
Note	Only show active holes that contains the user input value for Note. Example: Any holes that contains "testing" will display: 
Pile Type	Shows active pile that has the specific type of pile selected. 

Item	Description
Method of piling	Shows active holes that has the list of diameter. **Friction**: Select this if the pile type is to be embedded where there is no rock strata to stop the pile from deeper embedment. "Friction piles" are counted in the **Blow Count Report**. **End point**: Select this if the pile type is to be embedded where there is rock strata that will stop the pile from deeper embedment. **Elevation**: Select this if the pile type is to be embedded until it reaches a certain depth (such as in a solar farm where panels are to be attached to the top of the piles at a consistent elevation). Only the "elevation piles" use the 3D positional tolerance specified in **Project Settings** / **Computations** / **Piling** and are reported in the **Piling Quality Report**. **Other**: Select this if none of the other methods apply. Piles that use this method are also included in the **Blow Count Report**.

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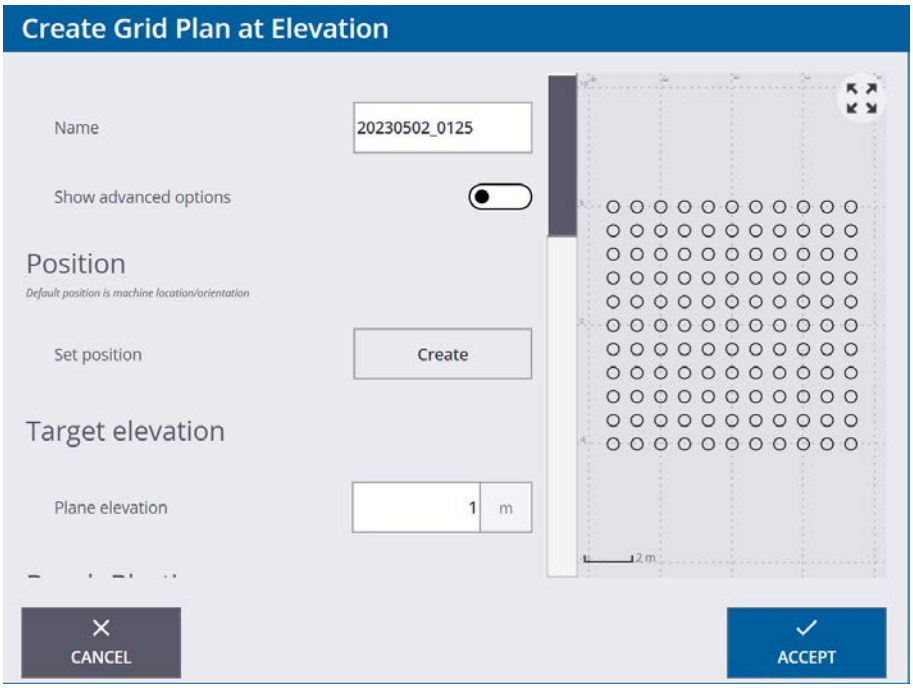
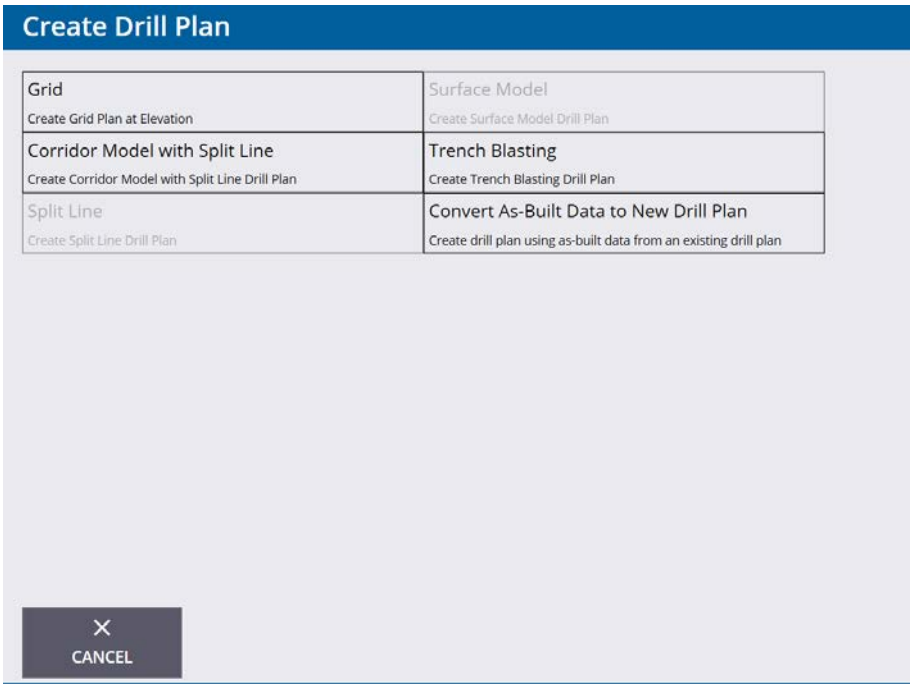
Drilling Configuration

Creating drill plans in the field

NOTE – All in-field designs now show a preview that interacts live with changes.



1. On the **Project Setup** screen, tap  next to **Drill Plan**.
2. Tap **Create Design**.
3. Select from the available drill plan types to create a drill plan.



> **NOTE –** If a drill plan is greyed out it means it cannot be created. This is either because the machine has no position or a design required to build that drill plan is not actively selected.

Create a Grid Drill Plan

The Grid drill plan creates a plan with limited options when you are not using a design, but allows the grid to be set on an elevation.

1. Select **Grid Model**.
2. Complete the following fields as required:
    - **Name**: Enter a unique name for the drill plan.
    - **Position**: The northing, easting, elevation for drill plan origin will be pre-filled using current tool position:
        - **N**– Enter northing value for drill plan origin (Hole ID 0:0).
        - **E** – Enter easting value for drill plan origin (Hole ID 0:0).
        - **Elv** – Enter top of hole elevation value for drill plan origin (Hole ID 0:0).
        - **Create custom line** – Tap **Create** and follow the prompts to create a custom line. This custom line is used to calculate the Plan orientation.

            > **NOTE –** If you create a custom line, another option called **Plan inclination** appears below **Plan orientation**. This value is automatically calculated to ensure that the hole start points intersect with the custom line (applies to inclined holes).

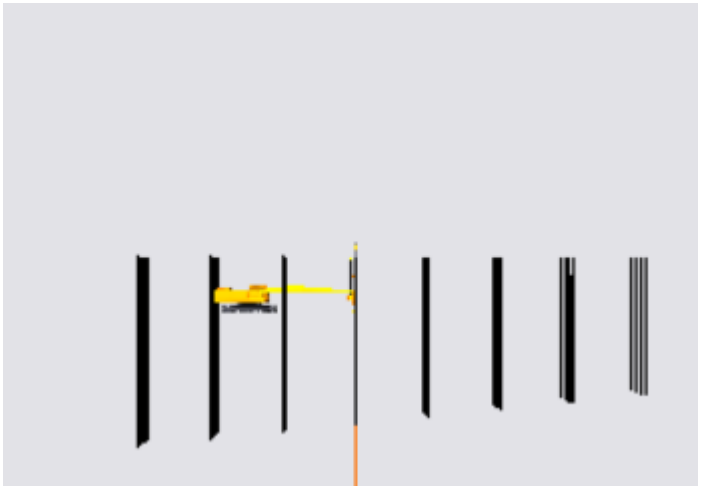
    - **Bench Blasting**:
        - **Plan orientation** – Enter the orientation of the drill pattern.
        - **Delta hole orientation**– If using inclined holes, enter the delta orientation to get the correct blast direction.
        - **Hole inclination** – Enter the hole inclination.
        - **Staggered** – Enable to stagger the drill pattern by half the row spacing (burden).
        - **Holes to left** – Enter the number of holes to the left of the drill plan origin in relation to the plan orientation.
        - **Holes to right** – Enter the number of holes to the right of the drill plan origin in relation to the plan orientation.
        - **Holes behind** – Enter the number of holes behind the drill plan origin in relation to the plan orientation.
        - **Holes ahead** – Enter the number of holes ahead of the drill plan origin in relation to the plan orientation.
        - **Row spacing (Burden)** – Enter the row spacing (burden).
        - **Hole spacing** – Enter the hole spacing.

- **Drill Plan Boundaries**:

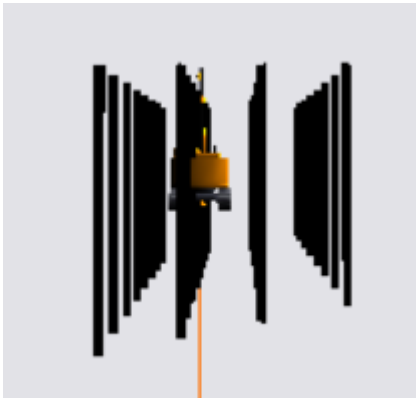
  NOTE – Boundaries must be present in the active VCL design in order to be selected.

  - **Outer boundary** – Select a boundary from the design to avoid having holes built outside of this boundary.
  - **Inner boundary** – Select a boundary from the design to avoid having holes built within this boundary.

- **Target Elevation**:
  - **Long slope** – Enter the percentage to have drill holes length follow the provided long slope:

  - **Side slope** – Enter the percentage to have the drill hole length follow the provided side slope:

  - **Plane elevation** – Sets the elevation to where the drill holes will end.

    NOTE – If the plane is not flat, the long slope and side slope must be entered as a percentage.

