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GRAVIPROBE 2.0

Customer User Manual

5 January 2022

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	4	*25/08/2017*	*minor changes*
	5	*25/08/2017*	*minor changes*
	6	*25/08/2017*	*Added usage instructions*
	7	*31/08/2017*	*updated download section*
	8	*31/08/2017*	*minor changes*
	9	*01/09/2017*	*added downloading CSV files drops*
	10	*01/09/2017*	*minor changes*
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	13	*23/04/2018*	*added GP Dino info*
	14	*02/07/2018*	*added depth offset*
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	20	*21/03/2019*	*Added β parameter to calculate static undrained shear strength*
	21	*27/11/2019*	*Screenshots new app updated*
	22	*27/01/2020*	*Updated for version 2.6.1*
	23	*16/12/2020*	*Updated for version 2.7.0.0*

Contents

Introduction

This user manual contains information, on how to operate the GraviProbe.

System Description

The GraviProbe is a fast and light rheological profiling system. It's a free fall impact instrument, analysing the underwater sediment layers during intrusion. Under its own weight, it accelerates, and penetrates fluid and consolidated mud layers.

The rheological conditions of the soil layers determine the probe's dynamical behaviour. The data acquired, from on-board accelerometers, inclinometers and pressure sensors, is feeding a dynamical model which determines the rheological parameters of the intruded medium (depth, undrained shear and viscosity).

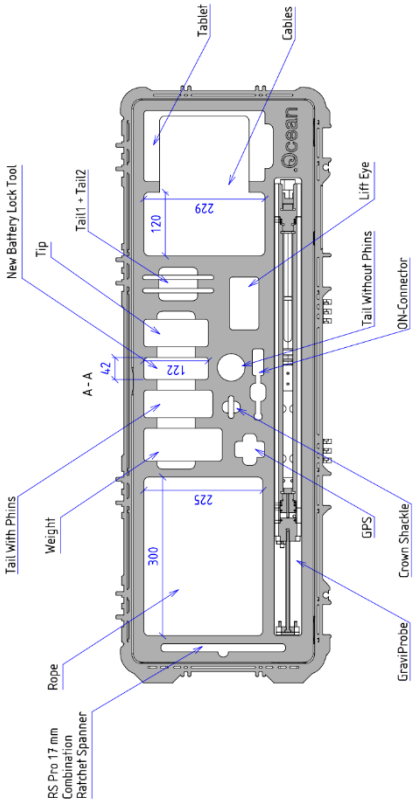
As a result, the GraviProbe is able to accurately distinguish the depth of the fluid mud, and consolidated soil layers, even in gassy environments.

The high sensor data acquisition rates above 5 kHz, and in combination with a low drag housing, it results in high quality profiles, at drop rates over 6 m/s.

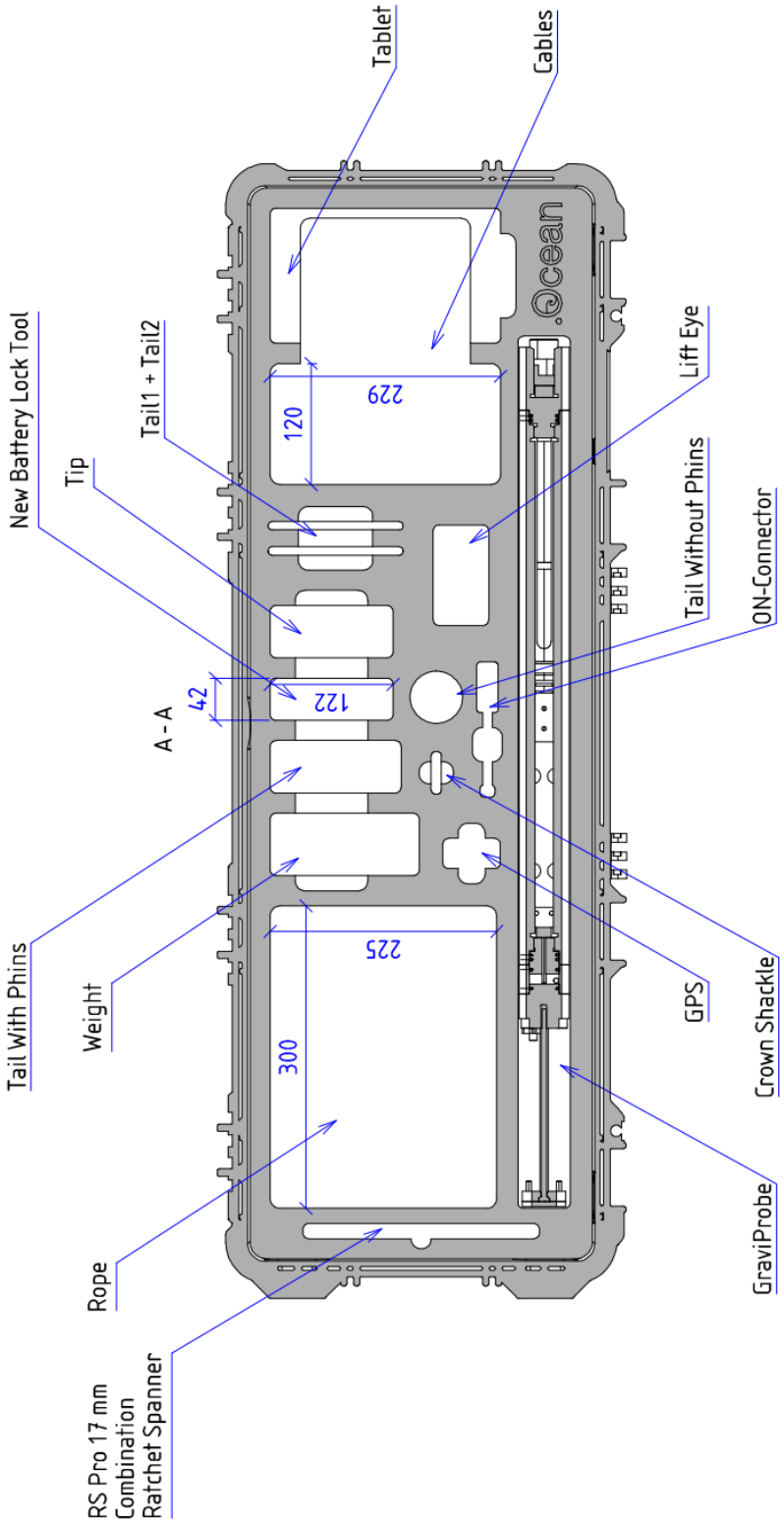
Due to its low weight, the probe can be operated manually, from a small vessel, platform or quay, and it limits the operational costs.

GraviProbe: Box Content

- GraviProbe main fuselage
- Lower tail section
- Upper tail section
- Fin 1
- Fin 2
- GraviProbe Tip
- M10 Lift eye
- Crown Shackle
- Dummy Connector
- ON-connector
- INOX Weight
- Battery Lock Tool
- GPS + Case
- Rope
- Tablet
- OTG cable
- USB to micro USB
- Charger + serial cable
- USB to Serial converter
- Charger for tablet
- M17 wrench

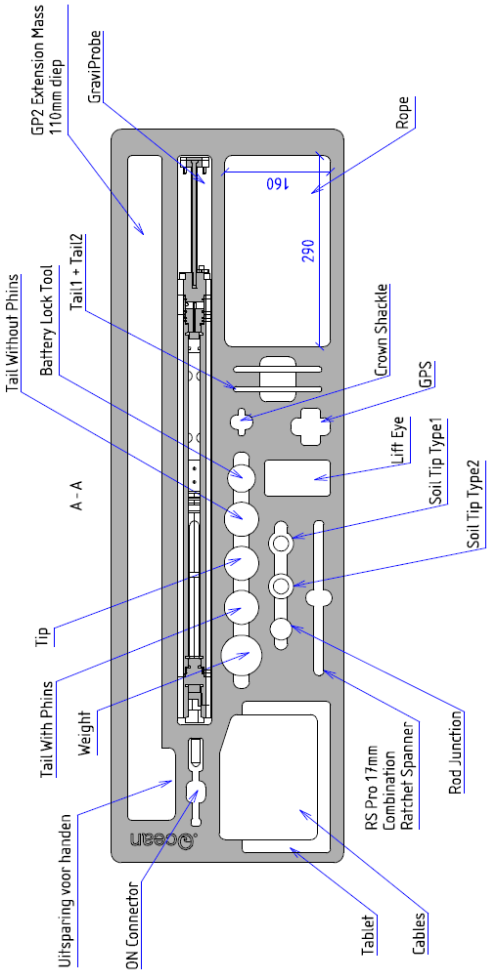


Graviprobe: Box tool placement

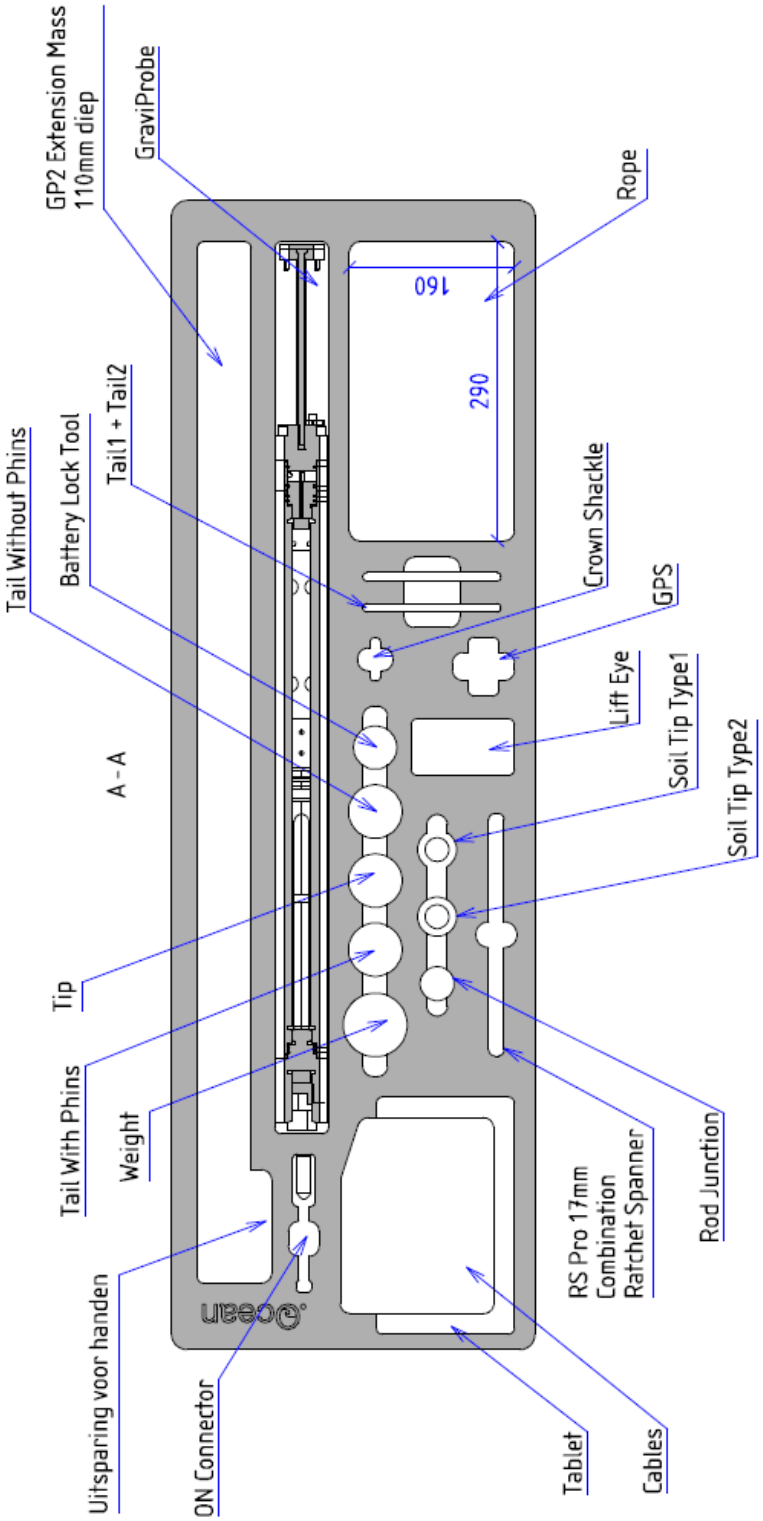


GraviProbe Soil: Box content

- GraviProbe main fuselage
- Lower tail section
- Upper tail section
- Fin 1
- Fin 2
- GraviProbe Tip
- M10 Lift eye
- Crown Shackle
- Dummy Connector
- ON-connector
- INOX Weight
- Battery Lock Tool
- GPS + Case
- Rope
- Tablet
- OTG cable
- USB to micro USB
- Charger + serial cable
- USB to Serial converter
- Charger for tablet
- M17 wrench
- GP rod
- Rod junction
- Tip 1
- Tip 2

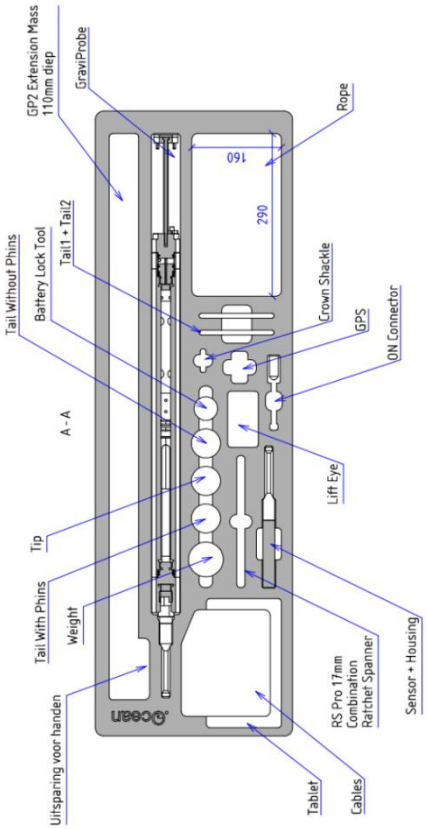


GraviProbe Soil: Box tool placement

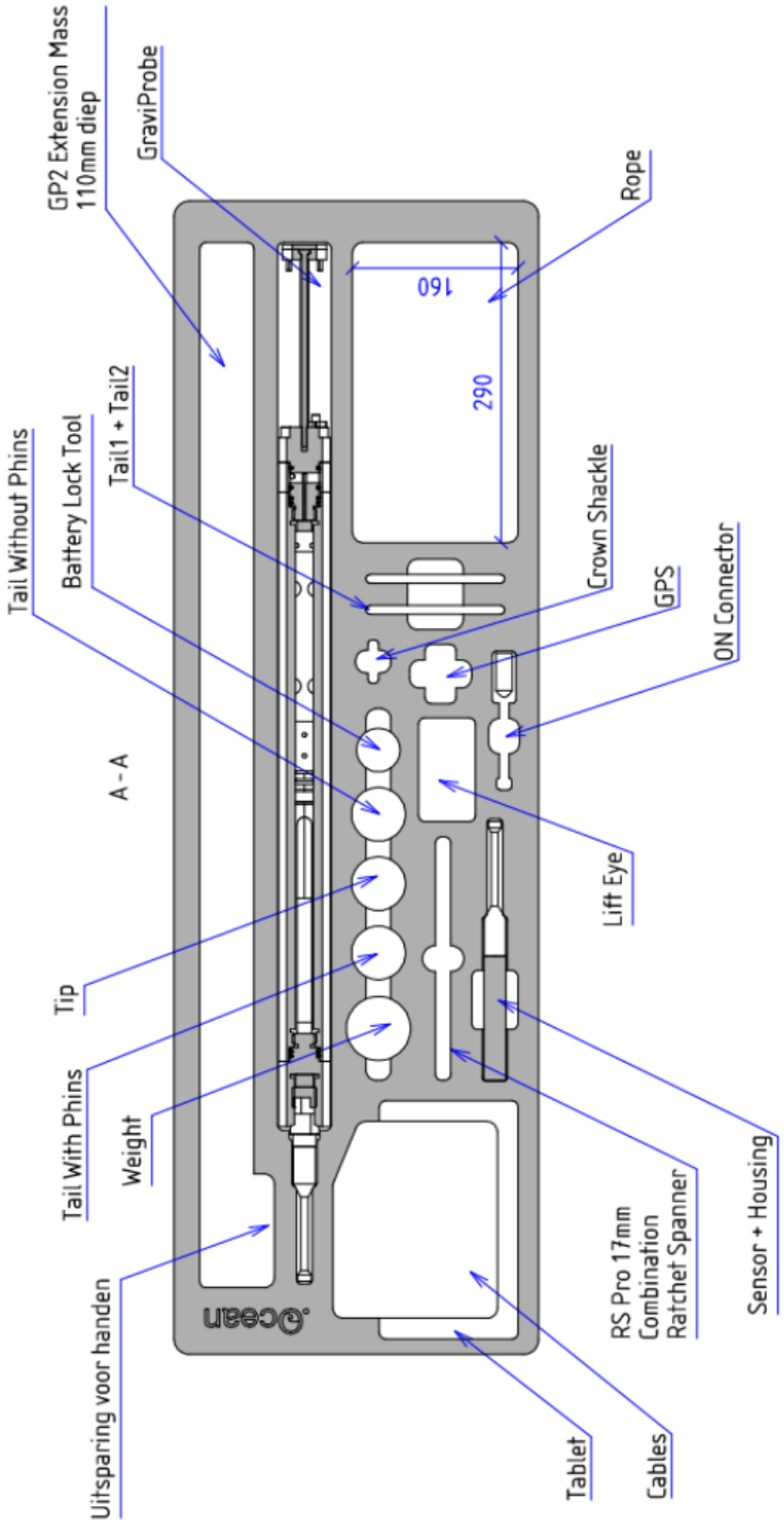


GraviProbe Dino: Box content

- GraviProbe main fuselage
- Lower tail section
- Upper tail section
- Fin 1
- Fin 2
- GraviProbe Tip
- M10 Lift eye
- Crown Shackle
- Dummy Connector
- ON-connector
- INOX Weight
- Battery Lock Tool
- GPS + Case
- Rope
- Tablet
- OTG cable
- USB to micro USB
- Charger + serial cable
- USB to Serial converter
- Charger for tablet
- M17 wrench
- GP2 Extension mass
- Extension sensor + housing
- Hex wrench
- Bronze coupling piece



GraviProbe Dino: Box tool placement



GraviProbe Device Component Description

The GraviProbe device is composed of the following components:

- GraviProbe main fuselage
- Lower tail section
- Upper tail section
- 2 fins
- A lift eye
- A crown shackle
- The tip
- In case of Soil GP: 2 rods
- In case of Soil GP: 2 tips
- In case of Soil GP: interconnection piece for rods
- In case of DINO GP: extension mass
- In case of DINO GP: bronze coupling piece
- In case of DINO GP: Extension sensor + housing
- In case of DINO GP: Extension cable

In order to perform measurements (drops), the device MUST be fully assembled according to the manual.

The GraviProbe device is supplied with the following assembly tool:

- M17 wrench
- In case of DINO GP: hex wrench

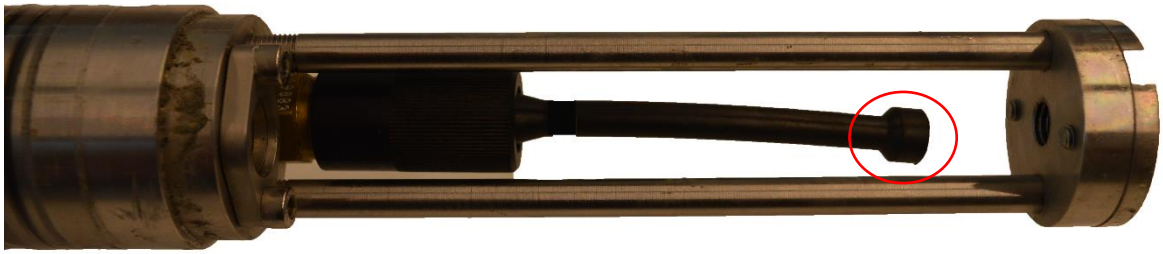
The GraviProbe is supplied with the following accessories to perform drops:

- Inox weight
- rope

The GraviProbe device can be fitted with the following connectors:

- Dummy connector
- ON-connector
- Charger cable

IMPORTANT: there is a small difference between the dummy connector and the ON connecter. The ON connector has a red tip, to identify it. When not using the GraviProbe, make sure that the Dummy connector is placed on the device, or the battery will be discharged.



The GraviProbe is supplied with the following drop processing tools:

- Tablet
- Tablet charger
- OTG cable
- GPS + case
- USB to micro-USB cable

The GraviProbe is supplied with the following support tools:

- Lock Tool
- USB to Serial converter

Do **NOT** use the support tools without support from a dotOcean engineer.

Meaning of the coloured LED's:

Colour	Meaning	Required action
Flashing blue	Device is ready for performing drops	None
Blue (<v1.0.7) **Blue/Red flashing (>=v1.0.7)**	Logger Inactive	Connect the tablet to the device & wait until device is flashing blue
Green	Battery full	Disconnect charger cable
Flashing green	Device is charging	None
Orange flashing	Low battery < 10%	Charge device
Fast orange flashing (<v1.0.7) **Orange/Red flashing (>=v1.07)**	Very low battery < 5%	Charge device
Red	Error	Contact support
Flashing red	Error, no data available	Contact support
Yellow/None/…	Device is booting	None

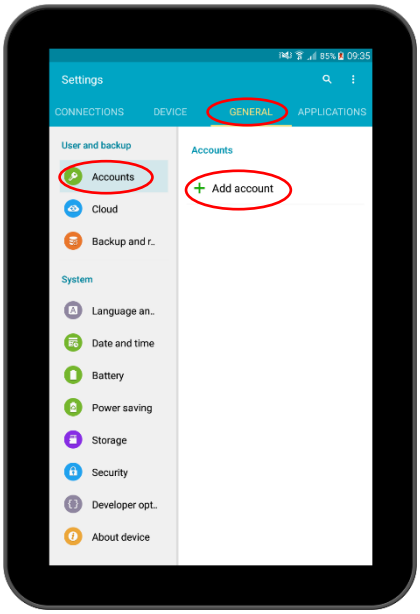
The GraviProbe app

The GraviProbe 2.0 tablet is used in conjunction with the GraviProbe. To use the tablet the Graviprobe app MUST be installed via the Google Play Store. For areas without access to the Google Play Store, the app and updates, will be provided by the dotOcean support team.

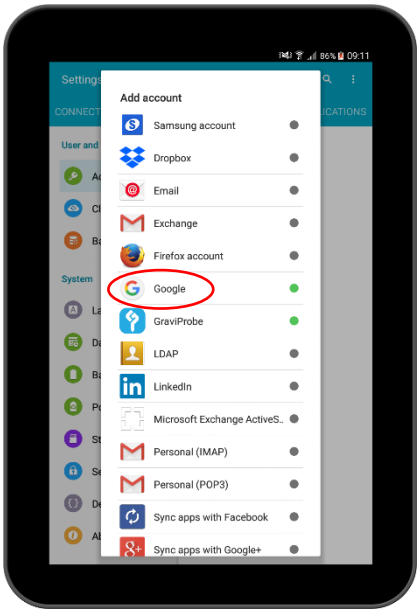
App installation guide

Add a google account

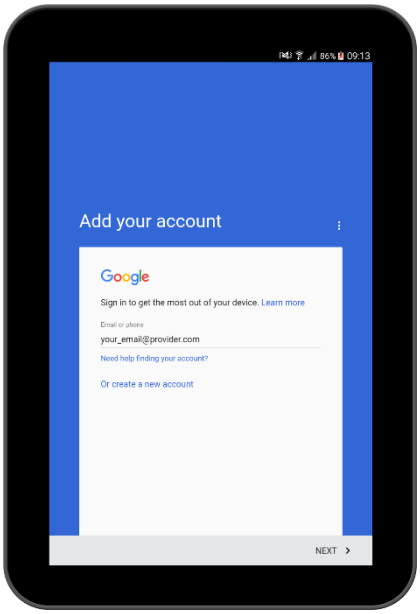
Navigate to the settings of the tablet, and select the general tab. In the left menu, tap Accounts, then tap Add account in the left.



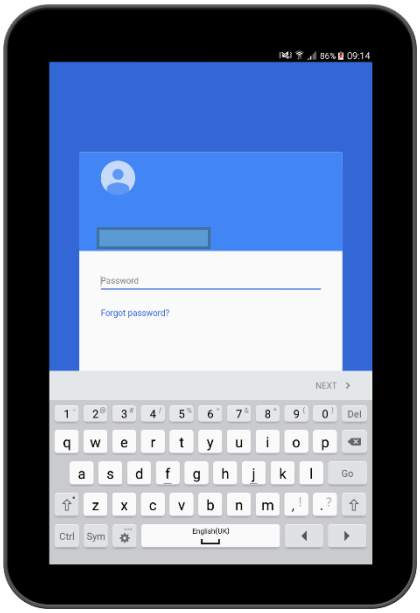
Select the Google option



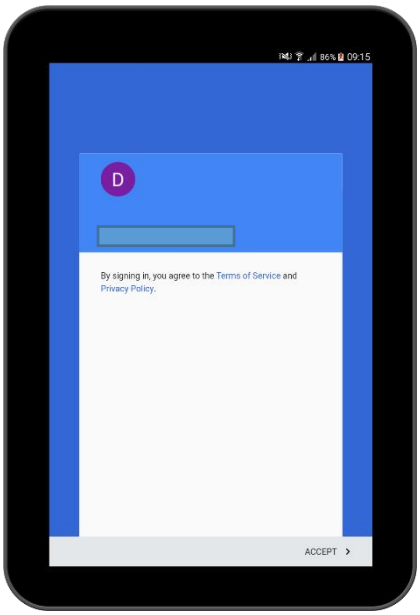
Enter your email connected to your Google account and, tap next. Should you not have a Google account, please tap create a new account, and follow the steps required.



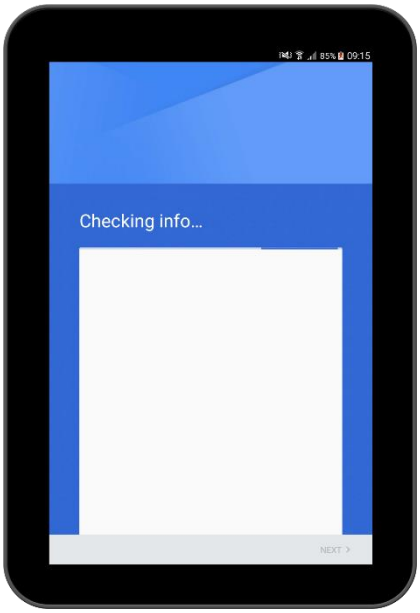
Enter your password.



Tap accept, after you have read the Terms of Service and Privacy Policy.



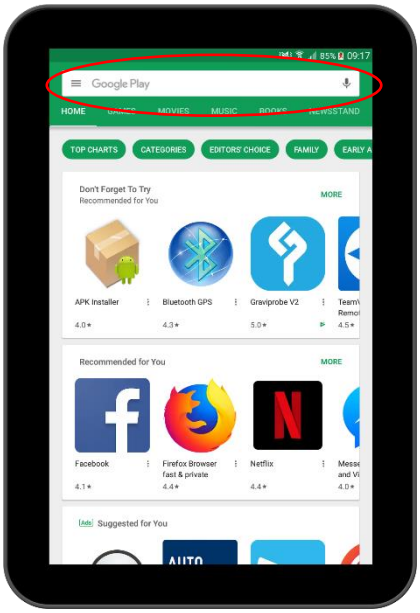
Please wait until Google checks your info. After this check, you will be redirected to the settings screen of the tablet.

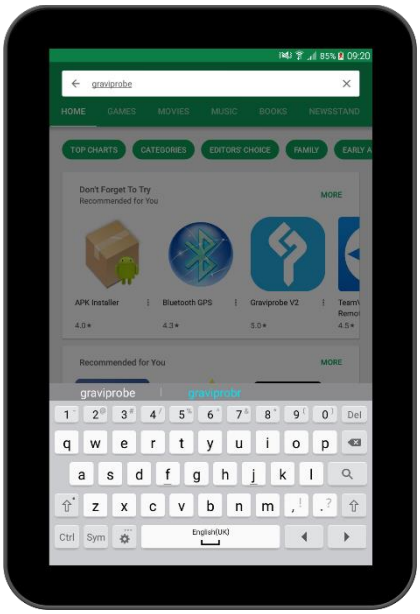


Install the app via the Google play store

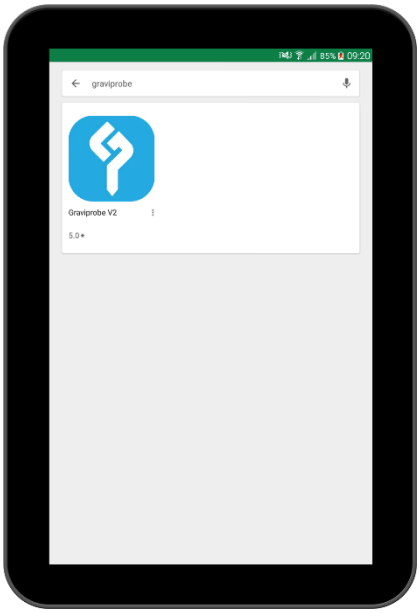
Open the Google play store

In the top search field enter Graviprobe

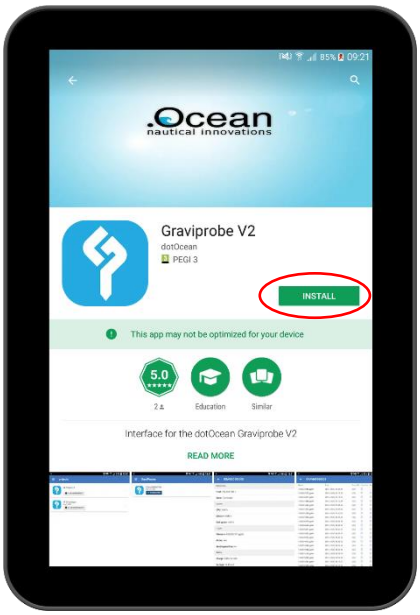




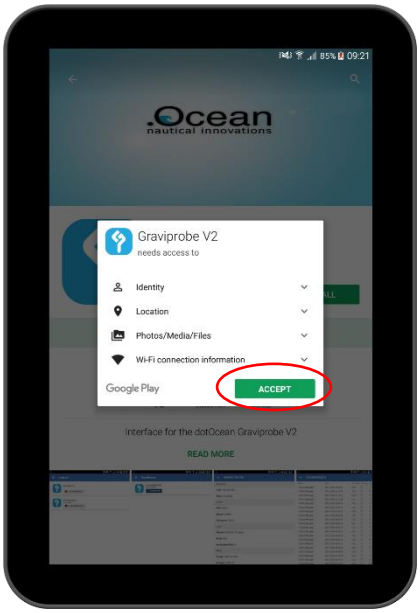
Tap the Graviprobe icon.