- **Sub Drilling**:
  - **Include percentage of row spacing (burden)** – Enter a percentage of row spacing (burden) to be used for blast hole sub drilling.
  - **Include depth percentage** – Enter a depth percentage of the drilled length to be used for blast

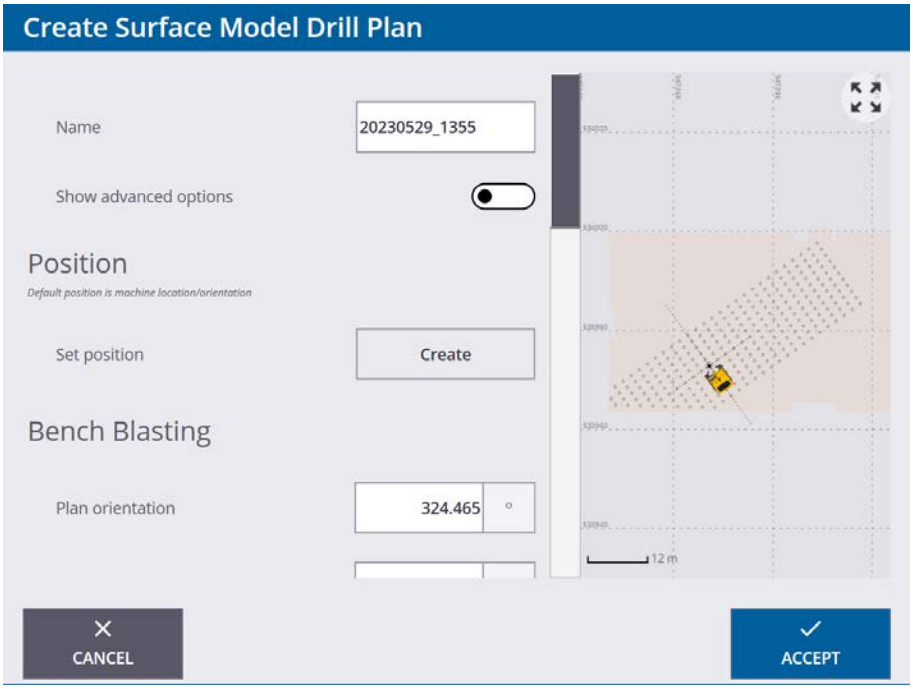
hole sub drilling.

- **Include blast hole constant** – Enter a constant value to be used for blast hole sub drilling.

- **Hole Diameter**:
  - **Blast holes** – Enter the diameter of the blast holes.

3. Tap **PREVIEW** to verify that the drill plan looks correct, then tap **ACCEPT** to exit the preview.
4. Tap **ACCEPT** to create the drill plan.

Create Surface Model Drill Plan



The Surface Model drill plan creates a grid drill plan which can be tied to the active surface in a design or a defined plane.

1. Select **Surface Model**.
2. Complete the following fields as required:
   - **Name** – Enter a unique name for the drill plan.
   - **Position** – The northing, easting, elevation for drill plan origin will be pre-filled using current tool position:
     - **N** – Enter northing value for drill plan origin (Hole ID 0:0).
     - **E** – Enter easting value for drill plan origin (Hole ID 0:0).
     - **Elv** – Enter top of hole elevation value for drill plan origin (Hole ID 0:0).
     - **Create custom line** – Tap **Create** and follow prompts to create a custom line. This custom line is used to calculate the Plan orientation.

> **NOTE –** If you create a custom line, another option called **Plan inclination** appears below **Plan orientation**. This value is automatically calculated to ensure that hole start points intersect with the custom line (applies to inclined holes).

- **Bench Blasting**:
  - **Plan orientation** – Enter the orientation of the drill pattern.
  - **Delta hole orientation** – If using inclined holes, enter the delta orientation to get the correct blast direction.
  - **Hole inclination** – Enter the hole inclination.
  - **Staggered** – Enable to stagger the drill pattern by 1/2 the row spacing (burden).
  - **Holes to left** – Enter the number of holes to the left of the drill plan origin in relation to the plan orientation.
  - **Holes to right** – Enter the number of holes to the right of the drill plan origin in relation to the plan orientation.
  - **Holes behind** – Enter the number of holes behind the drill plan origin in relation to the plan orientation.
  - **Holes ahead** – Enter the number of holes ahead of the drill plan origin in relation to the plan orientation.
  - **Row spacing (Burden)** – Enter the row spacing (burden).
  - **Hole spacing** – Enter the hole spacing.
- **Drill Plan Boundaries**:

  > **NOTE –** Boundaries must be present in the active VCL design in order to be selected.

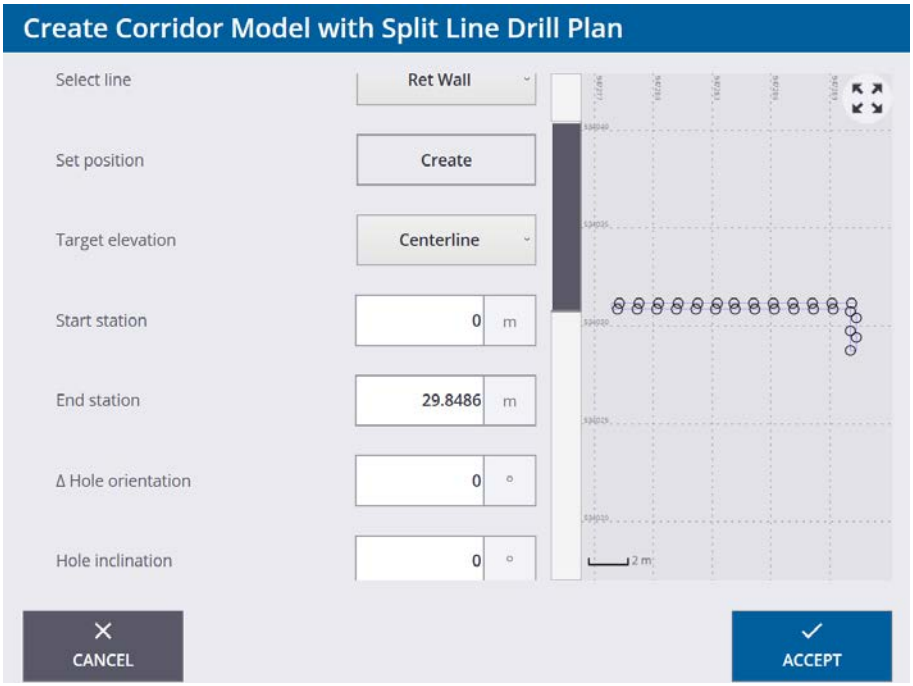
  - **Outer boundary** – Select a boundary from the design to avoid having holes built outside of this boundary.
  - **Inner boundary** – Select a boundary from the design to avoid having holes built within this boundary.
- **Surface Model**:
  - **Target elevation** – Select **Active Surface** to have holes end at the active surface from the design. Select **Plane Elevation** to enter the plane elevation the holes will end at.

  > **NOTE –** If the plane is not flat, the long slope and side slope must be entered as a percentage.
- **Sub Drilling**:
  - **Include percentage of row spacing (burden)** – Enter a percentage of row spacing (burden) to be used for blast hole sub drilling.
  - **Include depth percentage** – Enter a depth percentage of the drilled length to be used for blast hole sub drilling.
  - **Include blast hole constant** – Enter a constant value to be used for blast hole sub drilling.
- **Hole Diameter**:

- **Blast holes** – Enter the diameter of the blast holes.

3. Tap **PREVIEW** to verify that the drill plan looks correct, then tap **ACCEPT** to exit the preview.
4. Tap **ACCEPT** to create the drill plan.

Create Corridor Model with Split Line Drill Plan



The Corridor Model with Split Line drill plan creates a drill plan along a line and allows split lines to the left and right of the selected line to define where split holes are created. The target elevation for the holes can either be at the active surface or the elevation of the selected line.

1. Select **Corridor Model with Split Line**.
2. Complete the following fields as required:
   - **Name** – Enter a unique name for the drill plan.
   - **Select line** – Select a line from the design to be used for stationing.
   - **Create custom line** – Tap **Create** and follow prompts to create a custom line.
   - **Target elevation** – Select **Active Surface** to have all holes end at the elevation of the active surface. Select **Centerline** to have all holes end at the elevation of the selected line.

     > **NOTE –** This selection will change the available options for creating the drill plan.

   - **Start station** – Enter start station.
   - **End station** – Enter end station.

- **Delta hole orientation** – If using inclined holes, enter the delta orientation to get the correct blast direction.
- **Hole inclination** – Enter the hole inclination.
- **Row spacing (Burden)** – Enter the row spacing (burden).
- **Hole spacing** – Enter the hole spacing.
- **Lines to the left** – Enter the # of lines to the left of the selected line where holes will be created. Only available if **Target elevation** = **Centerline**.
- **Lines to the right** – Enter the # of lines to the right of the selected line where holes will be created. Only available if **Target elevation** = **Centerline**.
- **Split Line**: These options are only available if **Target elevation** = **Active Surface**.
  - **Hole spacing** – Enter the split hole spacing along split line(s).
  - **Hole inclination (split line)** – Enter the split hole inclination.
  - **Select split line (left**) – Select the left split line for split holes.
  - **Select split line (right)** – Select the right split line for split holes.
- **Sub Drilling**:
  - **Include percentage of row spacing (burden)** – Enter a percentage of row spacing (burden) to be used for blast hole sub drilling.
  - **Include blast hole constant** – Enter a constant value to be used for blast hole sub drilling.
  - **Include split hole constant** – Enter a constant value to be used for split hole sub drilling. Only available if **Target elevation** = **Active Surface**.
- **Hole Diameter**:
  - **Blast holes** – Enter the diameter of the blast holes.
  - **Split holes** – Enter the diameter of the split holes. Only available if **Target elevation** = **Active Surface**.

3. Tap **PREVIEW** to verify that the drill plan looks correct, then tap **ACCEPT** to exit the preview.
4. Tap **ACCEPT** to create the drill plan.

Create Trench Blasting Drill Plan

The Trench Blasting drill plan creates a drill plan along a selected line and additional holes can be offset to the left/right of that line.