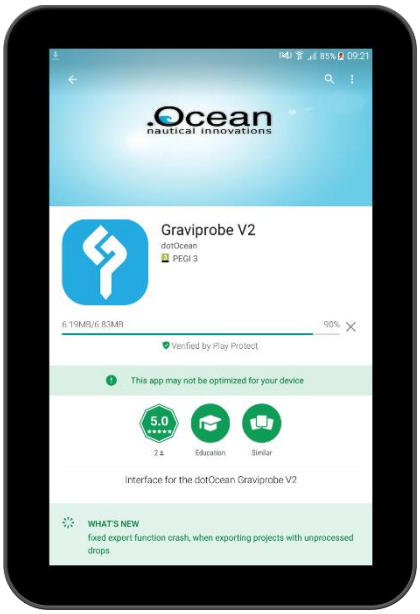


Tap the install button.

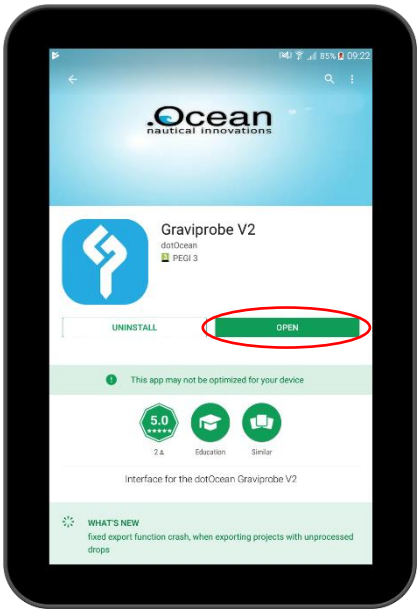


Tap the accept button, to let the app have access to identity, location, files and Wi-Fi connection information





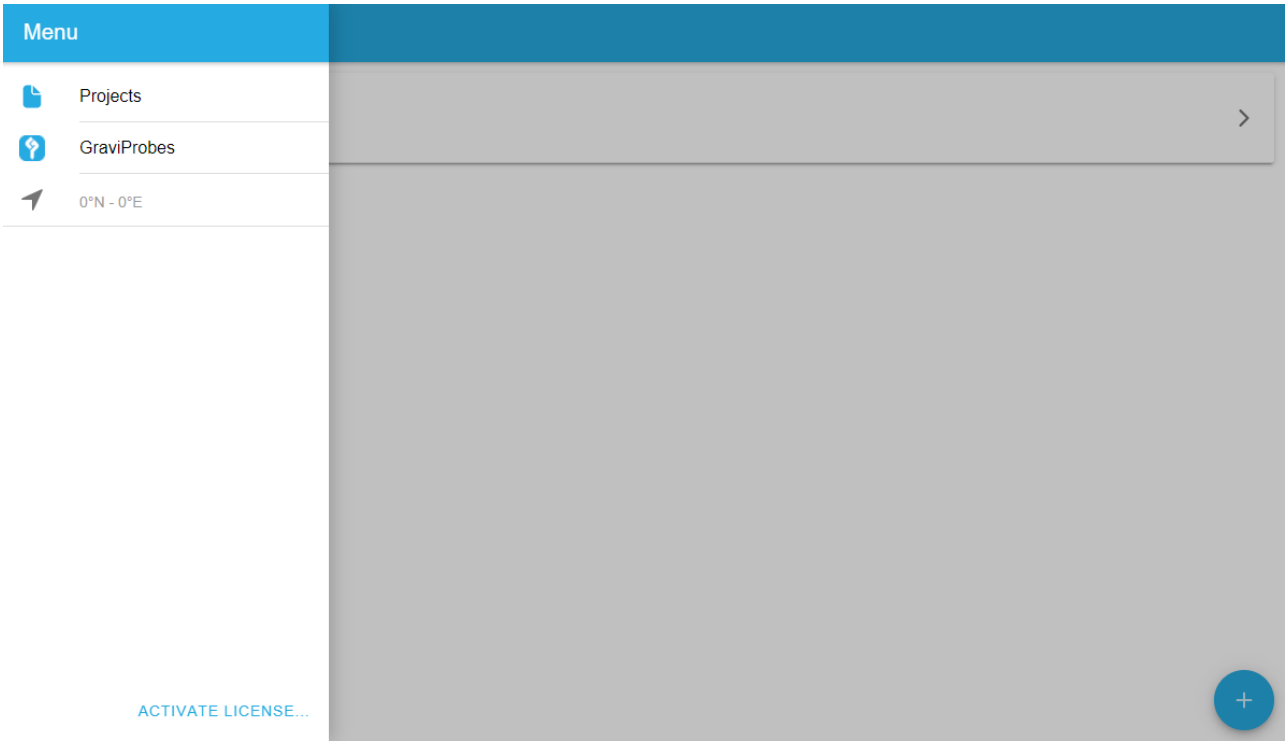
When the app has been installed, tap the open button to start the app. The app will also be available in the app list on the tablet.



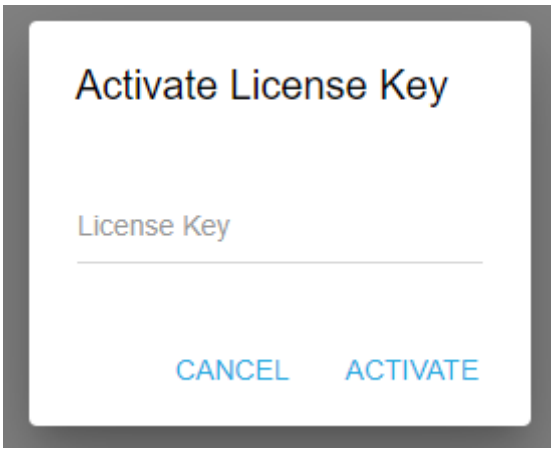
App overview

Menu side bar

The menu bar can be accessed by swiping right, from the left side of the tablet, or tapping the  button. From the menu bar, the device and project page can be accessed. The GPS coordinates are also shown, either from the tablet or the external GPS.



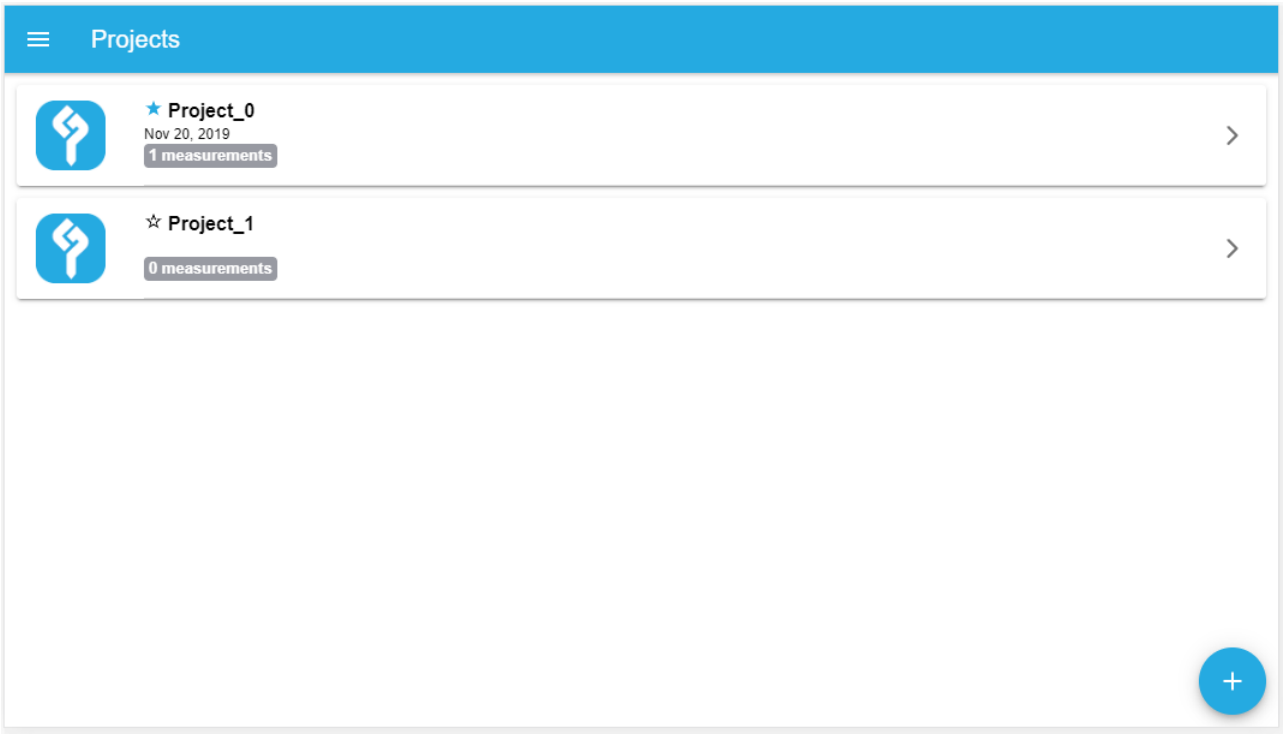
If you have received a key to activate a specific feature, the key can be entered after pressing “ACTIVATE LICENSE”. If the key is validated the unlocked section will become accessible.



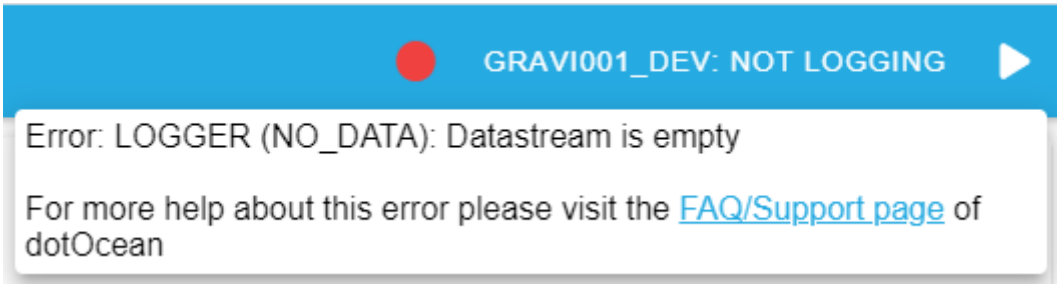
Main Project page

In the main project page, new projects can be created by tapping the button, previous made projects can be accessed by tapping the project name.

The current active project is denoted by a ★



If a GraviProbe is connected, there will be a component in the header throughout the app where the status will be visible. If there appears a red circle, there is a problem with the GraviProbe if there is a green circle, everything is OK. The logging status will also be shown. In case of a pro version of the app, the manual logging button will be visible.



Add project dialog

When creating a new project, the following MUST be entered:

- **Name**: the project name, this will be by default Project_(number).
- **Show water column**: Whether or not to show the water column in all the graphs.
- **Cone type**: this MUST be set according to the GraviProbe type. When choosing a soil version there is an added item, namely the Extension type. Add the number of extensions and extension types according to the way the GraviProbe is configured.
- **Processing type**: When a processing type has been selected, only matching cone types will be shown.
    - **Normal**: For more than 3m. water.
    - **Shallow water**: For water level between 0.5m and 3m.

      For a successful shallow water measurement, these items need to be considered:
        - Only hold the tip under water until all the holes are under.
        - The drops need to be at least 5 seconds apart from each other to detected the measurements.
        - Keep the GraviProbe as vertical as you can. You can achieve this by holding the GraviProbe at the rope and not at the body.
        - Get comfortable with the device before going out on a survey (practise a bit), this also apply for a normal measurement.
        - Sometimes the weight could improve the measurement, but other times it could be worse. Chose to use the weight appropriacy.
        - There could be false detections when washing the GraviProbe or when you accidently lower the GraviProbe too much into the water. Please keep this in mind.

      ** Shallow water processing only available for specific software versions*
    - **Corer:** A processing type for when the GraviProbe is attached to a Gravity Corer. This processing type only measures shear strength and no cone penetration.

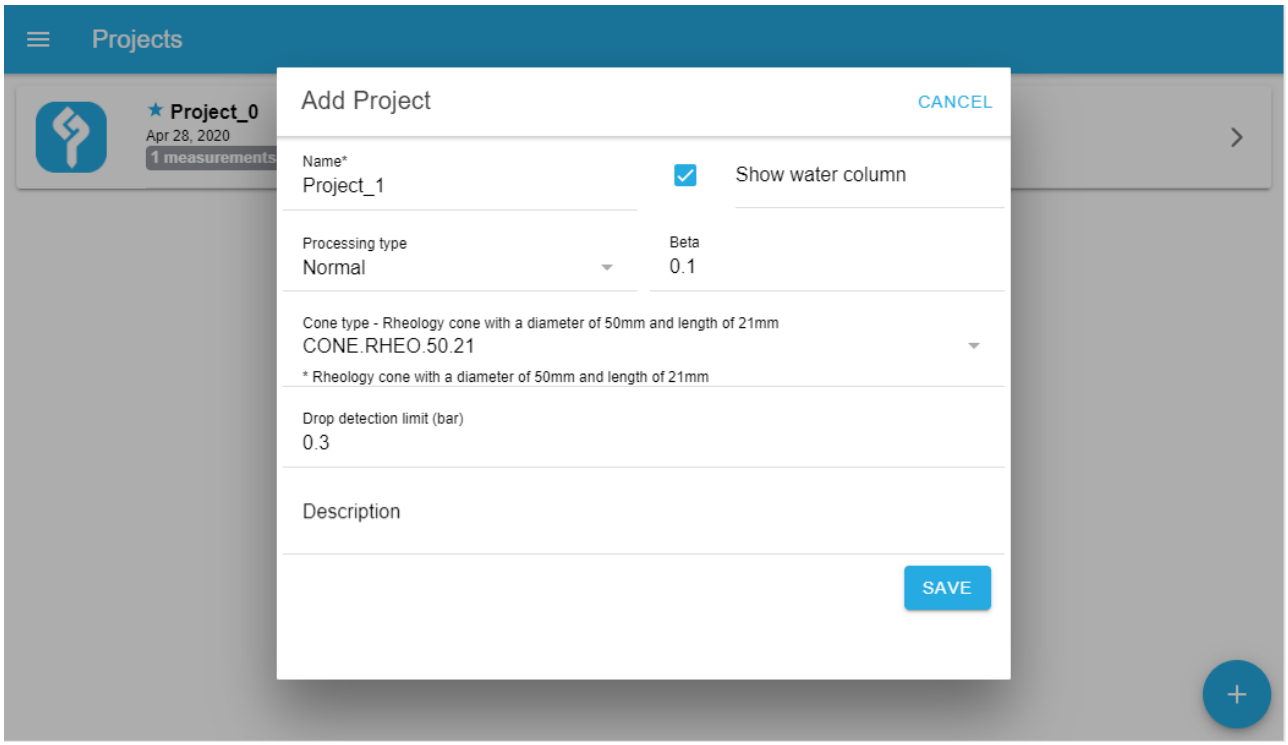
      ** Corer processing only available for specific software versions*
- **Beta**: This is a parameter used for the calculation of the static undrained shear strength. Static undrained shear strength is calculated from the dynamic undrained shear strength with following formula:

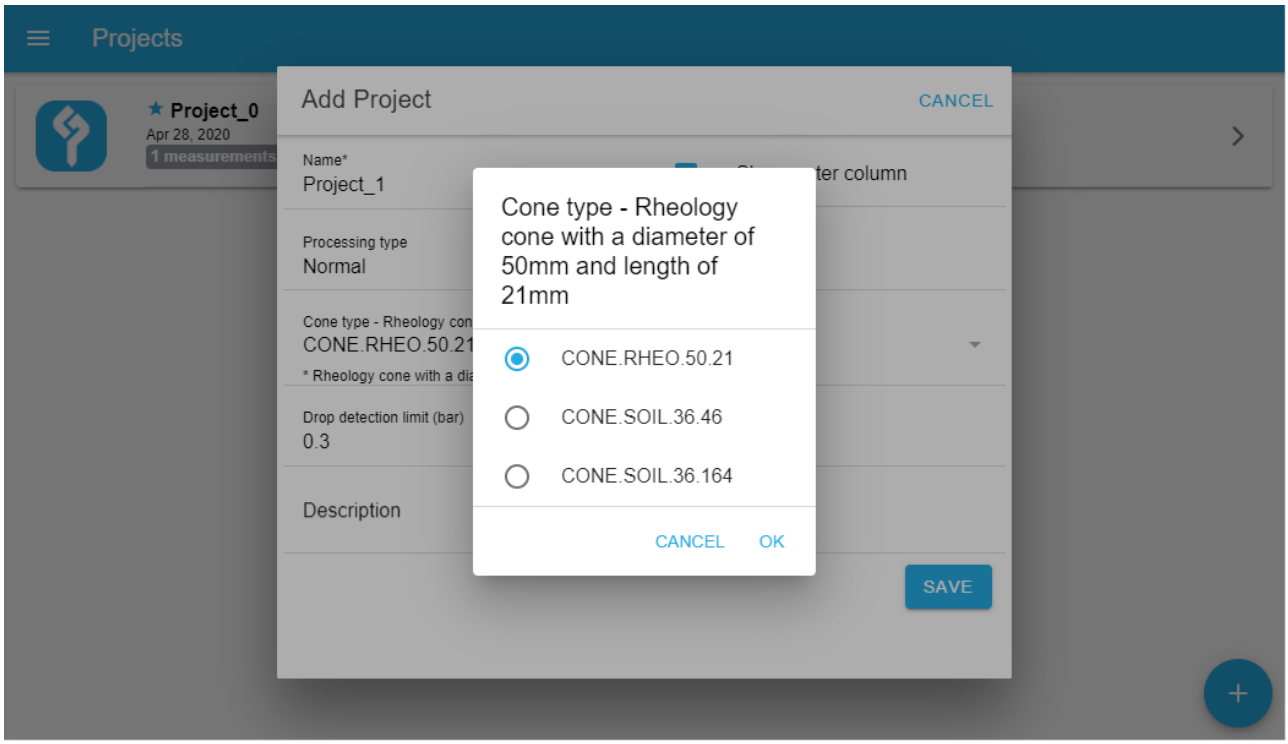
$$S_{u,stat} = S_u \left(\frac{\dot{\gamma}_{stat}}{\dot{\gamma}}\right)^{\beta} = \frac{S_u}{(v/0.02)^{\beta}}$$

With Su the dynamic undrained shear strength, γ the strain rate (1/s), v the velocity of the graviprobe and β the parameter that can be set in the project page. This parameter is dependent on the sediment material, but should be in the order of 0.1.

The following MAY be entered:

- **Drop detection:** Change the drop detection limit to correct the relative water pressure difference. (Pro users only!)
- **Description**: a description of the project may be entered here.





Project measurements page

In the project measurements page, the drops that have been added to the project will be shown. To view the processed data, tap the name of the drop in the list. Each measurement has its own status. The different statuses are: **Needs validation, Not OK, Validated and Error**.

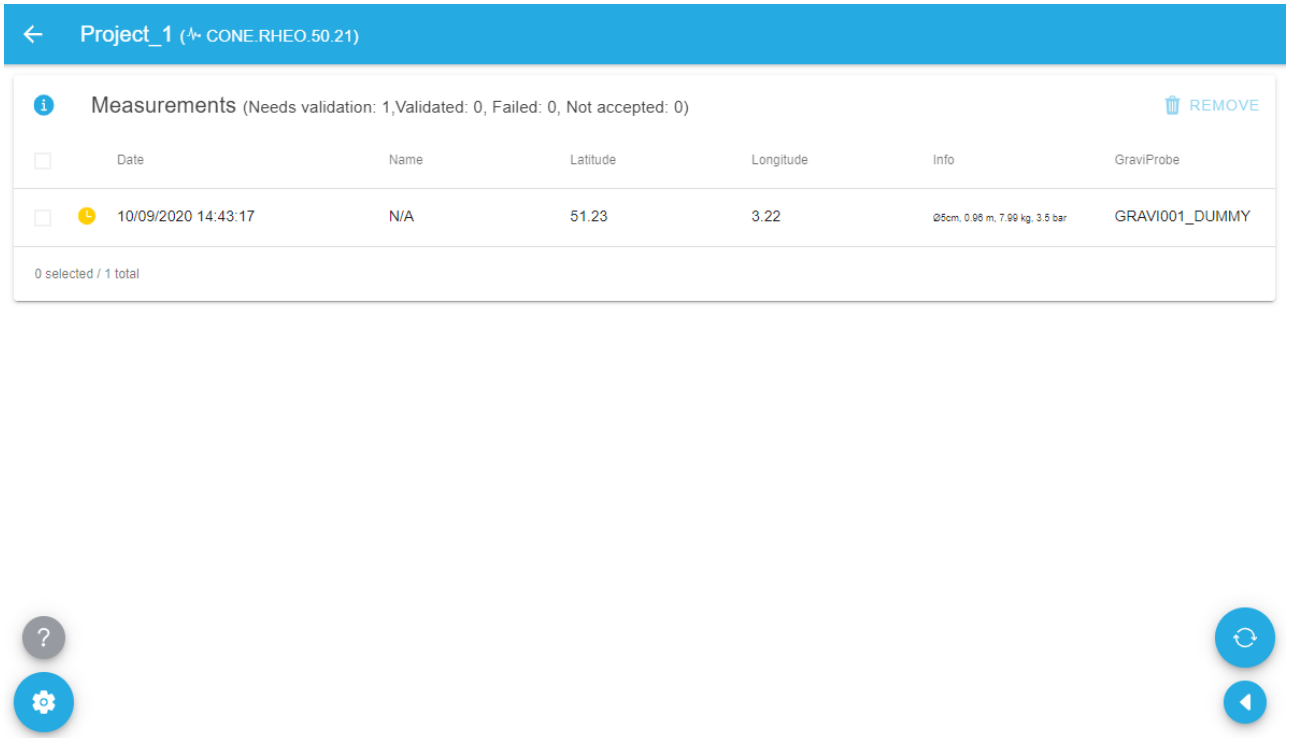
Tapping the button allows to edit the project information.

Tapping the button will download the drop data to a CSV-file, a menu will appear, in which the desired app to download the export with, can be selected. See page 54 for more information.

Tapping the button will synchronize the drop files between the device and tablet. During the synchronization, the download progress will be indicated by a pop-up showing a loader while busy. When the tablet has finished processing the detected drops will be added to the list.

Press to show a tutorial on how to take a measurement correctly.

To remove measurements simply select all the items you want to remove and click the remove button on the top right side.



Edit project dialog

In this dialog, it is possible to edit and save the project details.

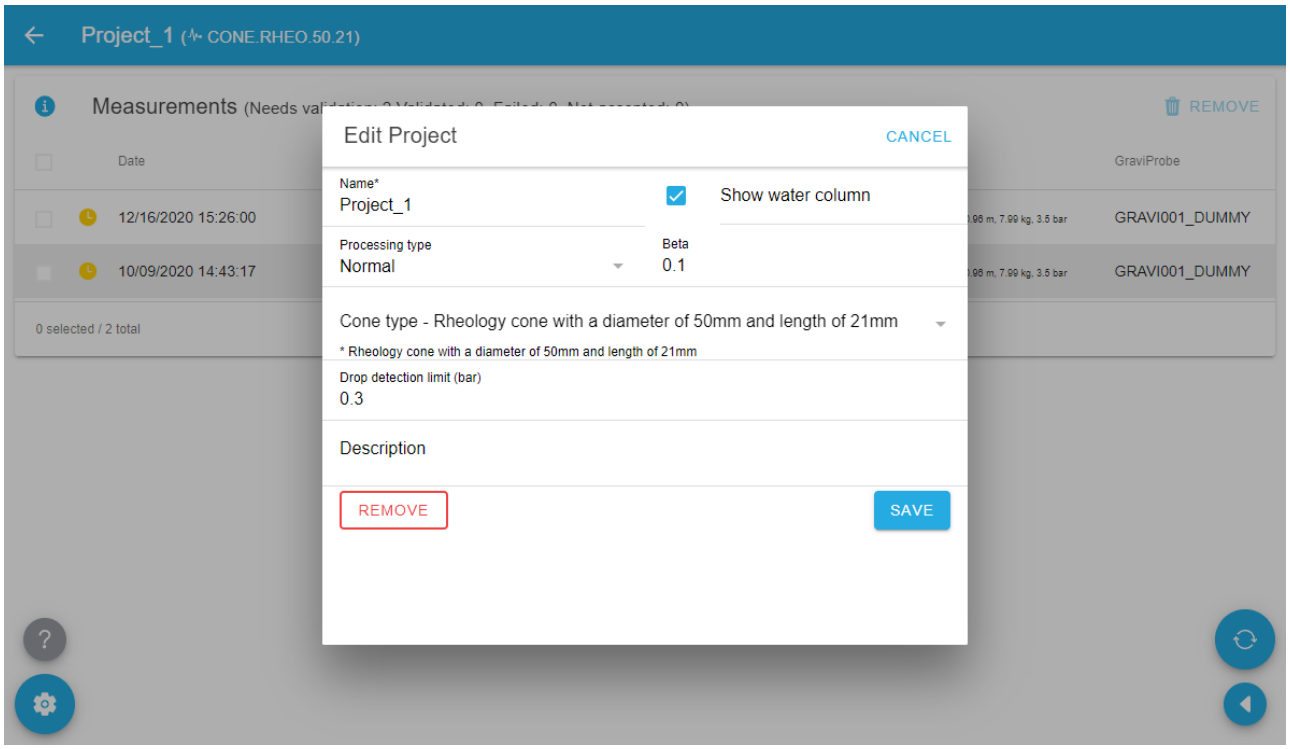
Processing type: Here you can change the processing type between Normal, Shallow water & Corer

Beta: Change the parameter for the calculation of the static undrained shear strength.

Cone type: Choose which cone type is connected to the GraviProbe.

Drop detection limit (bar): Set the relative water pressure difference (Pro users only!)

Description: Adjust to add additional info to the project.



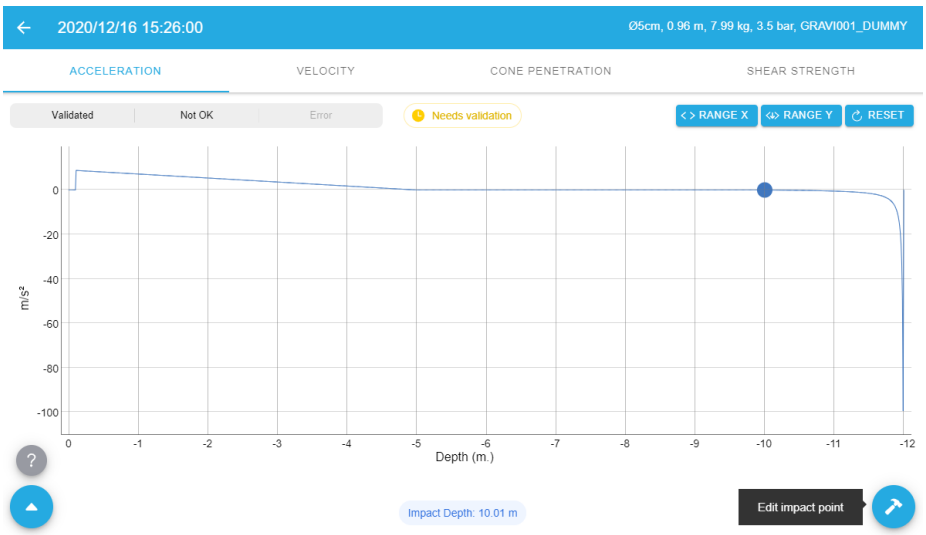
Data graphs page

In the data graphs page, the processed data from the drop is visualized in 4 graphs. The user can choose to accept the drop or not by pressing “Validated” or “Not OK”.

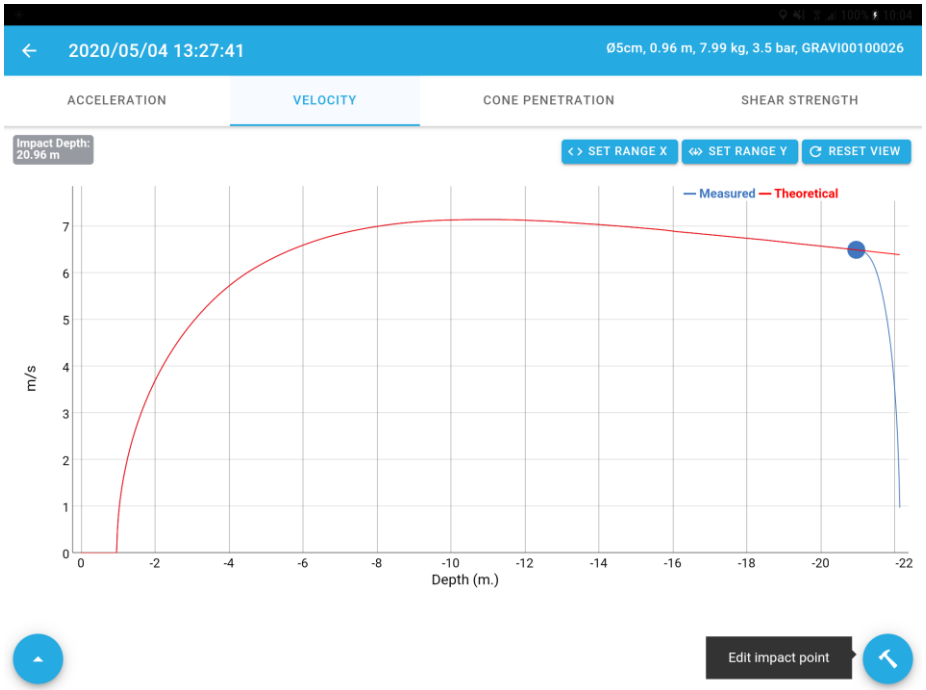
Press the ? button to see more information on how to validate a measurement (tutorial).