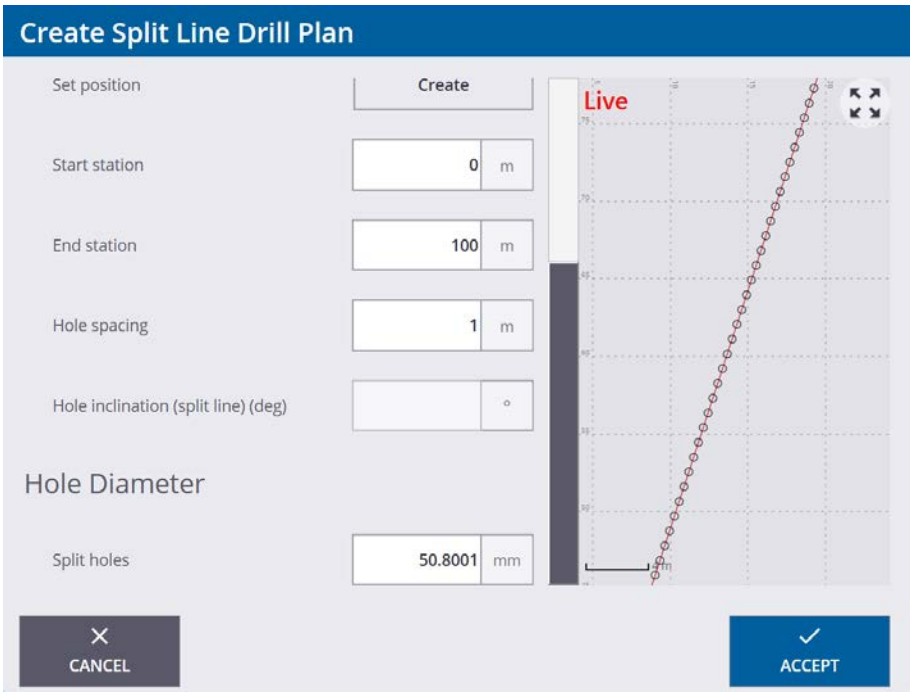
1. Select **Trench Blasting**.
2. Complete the following fields as required:
   - **Name** – Enter a unique name for the drill plan.
   - **Select line** – Select a line from the design to be used for stationing. The holes will use this line for stationing and all holes will end along this line.

- **Create custom line** – Tap **Create** and follow the prompts to create a custom line. The holes will use this line for stationing and all holes will end along this line.
- **Start station** – Enter the start station.
- **End station** – Enter the end station.
- **Staggered** – Enable to stagger the drill pattern by 1/2 or 1/3 the row spacing (burden).
- **Use centerline** – Enable to create holes along the selected line.
- **Lines to the left** – Enter the # of lines to the left of the selected line where holes will be created.
- **Lines to the right** – Enter the # of lines to the right of the selected line where holes will be created.
- **Spacing left** – Enter the spacing between lines to the left of the selected line.
- **Spacing right** – Enter the spacing between lines to the right of the selected line.
- **Delta hole orientation** – If using inclined holes, enter the delta orientation to get the correct blast direction.
- **Hole inclination** – Enter the hole inclination.
- **Row spacing (burden)** – Enter the row spacing (burden).
- **Sub Drilling**:
  - **Include percentage of row spacing (burden)** – Enter a percentage of row spacing (burden) to be used for blast hole sub drilling.
  - **Include blast hole constant** – Enter a constant value to be used for blast hole sub drilling.
- **Hole Diameter**:
  - **Blast holes** – Enter the diameter of the blast holes.

3. Tap **PREVIEW** to verify that the drill plan looks correct, then tap **ACCEPT** to exit the preview.
4. Tap **ACCEPT** to create the drill plan.

> **NOTE –** Tapping on a line in one of the map views and selecting **Create Plan** from the popup will take you directly to the **Create trench blasting drill plan** screen with that line preselected.

Create Split Line Drill Plan



The Split Line drill plan creates a drill plan with one row of holes which ends on the split line and uses the selected line to define stationing. The software calculates the angle from the tool position while creating the drill plan to the split line to define hole inclination to be used.

1. Select **Split Line**.
2. Complete the following fields as required:
   - **Name** – Enter a unique name for the drill plan.
   - **Select line** – Select a line from the design to be used for stationing.

     > **NOTE –** You can select the same line for the split line and the line.

   - **Select split line** – Select a line as the split line. Bottom of holes will end on this line.

     > **NOTE –** You can select the same line for the split line and the line.

   - **Create custom line** – Tap **Create** and follow prompts to create a custom line. By default, this line will be used as the line and split line.
   - **Start station** – Enter start station.
   - **End station** – Enter end station.
   - **Hole spacing** – Enter the hole spacing along the split line.
   - **Hole inclination (split line)** – This value is automatically calculated from the current tool position.
   - **Hole Diameter**:
     - **Split holes** – Enter the diameter of the split holes.

3. Tap **PREVIEW** to verify that the drill plan looks correct, then tap **ACCEPT** to exit the preview.
4. Tap **ACCEPT** to create the drill plan.

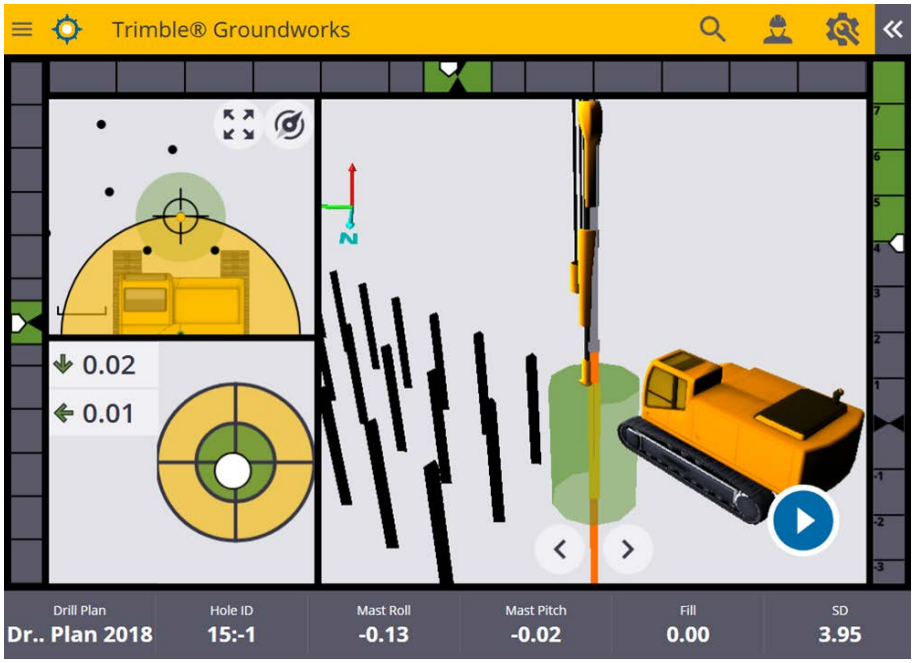
Convert As-Built Data to Drill Plan

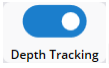
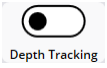
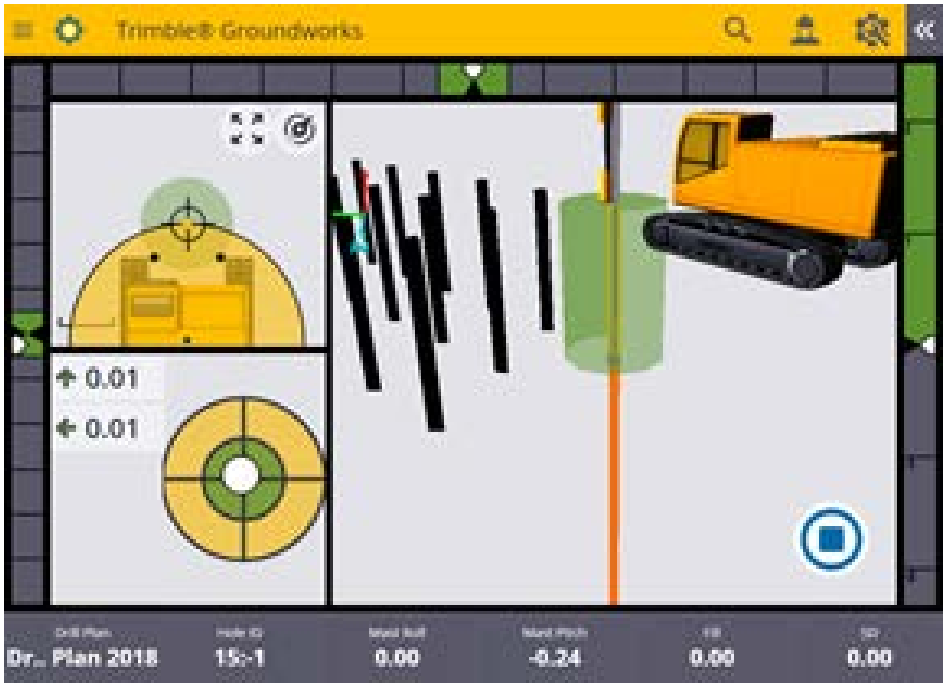
The Convert As-Built Data to Drill Plan creates a drill plan using as-built data from a previously completed drill plan. This can be used for applications where holes have already been drilled and another machine needs positioning guidance to follow the previously drilled holes.

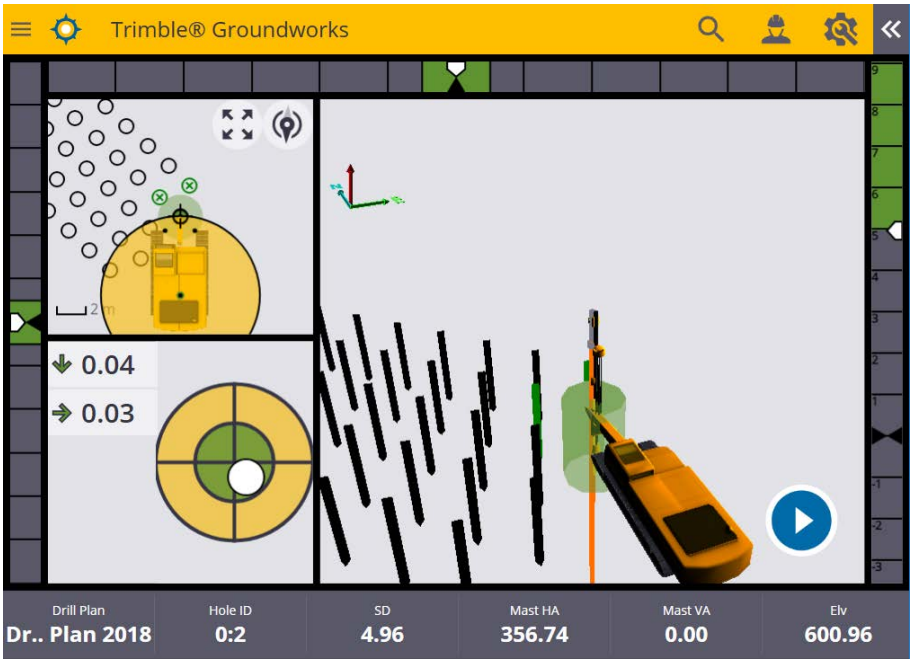
1. Select **Convert As-Built Data to Drill Plan**.
2. Browse your PC or USB stick and select the as-built data (Ends with quality.xml), then tap **ACCEPT**.
3. A new drill plan is created using the same name with the prefix Convert.

Typical Workflow

Step	Description	How
1	Select a hole.	The nearest hole that has not been completed is automatically selected while you move around the drill plan to indicate it is active. To lock onto a specific hole, tap on the hole and tap **Select** from the popup. While locked onto a hole, tap  to return to the auto select mode.
2	Navigate to the hole.	Use the bull's-eye view and/or guidance arrows to navigate the mast foot towards the active hole. They will indicate the direction and distance to the hole start point. The center of the bull's-eye is the tool and the hole is represented by a circle. • Up arrow = move forward • Down arrow = move backward • Left arrow = move left • Right arrow = move right As you approach the hole, the circle in the bull's-eye zooms in until a yellow outer ring (2x the specified tolerance) and green inner ring (within tolerance) are shown. Once you are within tolerance, the guidance arrows turn green. Place the mast foot firmly on the ground and ensure you're still within tolerance before proceeding to Step 3.

Step	Description	How
3	Incline the mast to match the hole orientation and inclination.	The green area in the pitch and roll bar represents how to incline the mast to match the hole orientation and inclination. Incline the mast in both axes until the indicator is in the middle of the green area to be within the specified orientation and inclination tolerance.  Ensure that your bull's-eye, pitch bar, and roll bar are all within tolerance before continuing to Step 4.
4	Lower the tool to the ground and start drilling.	Lower the tool to the ground and tap ⏵ to save the start point before you begin drilling. **TIP –** Ensure the drill bit is on the ground before saving the start point to gather accurate data for drilled length, drilling time, and existing ground surface.

Step	Description	How
5	Track drill depth until bottom of hole is reached.	Track the depth bar count down to 0 while drilling to stop at the correct location. In most cases, the steel changes are tracked automatically to ensure correct depth tracking. If steel changes are not tracked automatically, tap  before starting the steel change to manually pause depth tracking. When the steel change is complete and drilling is ready to resume, tap  to resume depth tracking. To manually track drilling layers while drilling, tap  on the toolbar, select the layer from the list, and tap **ACCEPT**. When you reach the bottom of the hole, tap  to save it. **TIP –** If auto stop and auto save are configured, the drilling will stop at the correct elevation and automatically save the end point.  **NOTE –** The depth bar shows yellow until the specified minimum drilling depth is met, then it turns green. The depth bar shows blue while retracting the drill with the bottom of the blue area representing the lowest depth achieved to indicate if material has fallen into hole. The depth bar shows red to indicate when over-drilling occurred.

Step	Description	How
6	Retract drill bit from hole and view as-built data.	Once the end point is saved, the completed hole will change color to GREEN if within specified tolerance or RED if outside of specified tolerance.  To view all of the planned and as-built properties of the hole, tap the finished hole then tap  .
7	Begin navigating to next hole.	Repeat steps 1-6 for each hole in the drill plan until complete.

2D and 2.5D Workflows

2D workflow

Version 1.20 and later of the Groundworks software enables 2D drilling workflows to be used where GNSS is not available and the operator needs to only record the depth and the inclination of a hole.

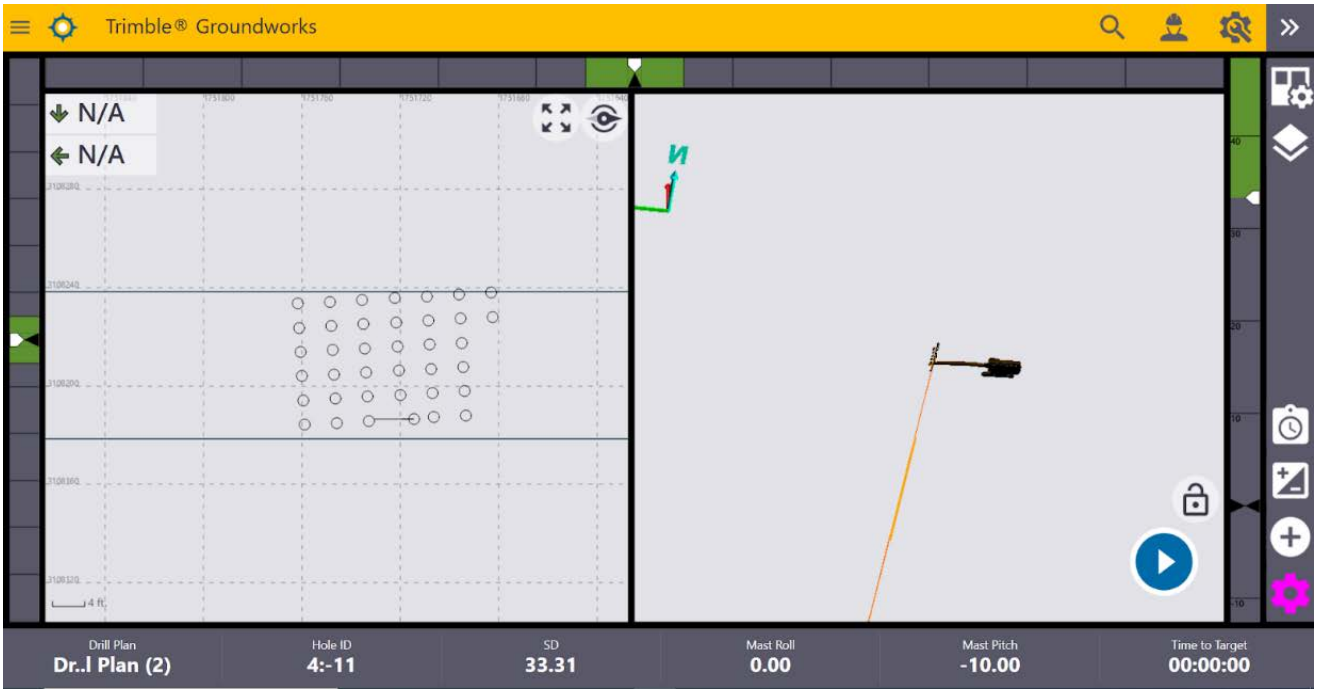
Use cases

Scenario 1 – Drill holes staked out on the field

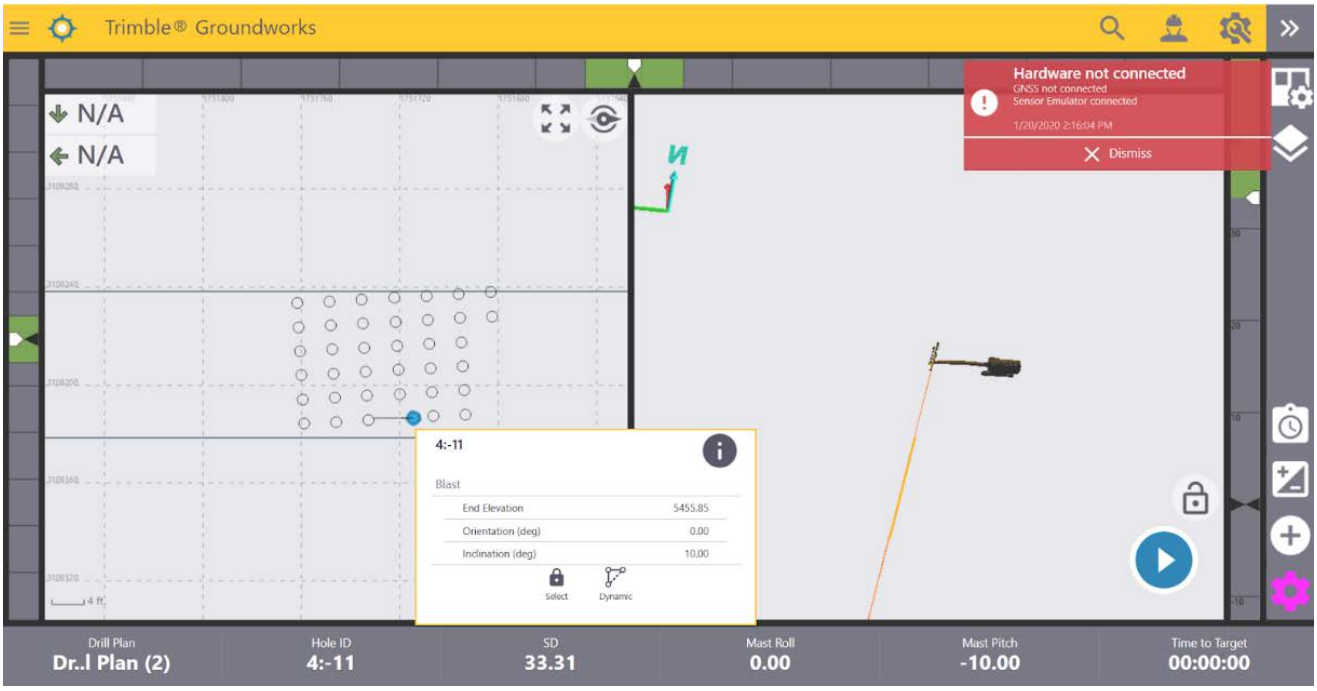
- The software creates exploratory drill plans matching the field drill plan.
- The operator records the inclination and depth for each hole.