The x-axis is the depth relative to the start depth of drop. You can edit the drop depth by using the edit button.

- Acceleration

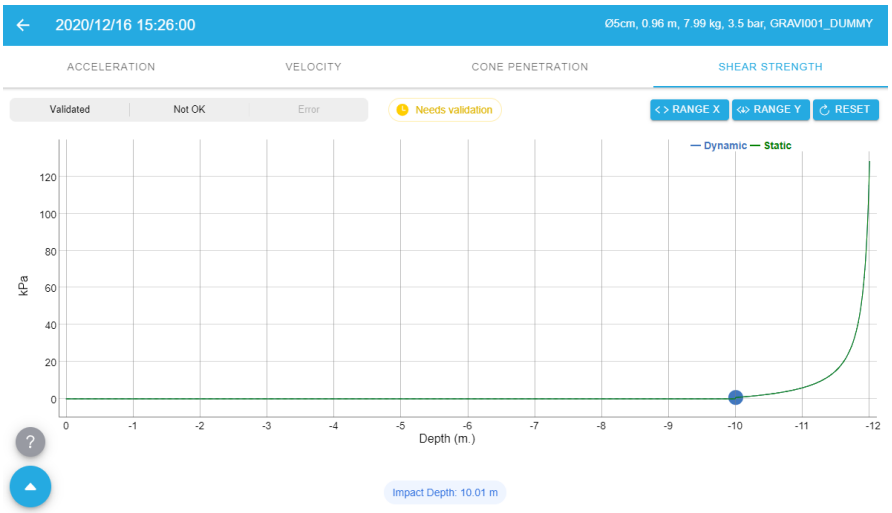


- Velocity



Cone penetration (Not available with processing type: Corer)

- Shear strength

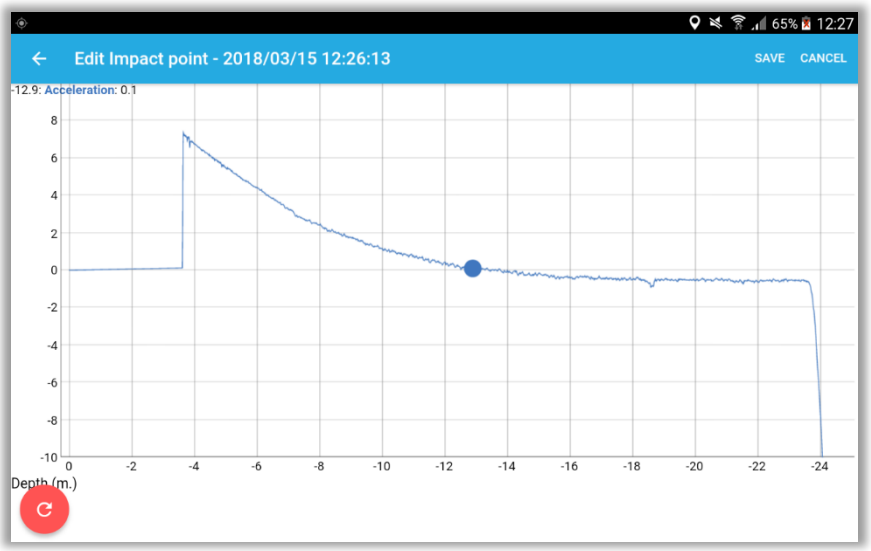


Tapping the button allows to edit the measurement information.

Tapping the button will enable to set a different impact point.

Edit impact point page

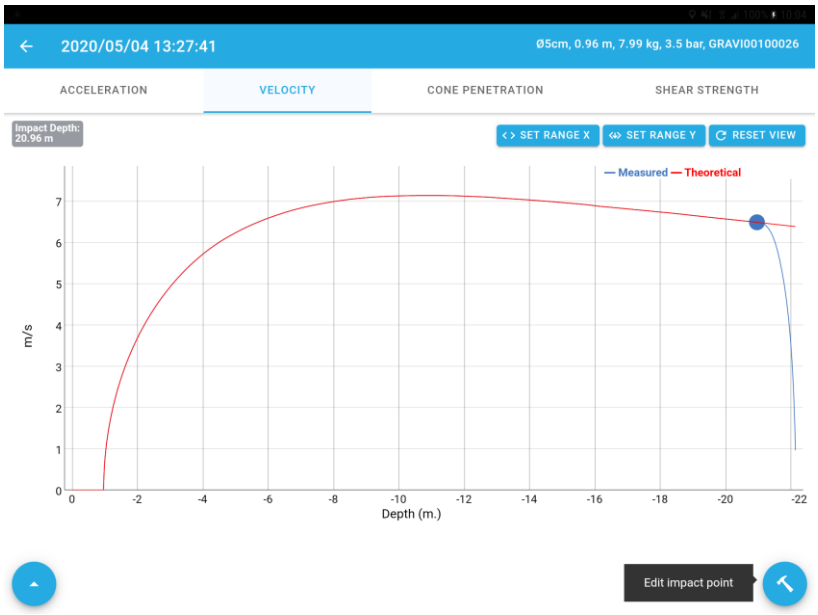
In the edit impact point page, it is possible to select a new point of impact and re-process the drop. To select a new impact point, tap the desired point on the graph. The acceleration of the selected point will be shown in the upper left corner. For more precision in selecting the new impact point, it is recommended to zoom in on the graph, before tapping the edit impact point button. The depth and acceleration of the selected point are shown in the upper left corner of the graph.



Then tap the save button, to continue, or the cancel button to cancel the edit.

To obtain correct data it is important that the impact point is set at the correct depth. The impact point must be set at the moment that the GraviProbe enters the soil. This is when the acceleration curve shows a fast deceleration.

If the impact point is set well, the theoretical velocity curve (the red one) will follow the actual velocity curve (blue) until the impact point (entering the soil). If the red one, leaves the blue curve earlier, you've must edit the impact point manually.



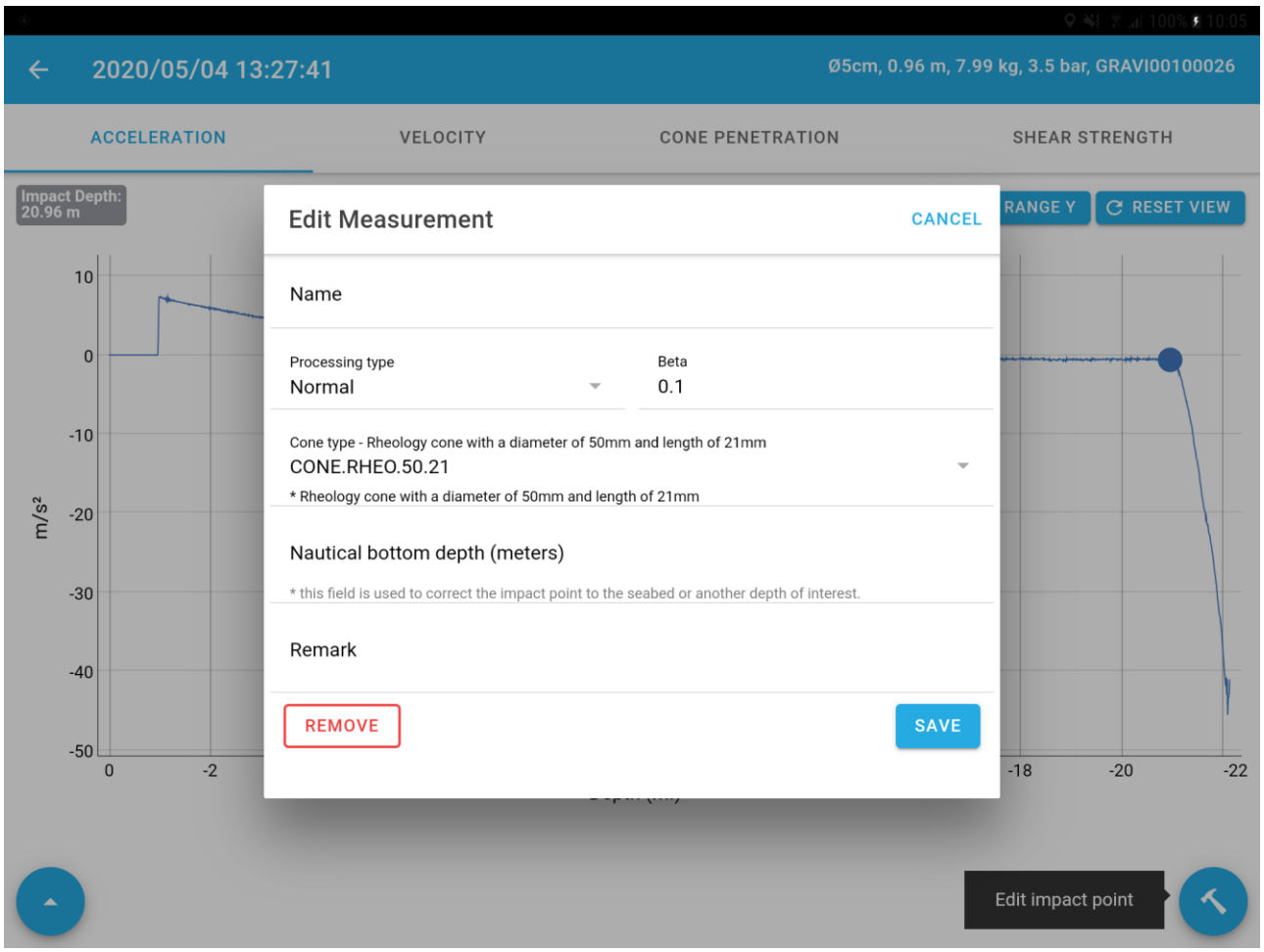
Edit measurement dialog

In this dialog, it is possible to edit and save the measurement details.

On this dialog you can enter the depth of the seabed in meters (if known) to correct the impact point to the actual depth of the seabed, instead of the relative depth. This will result in a shift on the depth axis, so that the impact point will be at the inserted value. If this field is blank then there won't be a correction calculated.

Processing type: Here you can change the processing type between Normal, Shallow water & Corer

Beta: Change the beta parameter for the calculation of the static undrained shear strength.



Export graph: To export the current selected graph tab the  button.

Main Device Page

The main device page shows the device the tablet is currently connected to.

The following data is shown next to the GraviProbe logo:

- GraviProbe name
- Connection status

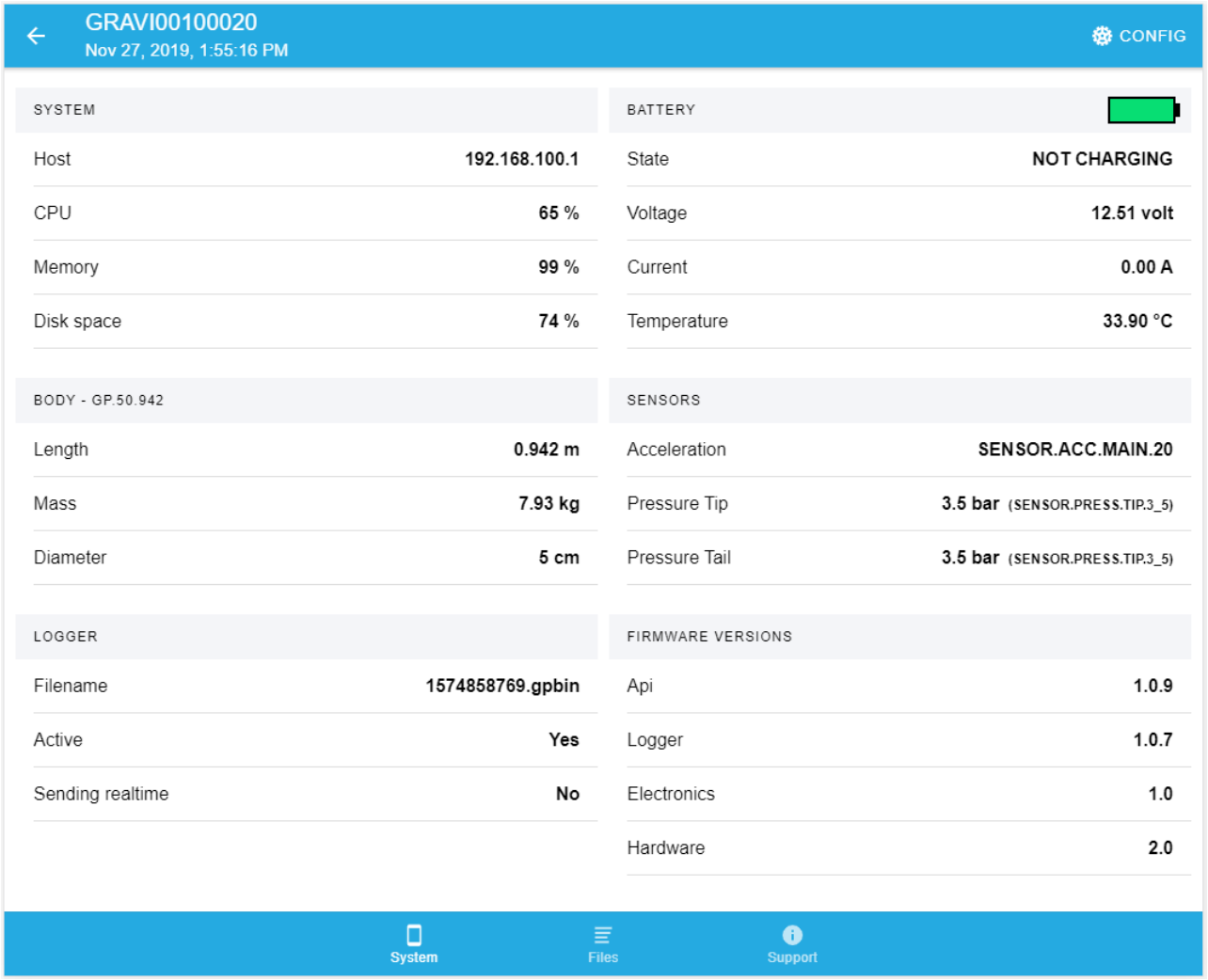
By tapping the device name, the following pages can be accessed:

- Device vitals page
- Device drop list page
- Support Page

Device vitals page

In the device vitals page, information is shown, concerning the GraviProbe Device:

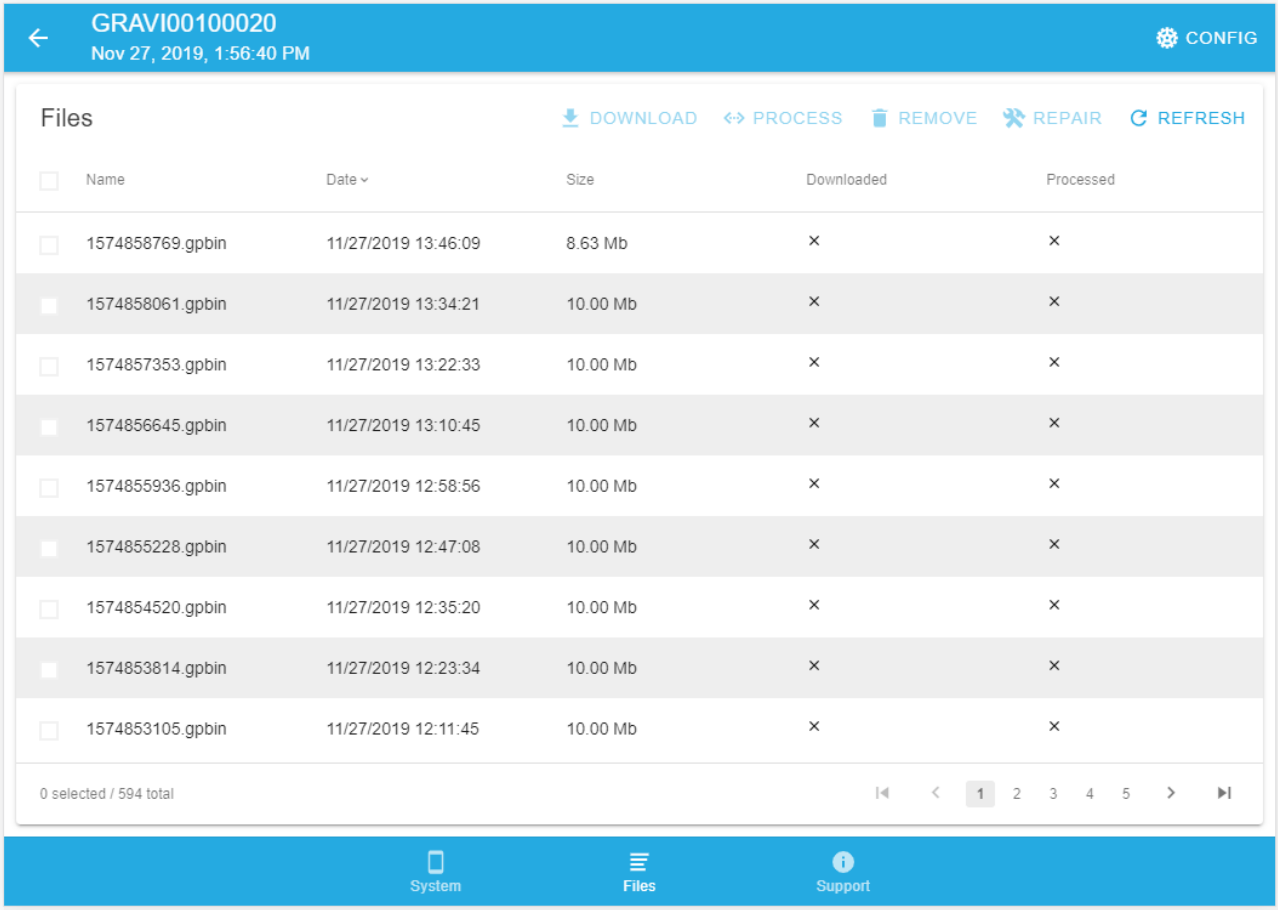
- System info
- Battery info
- Body info
- Sensor info
- Graviprobe Firmware versions
- Logger info



Device drop list page

This page shows all the files on the GraviProbe. After selecting one or more files the following options become available:

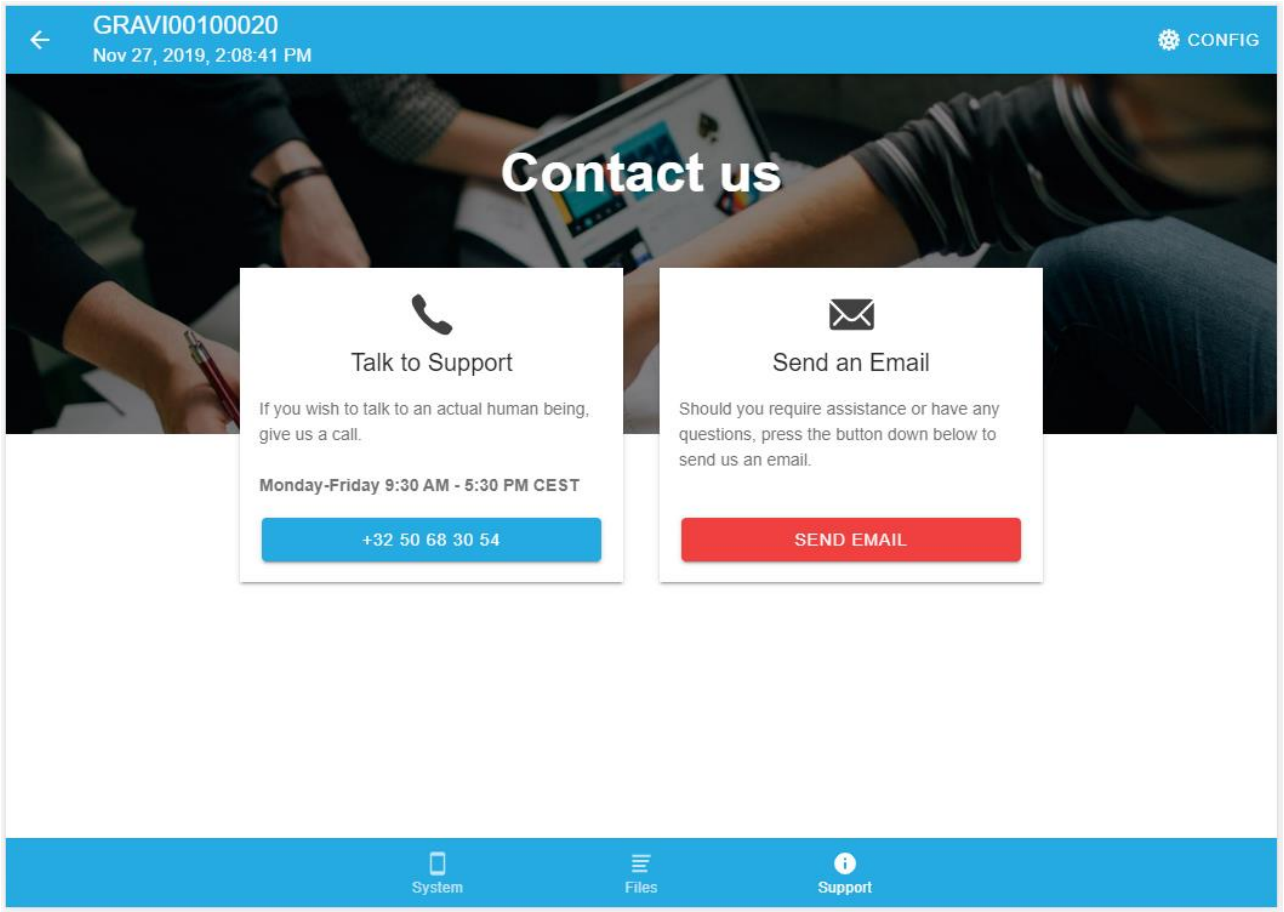
- Download: Download the files to the locally.
- Process: Redownload and process the selected files, and add the drops found to the selected project.
- Remove: Remove selected files.
- Repair: If a pressure sensor is broken it is possible to repair the file so the working sensor data will be copied to the broken sensor data. After this it may be again possible to process the file and find a drop.
- Refresh file list of the GraviProbe.



Support page

At the support page you can phone dotOcean or send an email.

Note: a Gmail account must be added to the tablet, and internet access must be available to send the email.



Performing measurements

Preparations

GraviProbe 2.0

An instructional video on how to assemble the Graviprobe can be found on YouTube at:

https://www.youtube.com/watch?v=Y1gSLm6ytWQ

1. **Place the ON-Connector (with the red tip) over the pins at the tail of the GraviProbe. Wait a few seconds. While the LED's are yellow, the device is booting. When the LED's are blue, the device has booted.**

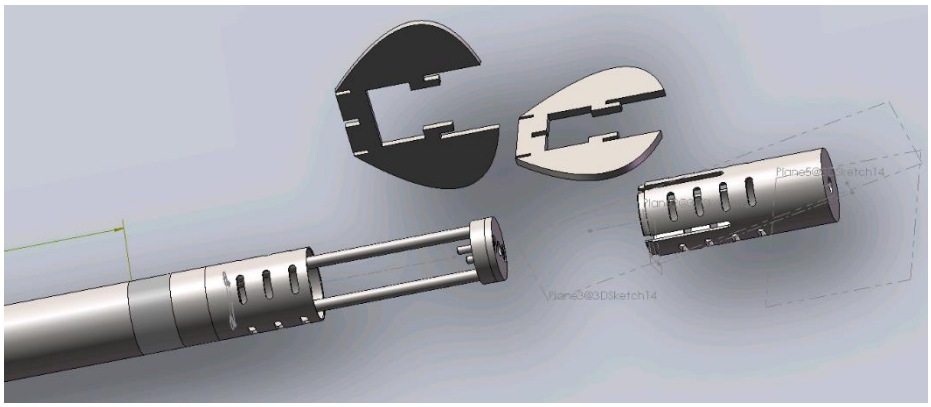
2. **Assemble the GraviProbe**

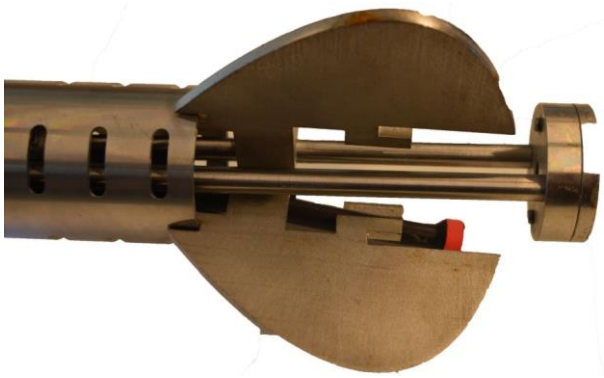
   Step 1:

   Slide the small cylinder over the device

Step 2:

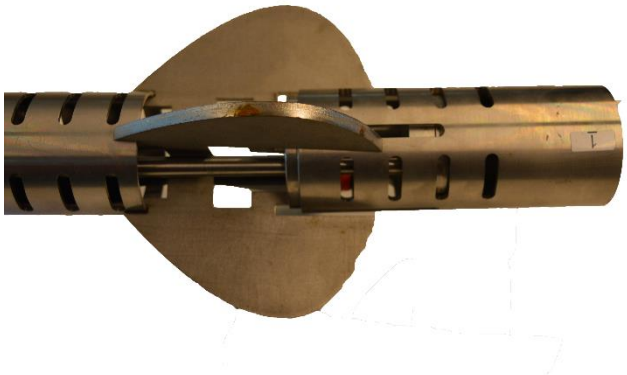
Assemble the fins and place them on the GraviProbe

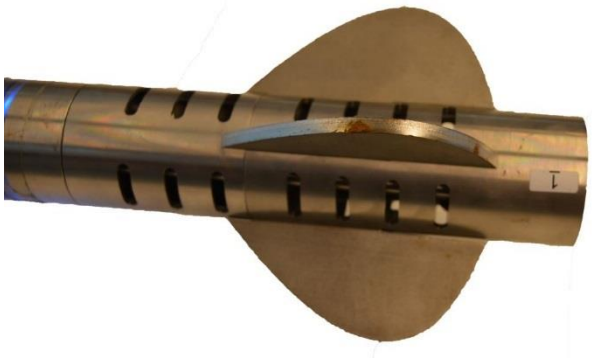




Step 3:

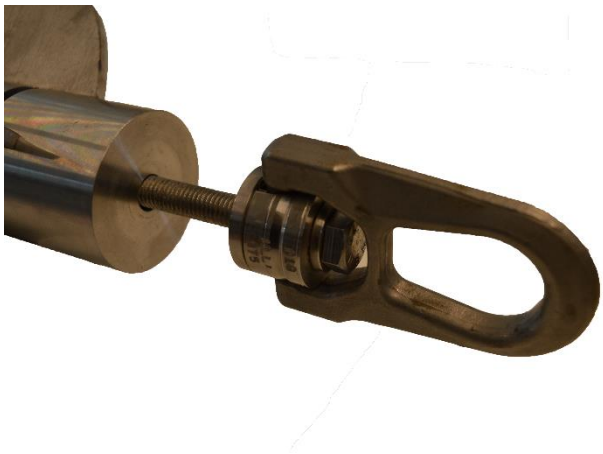
Slide the large cylinder over the fins and the device.





Step 4:

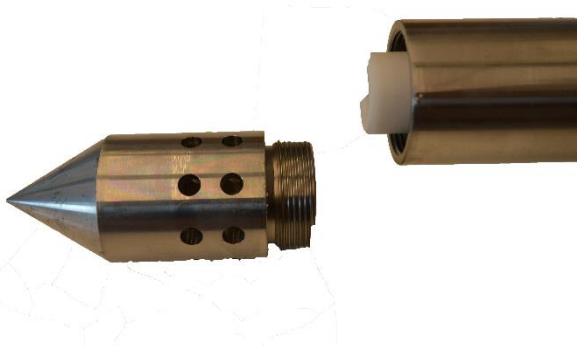
Screw the lift eye into the back of the device and fasten the bolt with the M17 screw.



(in case of GraviProbe DINO, please follow firstly the additional steps for DINO)

Step 5:

Screw the desired tip on the front of the GraviProbe.



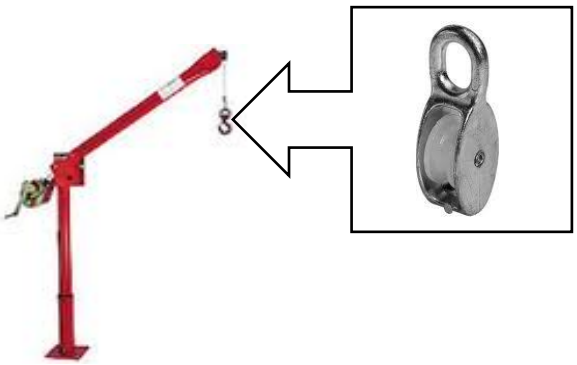
3. **Put the rope through to eye of the weight and connect the rope to the lift eye with the crown shackle.**

Secure the connection with a tie wrap.

4. **Secure the rope to the boat or anchor point.**

Secure rope to the boat

1. For safety reasons stand behind a railing if present.
2. Note: For a successful measurement, use a rope with a length of minimum 2x the depth.
3. If possible, connect the rope to a Davit by use of a pulley.