Scenario 2 – Drill holes staked out on the field

- The software uploads the drill plan that is matching the staked out drills:



- The operator selects the hole to drill. Once the hole has been selected, the inclination and depth information from the hole metadata is stored in the software:

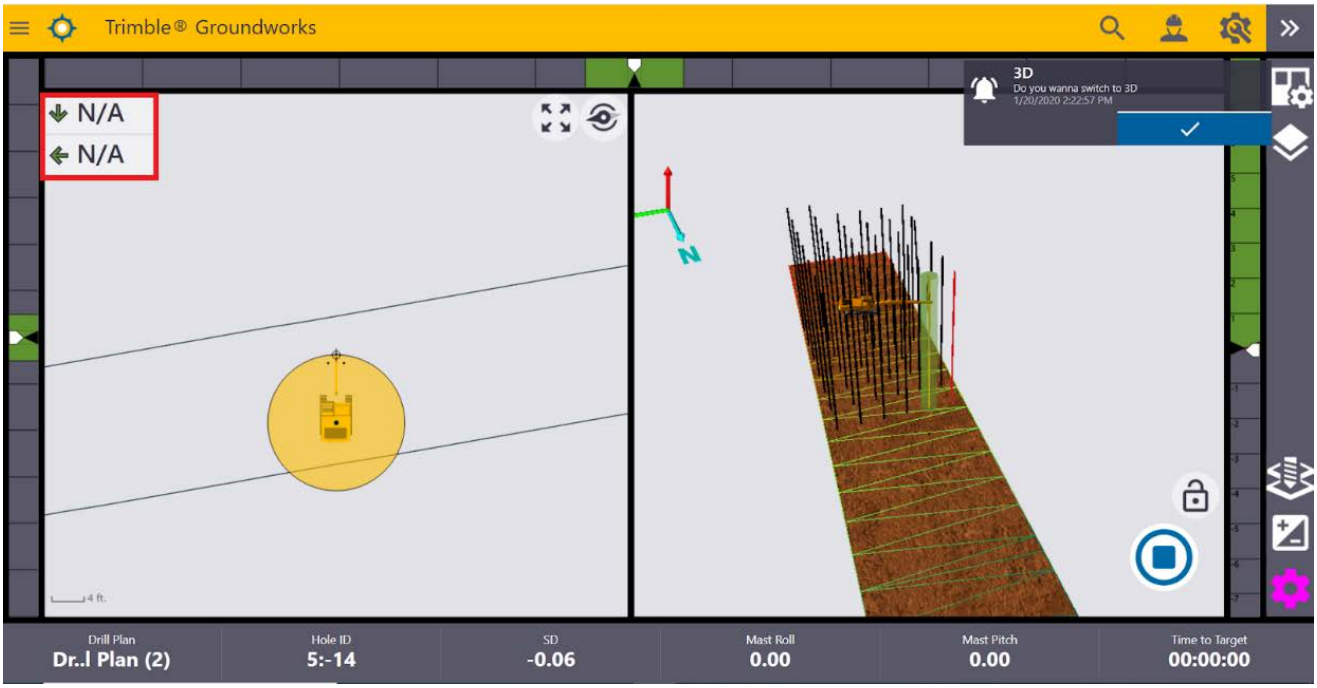


- The operator tracks to the hole in the real world (the heading of the machine is not provided unless the machine already has a built-in GPS compass sensor or the current machine installation has a sight sensor).
- ***If neither a sight nor the GPS compass sensors are part of the machine installation, Trimble does not recommend digging holes with an inclination to avoid errors in the orientation of the inclined hole.***

Scenario 3 – Loss of GNSS connection

- Version 1.1 could only drill down based on the last known GNSS location (**Settings** / **System** / **Advanced** / toggle on **Save end point without live position**).
- Version 1.2 and later enables the operator to continue to drill depth and the inclination to allow smooth and continuous operation using depth and inclination.

- The operator can switch to 2D mode to continue drilling without waiting for GNSS to become available.



NOTE – Positioning information such as heading and position to the hole will be unavailable, but the software will record the depth and the inclination.

NOTE – Absolute or relative heading is stored only if sight or GPS compass are used in the installation.

Scenario 4 – Drill holes are not staked out

- Drill exploratory holes and record the inclination and depth.

NOTE – Absolute or relative heading is stored only if sight or GPS compass are used in the installation.


Trimble® Groundworks
N/A
N/A
Add New Hole
Inclination
0
Depth
10
ft.
CANCEL
ACCEPT
Drill Plan
N/A
Hole ID
N/A
SD
10.00
Mast Roll
0.00
Mast Pitch
0.00
Time to Target
00:00:00


Trimble® Groundworks
N/A
N/A
Drill Plan
N/A
Hole ID
N/A
SD
32.81
Mast Roll
0.00
Mast Pitch
0.00
Time to Target
00:00:00

2.5D workflow

Version 1.20 and later of the Groundworks software support 2.5D piling workflows, which can be used where GNSS is unavailable and the operator only needs to record the depth and the inclination of a hole. 2.5D workflows are specific to Epiroc equipment, wich is equipped with special sensors, including a sight and a GPS compass, to determine the machine's heading.

Use cases

Scenario 1 – Using the GPS compass sensor (Epiroc and Atlascopco has this sensor built in)

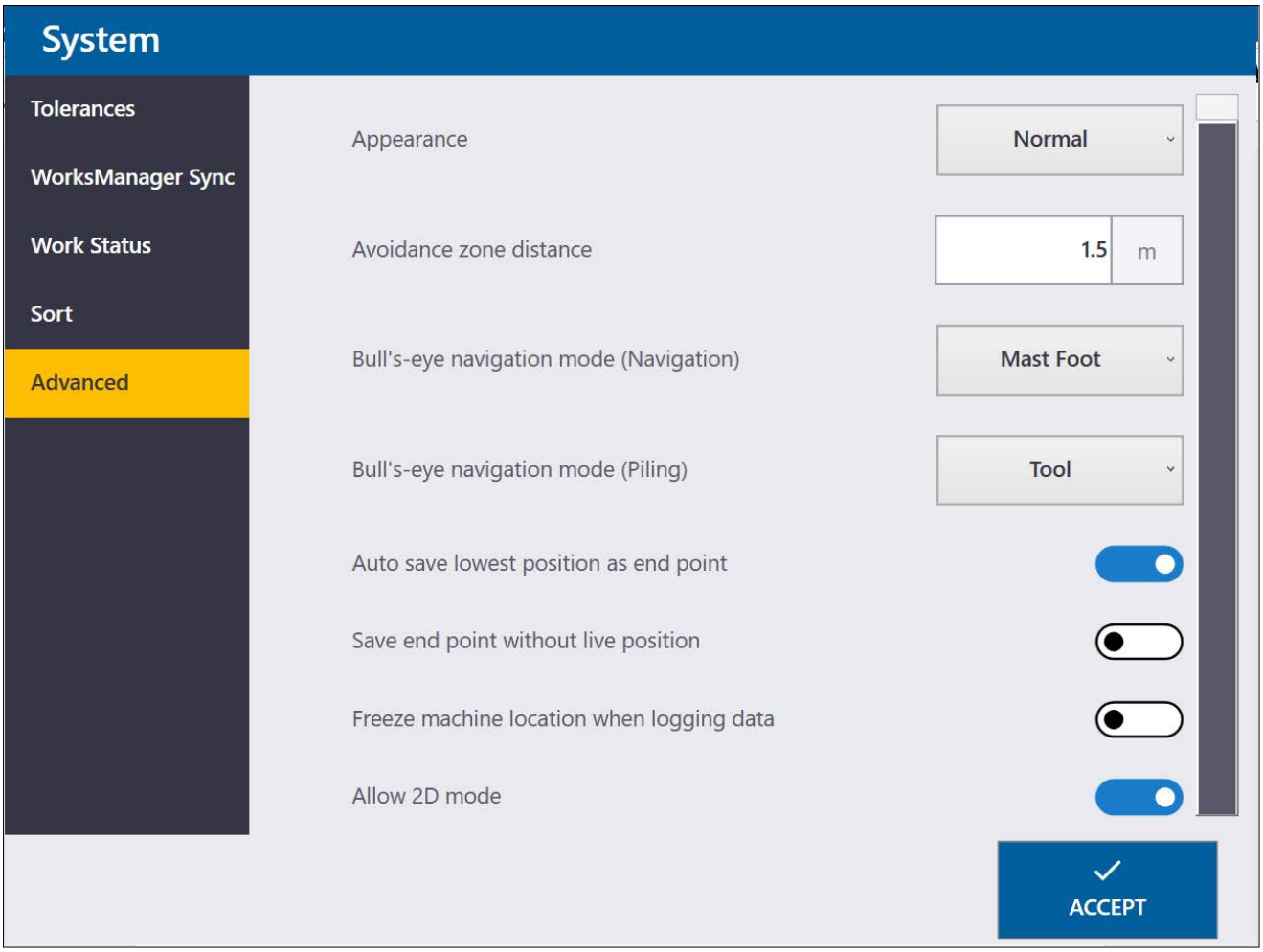
- If the machine contains a GPS compass sensor, the software can display absolute heading information.
- Unlike the 2D systems, the machine can show orientation but not N,E,Elev positions.
- The machine can be tracked to the required hole location and align the inclination and depth relative to the correct heading of the required plan.

Scenario 2 – Using a sight sensor

- The system using the sight sensor uses the input from the sensor to set the direction.
- The heading is defined by the output from the sight sensor.
- The software guides the mast to the correct pitch and roll using the sight and the vertical angles from the sight sensor and the TS900 tilt sensor.