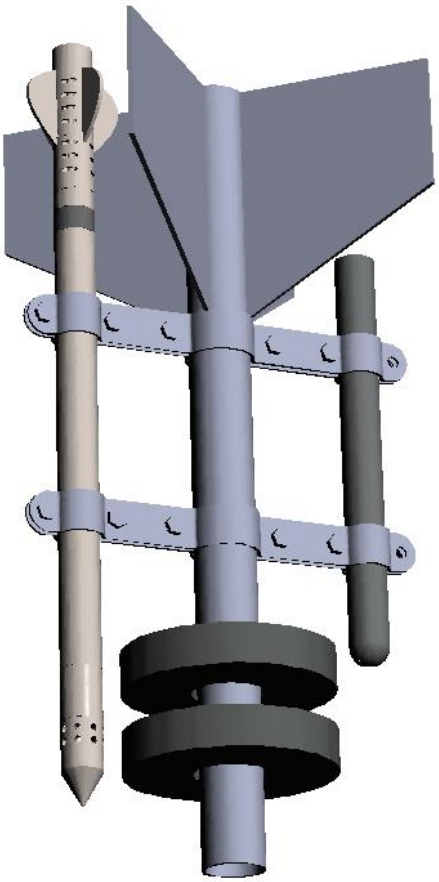
5. **If the LED's are flashing blue, the Graviprobe is recording data and the measurements can be performed. (See: Making the drop)**
6. **If the LED's are NOT flashing blue (static blue or flashing blue/red), the Graviprobe is not yet recording and one has to make connection first with the tablet. (See: Establishing a connection with the device)**

Additional steps for GraviProbe 2.0 DINO

1. Remove the dummy connector from the 'extension sensor + housing' and put it on the extension cable.
2. Gently slide the sensor + housing and the extension cable in the extension mass. Start entering the extension cable in the extension mass from the side with the hex socket grubs.
3. Screw the 'bronze coupling piece' onto the extension mass. (on the side of the connector, not on the side of the sensor)
4. On the top of the GraviProbe body, there is an 8-pin connector. Put the extension cable on the connector and tighten it with the locking sleeve.
5. Gently screw the extension mass with the bronze coupling piece on the GraviProbe body. This must be done very carefully to not make any damage to the rifling. Position the GraviProbe and the extension mass vertically (GraviProbe on the ground) to screw the extension mass on the GraviProbe body. Be sure that the top sensor and its housing isn't yet locked with the hex socket grubs.
6. Lock the top sensor with the hex socket grubs and the hex wrench (included in the case).
7. Screw the tip on the extension mass.
8. Be sure you've set up the **correct body type** in the app and on the device (see chapter "**change hardware configuration**")

Additional steps for using the GraviProbe 2.0 with the Gravity Coring System

1. Attach the GraviProbe Rheology (not the DINO version) and the counter weight to the Coring System main body using the brackets. (see picture below)
2. Be sure you've set up the **correct body type** in the app and on the device (see chapter "**change hardware configuration**")
3. Be sure you've set up the **correct processing type** for your project in the app



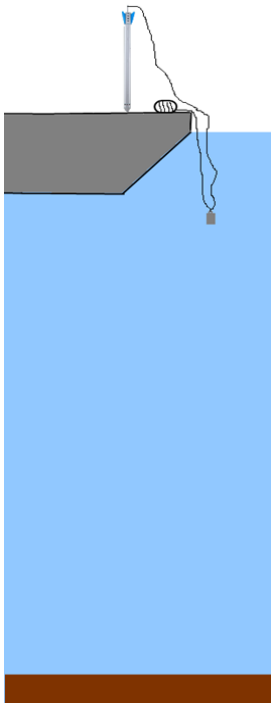
Making the drop

Safety notices

1. If possible, release the device approximately 50 cm away from the edge of the boat, if unable, be careful while recovering the device.
2. The **boat propeller** should be **SHUT OFF** as soon as the weight is in the water: if ignored this can lead to loss of the GraviProbe.

Measuring procedures

1. Normal procedure



- **Lower weight**

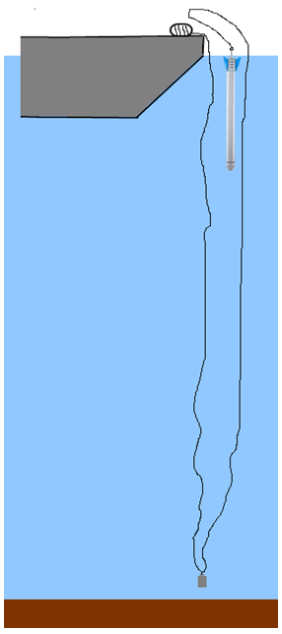
  The weight needs to be lowered to a depth approximately equal to the measuring depth.

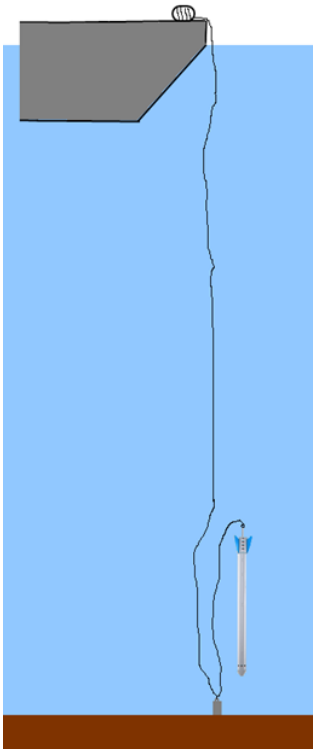
  Note: try to avoid the weight twisting the rope.

- **Lower GraviProbe**

  Lower probe until the tail fins are just beneath the water surface.

  Hold for 2 seconds (stabilizing sensors).

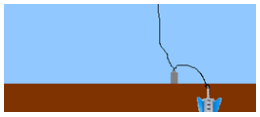


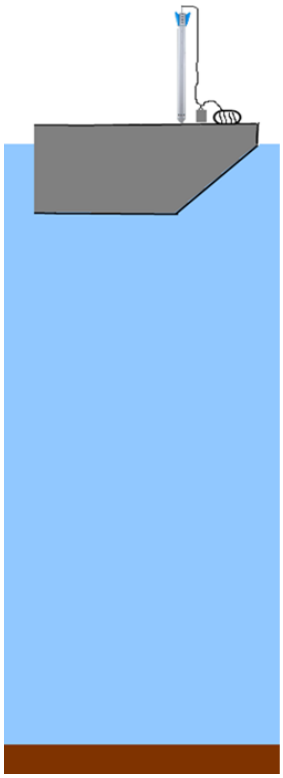


- **Release GraviProbe**

  Note: Try to avoid any upward or downward movement of the rope and/or probe.

  Wait for 5 seconds while the probe is free falling (measures the fluid-mud and sediment layer).





- **Pull up the probe and weight**

  Note: avoid hitting the probe against the bottom of the ship and/or the Davit!

- **Repeat the process**

  Note: duration of 1 measurement cycle is ±30sec (depending on the measuring depth)

  Note: It's recommended to put the probe on deck while relocating (to avoid damage and loss)

2. *High depth procedure*

If you are measuring at high depths, it is unnecessary to bring the GraviProbe to the surface each time. You can release the GraviProbe 20m. above the seabed and afterwards correct the depth accordingly.

For this type of measurement, you need to use a special release mechanism so the weight can be lowered while the GraviProbe stays in position.

The measurement procedure is exactly the same as *1. Normal procedure*, but you release the GraviProbe at a high depth below the surface. The release procedure depends on what type of release mechanism you have.

This procedure is supported from app **version 2.0.3** and higher.

See **addendum A** for more information about the release mechanisms.

3. *Shallow water procedure*

This procedure isn't available yet but will be available in the near future.

So, stay tuned.

4. *Corer procedure*

Release the Gravity Coring system with the winch. Be sure the Gravity coring system has a free fall and is not limited by the winch or any tension on the rope.

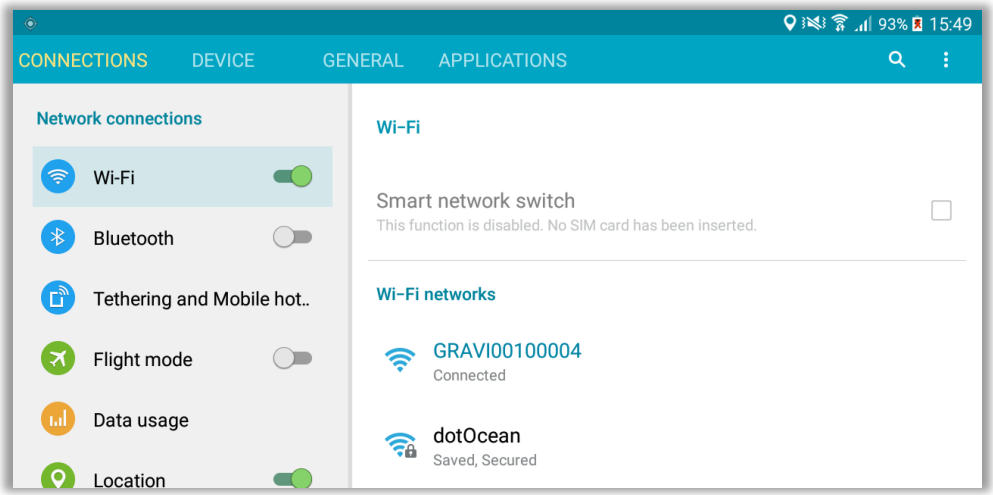
Using the GraviProbe 2.0 app

The GraviProbe 2.0 app is available on the Google Play Store. For updates, a connection to the internet must be present, and a Google account must be added in order to receive the updates from the Google Play Store. See the App installation guide (p. 11).

Establishing a connection with the device

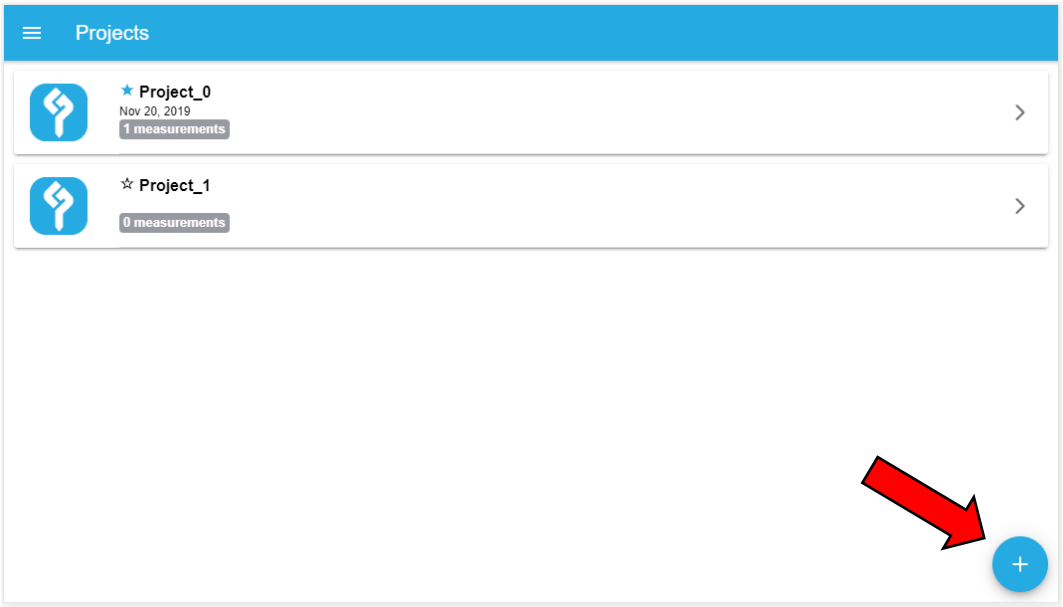
Go to the tablet's configuration screen, and go to the connections tab.

If the device is ready (Static Blue LED on Graviprobe), it is possible to connect to the device's wi-fi, simply tap the device name in the list of wi-fi networks. The Blue LED will start flashing if the Graviprobe was able to successfully connect to the tablet. At this point, the Graviprobe starts logging his data.

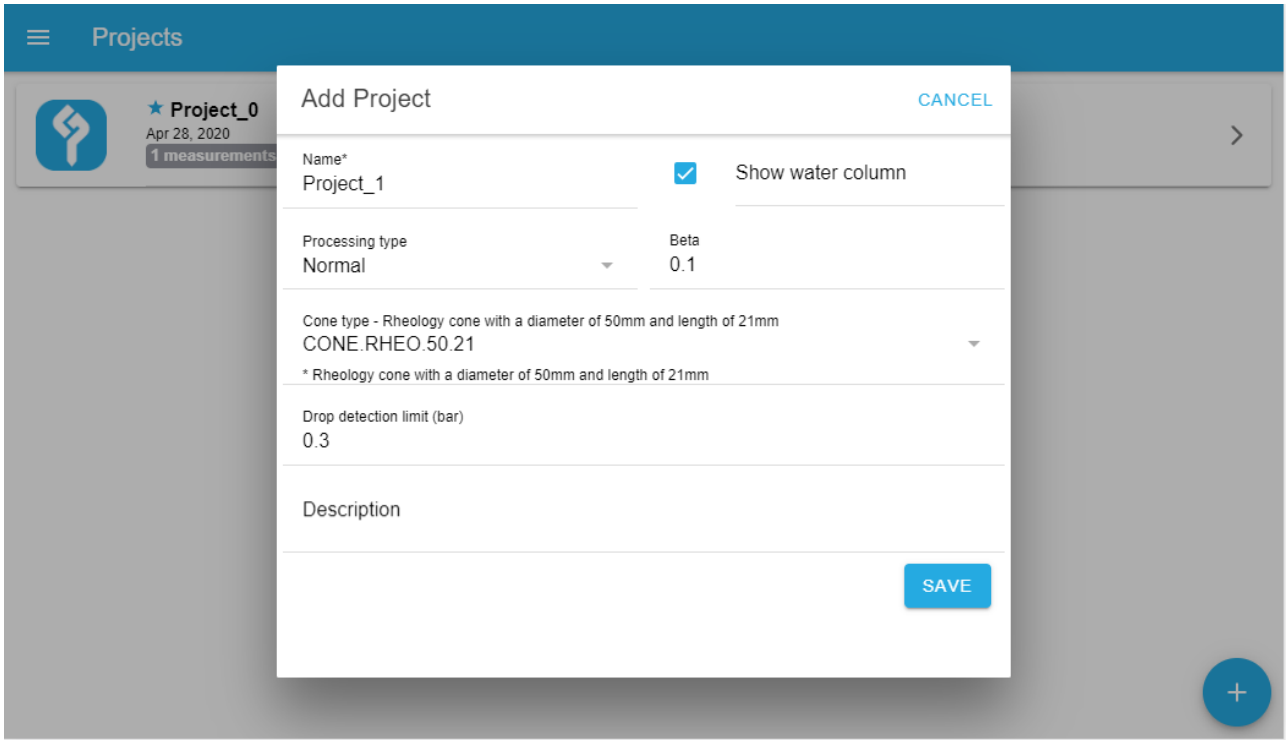


Creating a project

Open the GraviProbe 2.0 app, you'll be redirected to the projects page. Here you can see earlier made projects, or if this is the first time using the app, the list will be empty. To create a new project, click the plus button on the right bottom corner.