Activating 2D and 2.5D Piling

1. Select **Settings** / **System** / **Advanced**:

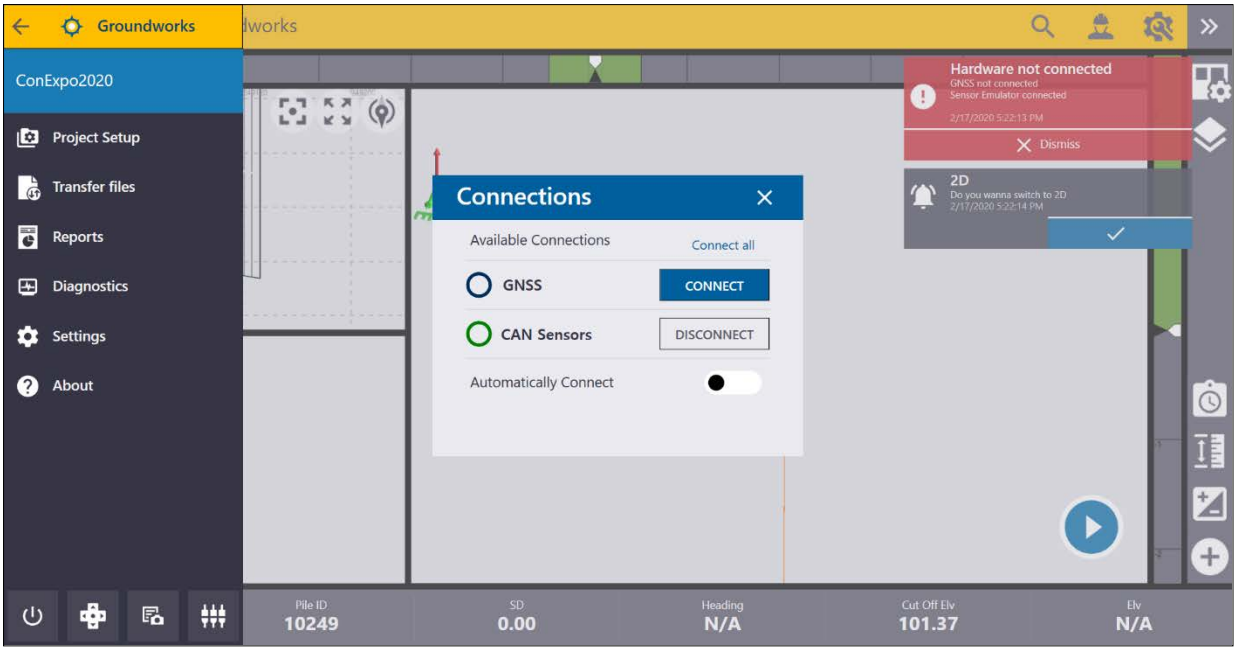


2. Toggle on **Allow 2D mode**.

> **NOTE –** For Epiroc machines that are using either a sight or GPS compass, the machine will be placed into 2.5D mode (see page 136).

3. A 2D pop-up message appears. You must tap on the check mark to confirm 2D mode.
4. There are two ways to activate the 2D mode:
   - Disconnect the GNSS from the software from the **Connections** menu. See Connecting the GNSS and CAN sensors, page 102.
   - The connection from GNSS is lost. The software automatically alerts the operator if they want to be in 2D mode.

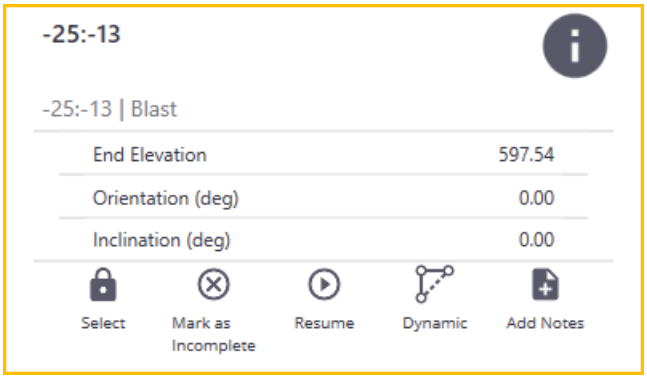
5. Disconnecting the GNSS from the connection window automatically alerts the operator to use the software in 2D mode. Tap **ACCEPT** to allow the operator to activate 2D mode.



6. To enable 3D mode again, reconnect the GNSS from the connection window and then tap **ACCEPT**.

Additional Drill Plan Features

Tap on a hole in the plan view or 3D view to access a pop-up with additional features.



Icon	Description
	View all properties for the selected hole.
	Selects the hole as the active hole. If the hole was previously drilled, saving additional as-built data is considered a re-drill and new quality data is stored.
	Mark hole as incomplete to be reminded to complete at a later date. Incomplete holes are marked as blue. Only applies to holes with as-built data.
	Mark incomplete hole as complete. Only applies to holes with as-built data.

Icon	Description
	Resume the hole to override the previously saved end point.
	Selects the hole as the active hole and recalculates the hole inclination to intersect with mast foot. Move mast foot to desired start point and line up the pitch/roll bars to drill to design end point. This feature is useful when you cannot reach the design start point.
	Add a text note to the selected hole. Only applies to holes with as-built data.

Adding a New Hole

To add a new hole to an existing drill plan:

1. On the toolbar, tap  .
2. Complete the following fields as required:
   - **Enter coordinate**: Enable to be prompted to enter northing and easting values. If disabled, the hole can be drilled in any location but you will use the defined Elv, Orientation, Inclination, and Rotation values.

     NOTE – Entering coordinates allows the hole to be displayed in map views.
   - **N**: Only available if **Enter coordinate** is enabled. Enter the northing value for the bottom of hole.
   - **E**: Only available if **Enter coordinate** is enabled. Enter the easting value for the bottom of hole.
   - **Elv**: Enter the target elevation for the bottom of hole.
   - **Orientation**: Enter the hole orientation.
   - **Inclination**: Enter the hole inclination.
3. Tap **ACCEPT** to create the hole.

NOTE – If a hole has been added but not drilled, you can tap  to remove the newly added hole.

Advanced Features

If you need to modify the design drill plan in the field, tap  on the toolbar to access the Holel Parameters settings.

NOTE – Hole Parameters are reset to default settings if the project, design, or drill plan is changed. Restarting the Groundworks software also resets these settings to default.

Sub Drilling Mode

Possible sub drilling mode options and their effect on the drill plan:

- **Off**: Sub drilling values from drill plan will be ignored.
- **On (Value From File)** (default setting): Only applies to VCL drill plans. Sub drilling values from drill plan will be used.
- **On (User Defined Value)**: Manually enter a constant sub drilling value to be used.
- **On (Percentage)**: Manually enter a percentage of the drilled length to be used.

Depth Mode

Possible depth mode options and their effect on the drill plan are:

- **Design** (default setting): Design hole end point will be used.
- **Active surface**: Hole length will be increased/decreased until they intersect with active surface.
- **Plane elevation**: Manually enter a plane elevation to increase/decrease all hole lengths until they intersect with defined plane elevation.
- **Hole depth**: Manually enter a hole depth which will be the drilled distance from start point.

Minimum Hole Length Mode

Possible minimum hole length mode options and their effect on the drill plan are:

- **Off**: Minimum hole length values from drill plan will be ignored.
- **On (Value From File)** (default setting): Only applies to VCL drill plans. Minimum hole length values from drill plan will be used.
- **On (User Defined Value)**: Manually enter a constant minimum hole length value to be used.

Override Hole Orientation and Inclination

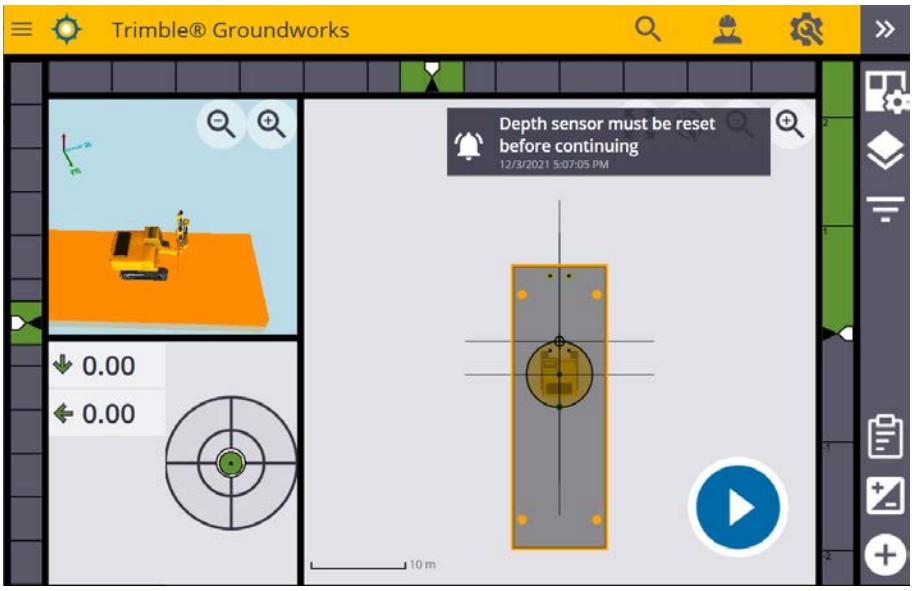
To override hole orientation and inclination values for the active drill plan:

1. Enable the **Apply** option under the **Override** section.
2. Enter the hole orientation.
3. Enter the hole inclination.
4. Tap **ACCEPT**.

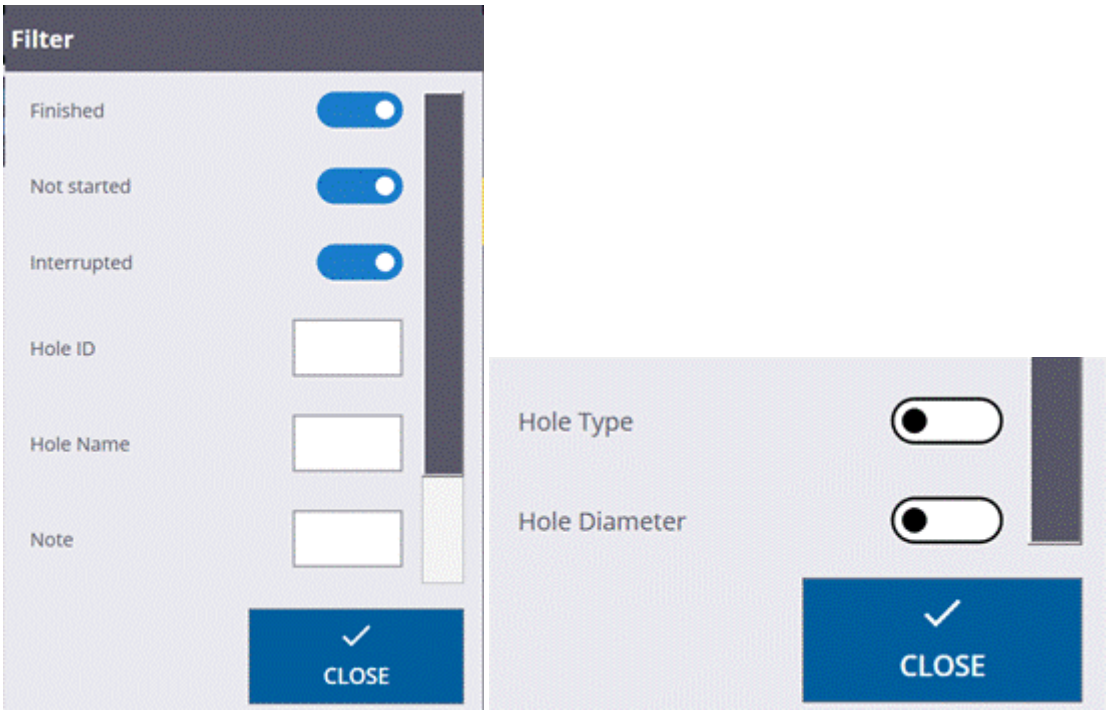
Filter

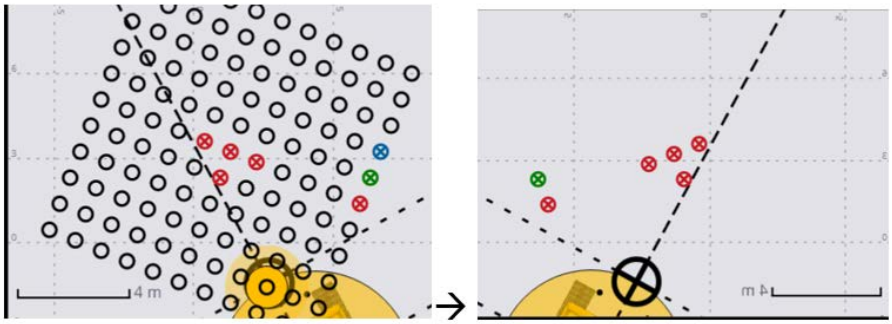
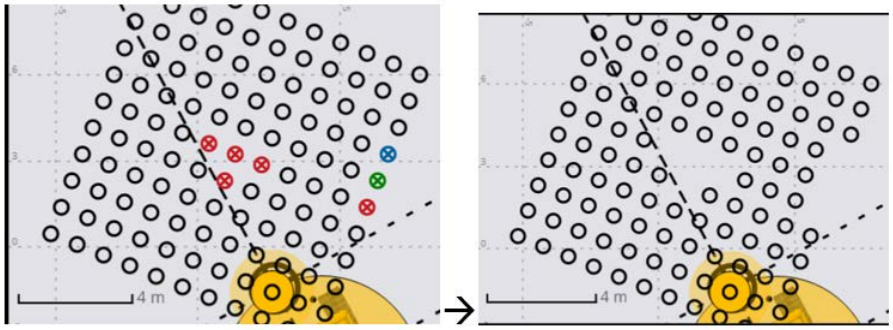
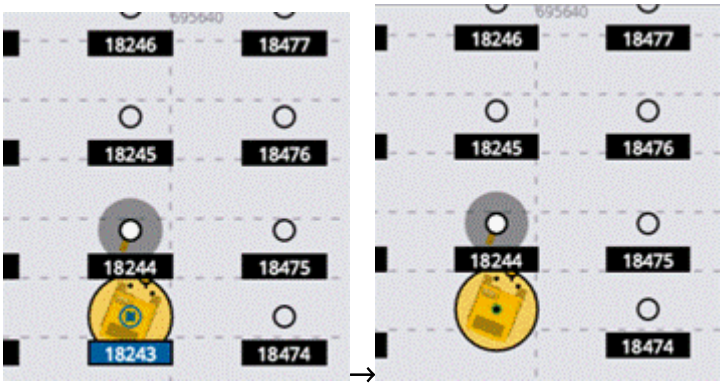
To enable filters on the drill plan:

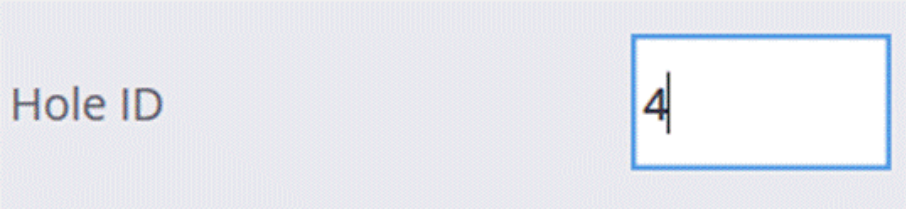
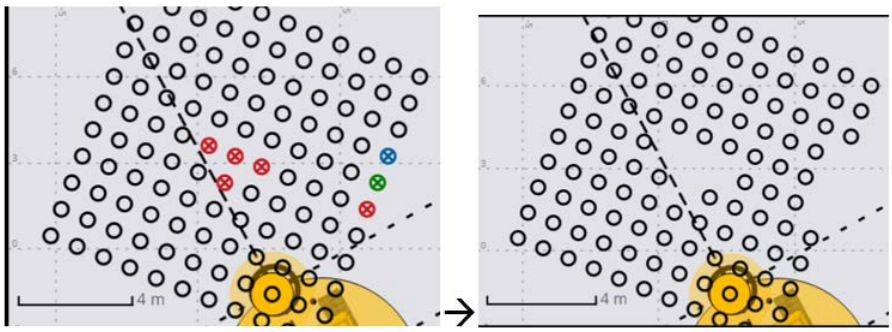
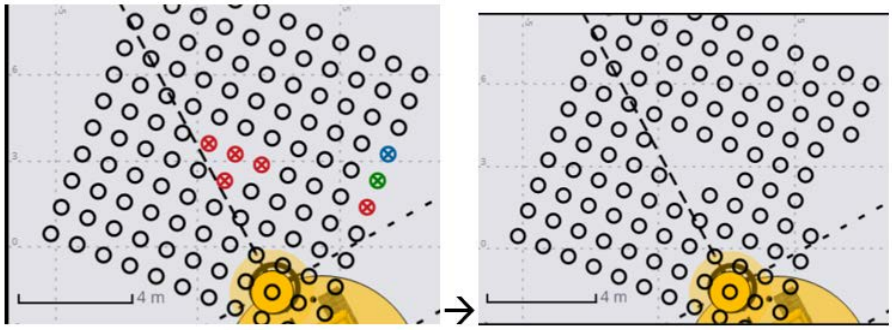
1. On the toolbar, tap .

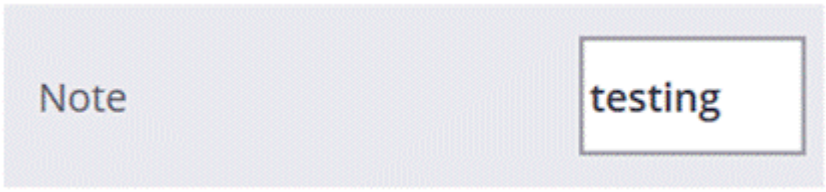
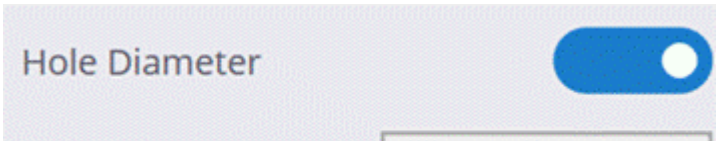
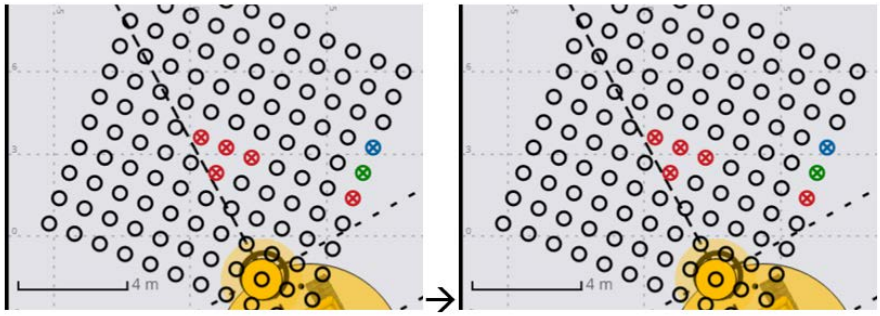


2. The list of features are shown below.



Item	Description
Finished	Filter Design data to display only completed holes marked as Red or Green. 
Not Started	Filter Design data to display only unfinished holes marked as Black. 
Interrupted	Shows the incompleted holes shown in blue. 

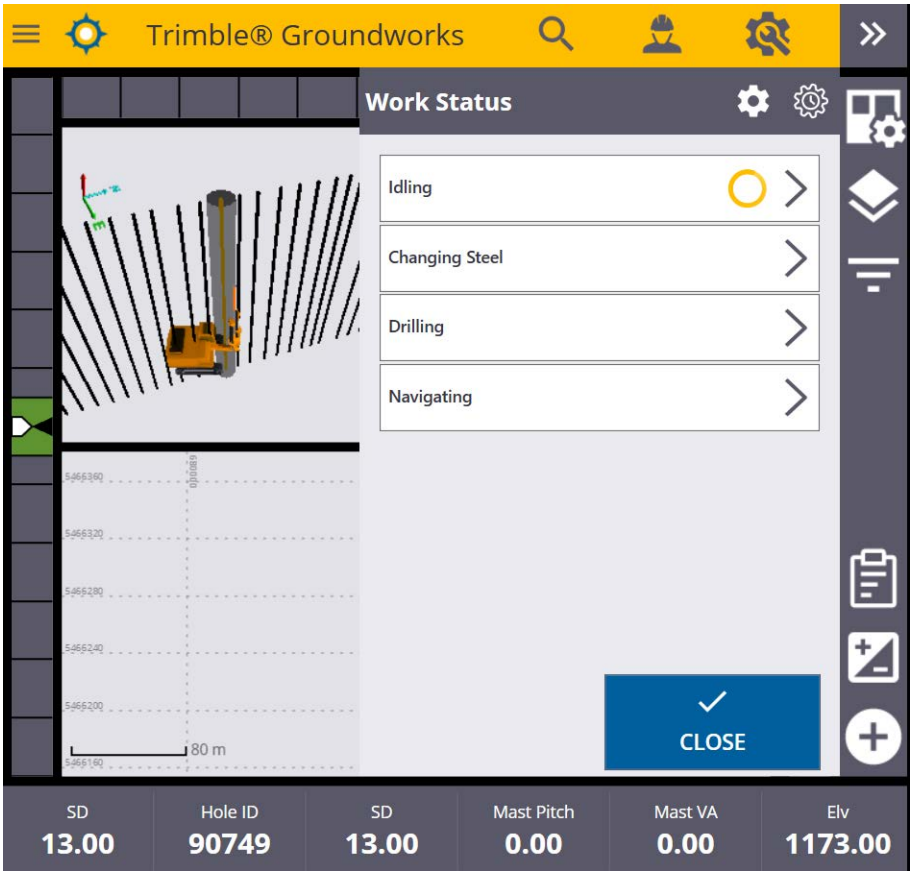
Item	Description
Hole ID	Filter drill plan to show the value input by operator. Example: Operator puts number 4 in **Hole ID**, the software will filter out to show all Hole IDs that contain 4.  
Hole name	Filter drill plan to show the value input by operator. Example: Operator puts number 4 in **Hole Name**, the software will filter out to show all hole names that contain 4.  

Item	Description
Note	Only show active holes that contains the user input value for **Note**. Example: Any holes that contains "testing" will display: 
Hole Type	Shows active hole that has vertical or inclined hole. 
Hole Diameter	Shows active holes that has the list of diameter.  

Track Custom Work Status

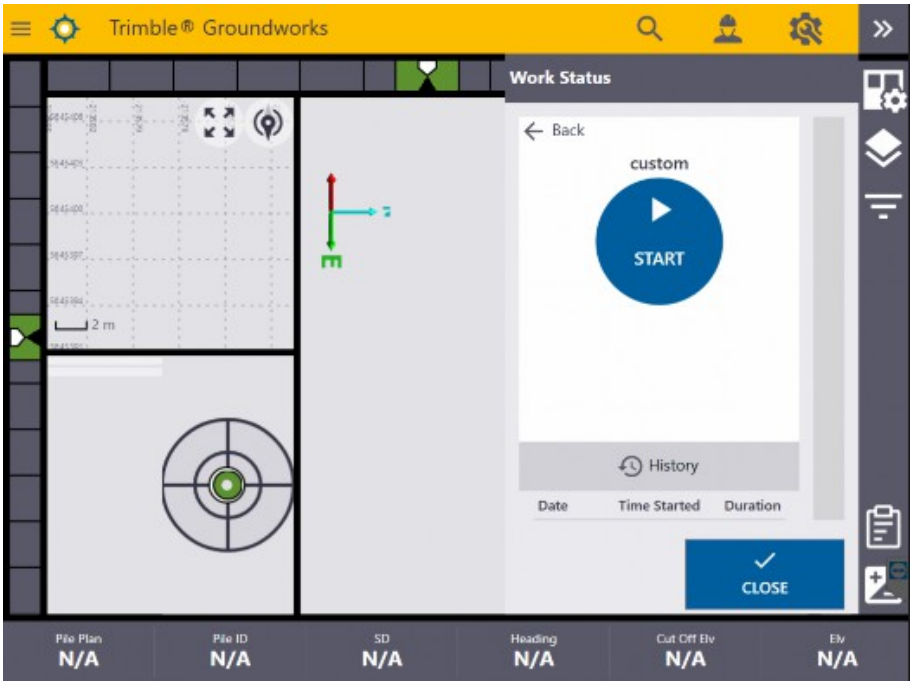
To track custom work statuses for machine utilization data:

1. Tap from the toolbar.



2. Tap to add a custom work status.
3. The statuses **Idling**, **Changing steel**, **Drilling**, and **Navigation** will automatically track the status messages.

4. The custom status message requires manual intervention to start logging. Tap **custom message**to view the following logging window:



5. To start logging time, tap **Start**.

> **TIP –** Saving the start point for a hole automatically starts logging time towards drilling and stops tracking time towards the previously active custom work status.

Reports

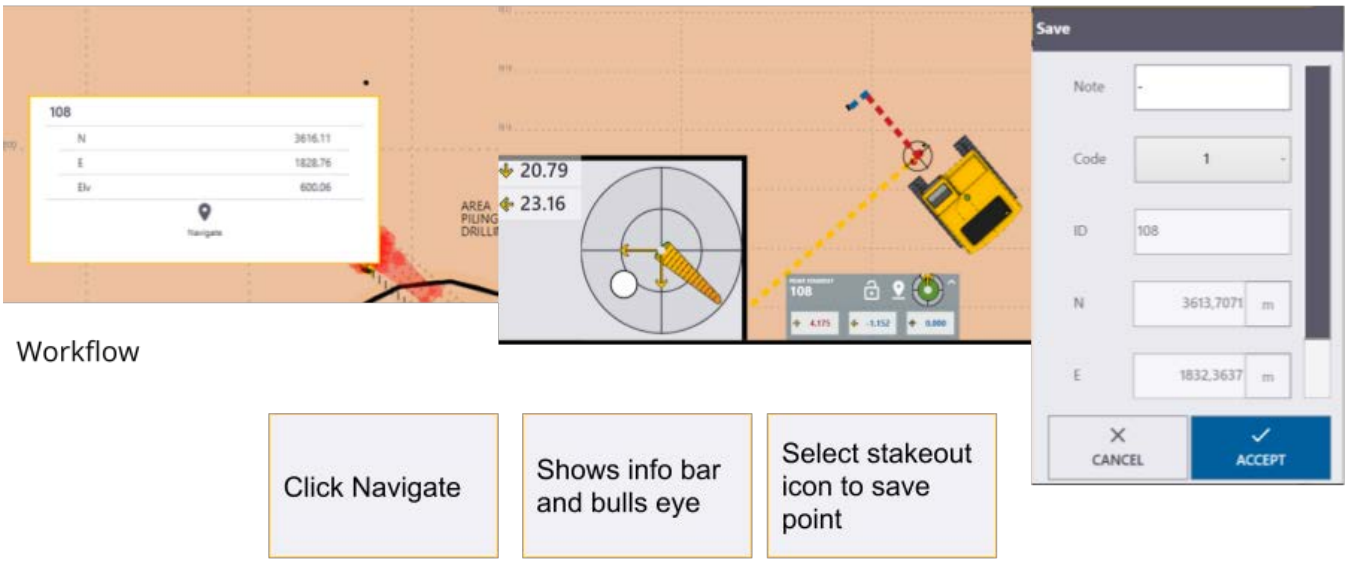
To access reports, tap ☰ and then tap **Reports**.

- **Daily Summary**: Contains total, average and daily productivity data which can be filtered by user, machine, and drill plan.
- **Quality**: Contains quality data with pass/fail results based on defined tolerance settings for the active drill plan.
- **Layer Depth**: Contains as-built layer information for the active drill plan.
- **Drilled Lengths**: Contains hole quantities based on user-defined drilled lengths to be used for ordering blasting materials for the active drill plan.
- **MWD**: Contains as-built MWD (Measure while drilling) information for the active drill plan.
- **Report Generator**: Allows a combination of reports to be exported in various formats along with source data for the selected drill plan.
- **Operations**: Contains machine utilization data.

Groundworks Features

Point navigation

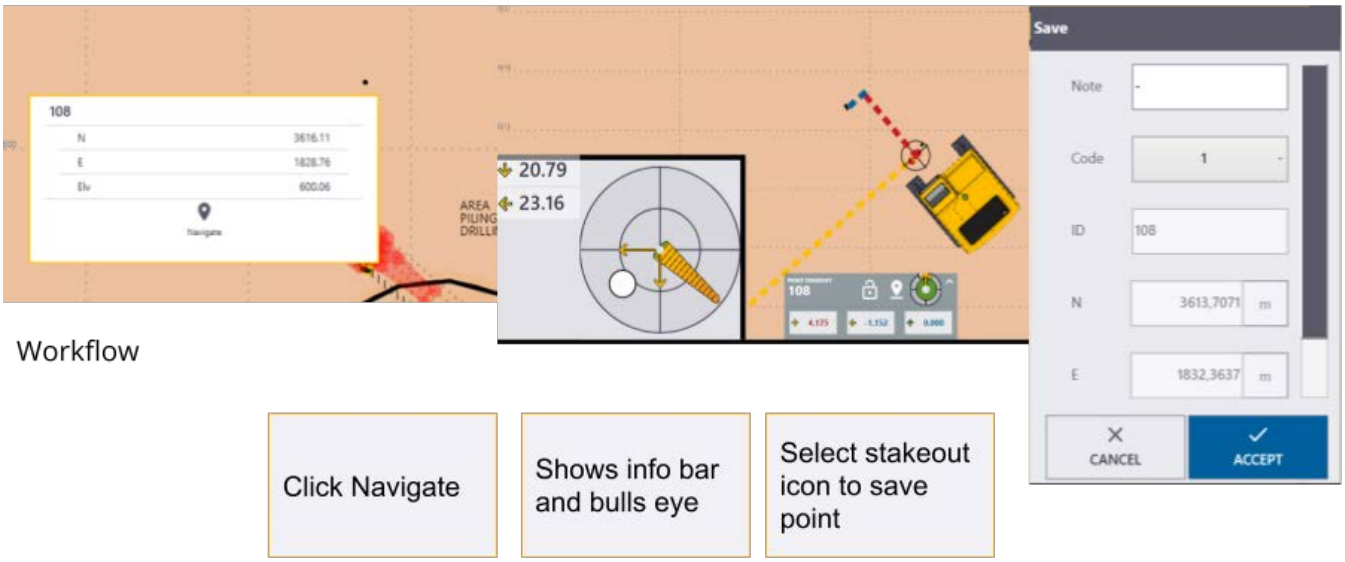
Within the Groundworks software you can navigate to a point and stake out a point.



1. Select a point.
2. From the popped up window tap the Navigate icon.
3. A window shows the delta values in northing easting and elevation.
4. From the same menu, tap the GPS icon to stake out a point.
    a. Add notes.
    b. Add an attribute code.

Line navigation

The Groundworks software allows users to navigate to a line. Additionally, users can save their own line by saving points at intervals set by them or by manually selecting points that automatically connect to the previous point to form a line.



1. Select the line you wish to follow.
2. Tap the **Navigate** button from the pop-up window above the info bar. A blue box will appear, allowing you to begin saving a line. Tap the three dots to select a saving method:
   - **Offset Vertical**: Sets a vertical offset to the existing line.
   - **Offset Horizontal**: Sets a horizontal offset to the existing line.
   - **Interval**: Automatically records points at a set distance to create a line.
   - **Manual**: Creates a series of points forming a line when you manually tap **Save**.

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