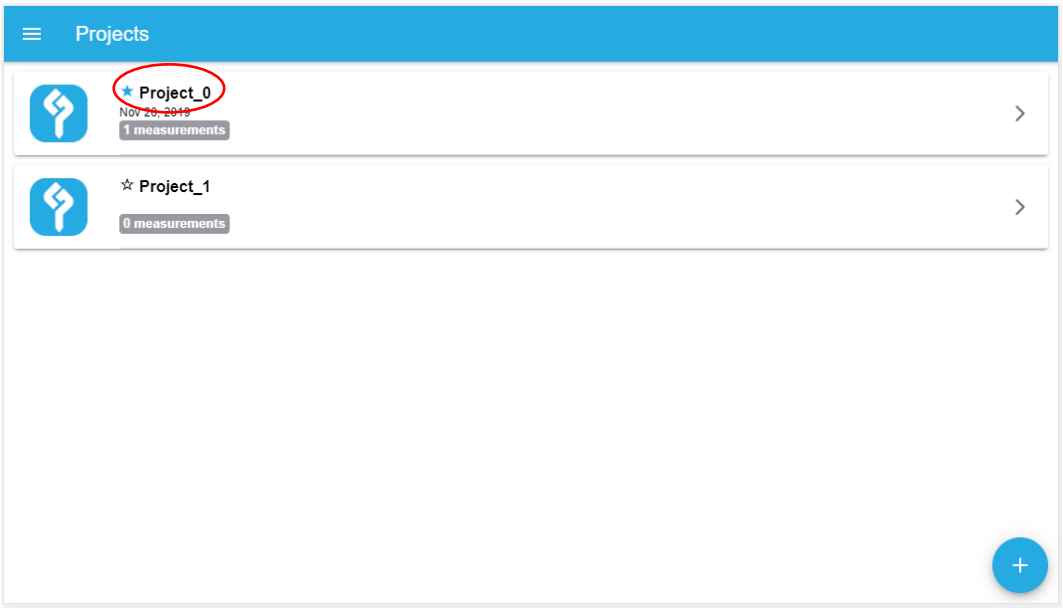


A new screen will appear, where you can enter the project name, select if the cone type of the Graviprobe (Soil, Rheology, …), and add a description to your project. Press Save to continue, or cancel if you should change your mind. Data must be transferred into a project in order to view the generated charts and data.



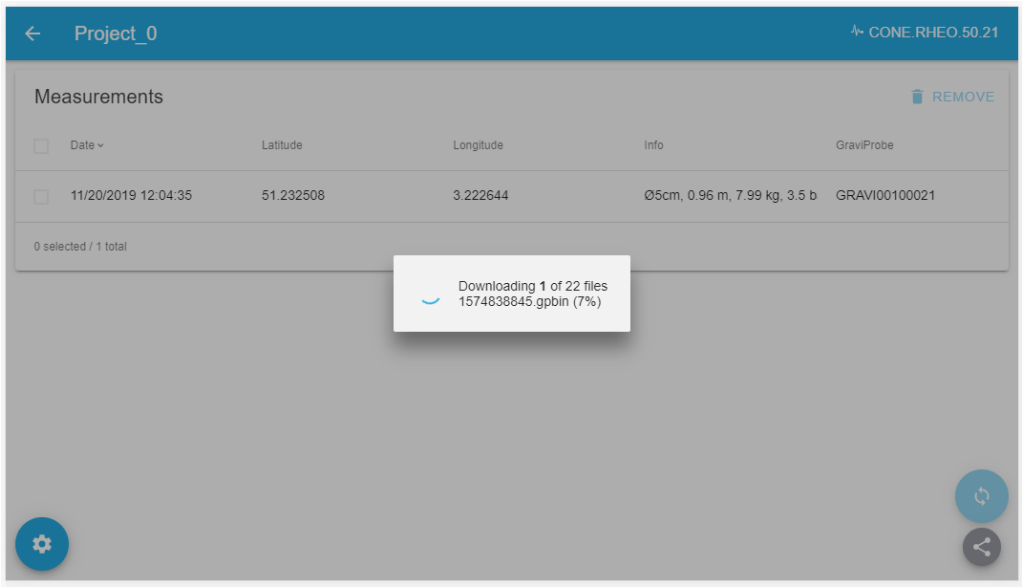
When you tap save, the new project will appear in the list with projects

Selecting the project in which data will be transferred and processed, can be done by selecting the star next to the project name. The blue star represents the current active project. After processing, drops will be automatically added to the active project.



Downloading and processing the data

When the device is connected to the tablet, the drop files can be downloaded to the tablet and then processed by tapping the synchronize button . Make sure that during the synchronization, the connection between device and tablet is not severed.



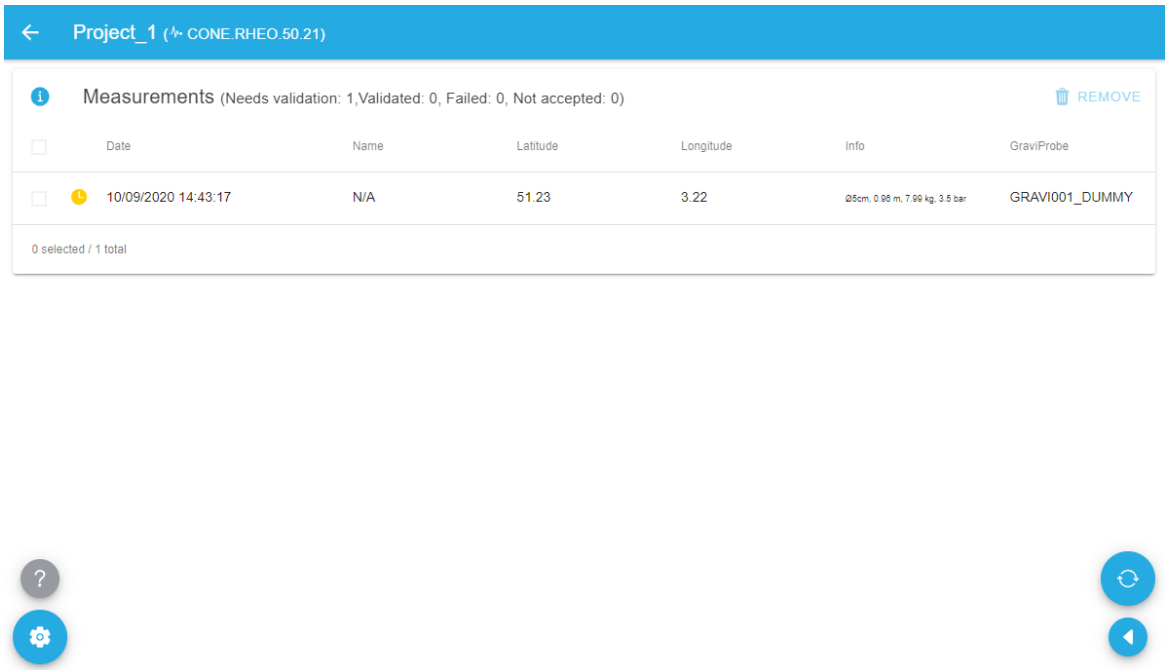
When the tablet has finished processing the detected files, the drops will be added to the list.

Drops that were synced will receive a latitude and longitude according to the position of the tablet at the time of syncing. Drops that were added via the file list are not given position stamps.

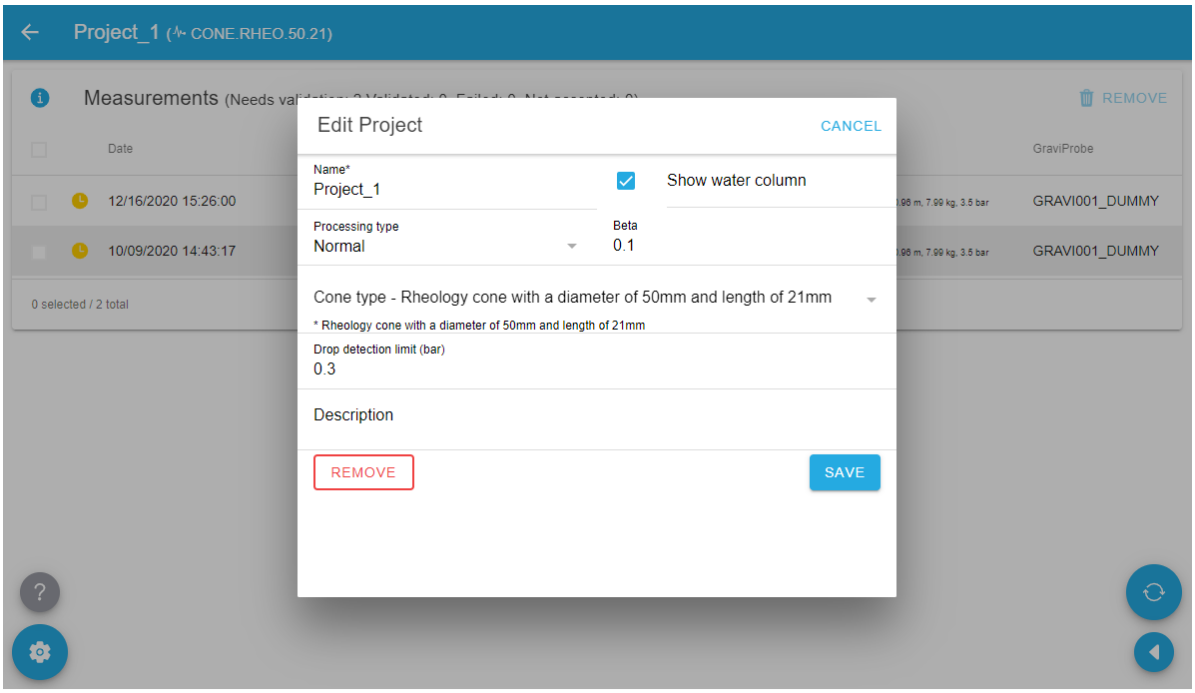
If you wish that the lat and lng coordinates are the same as the drop site, please make sure that you sync with the device when it is pulled back up and a stable connection can be made.

Viewing the data

Tap the menu button and navigate to the projects page, then tap your project. The logging that has been added is now displayed in a list, sorted by date, and also the position and device used is shown.

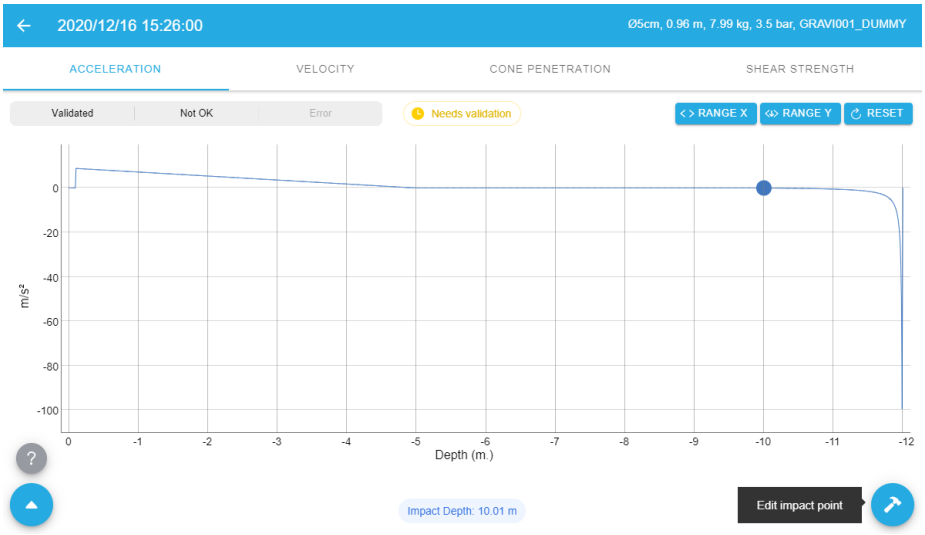


By tapping the edit button  , you can edit the projects information or remove the project:

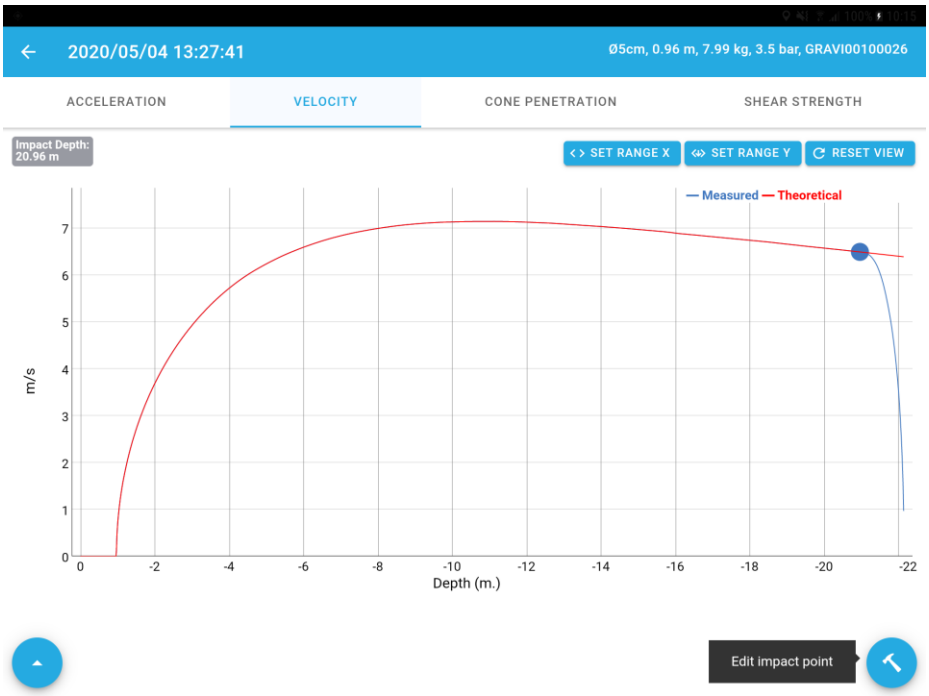


When tapping the file, a new screen appears showing the logged data in 4 graphs:

- Acceleration

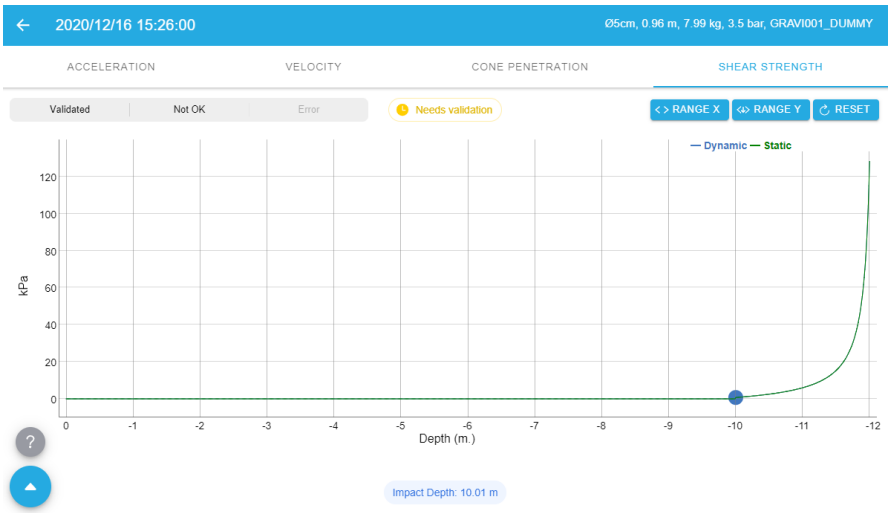


- Velocity

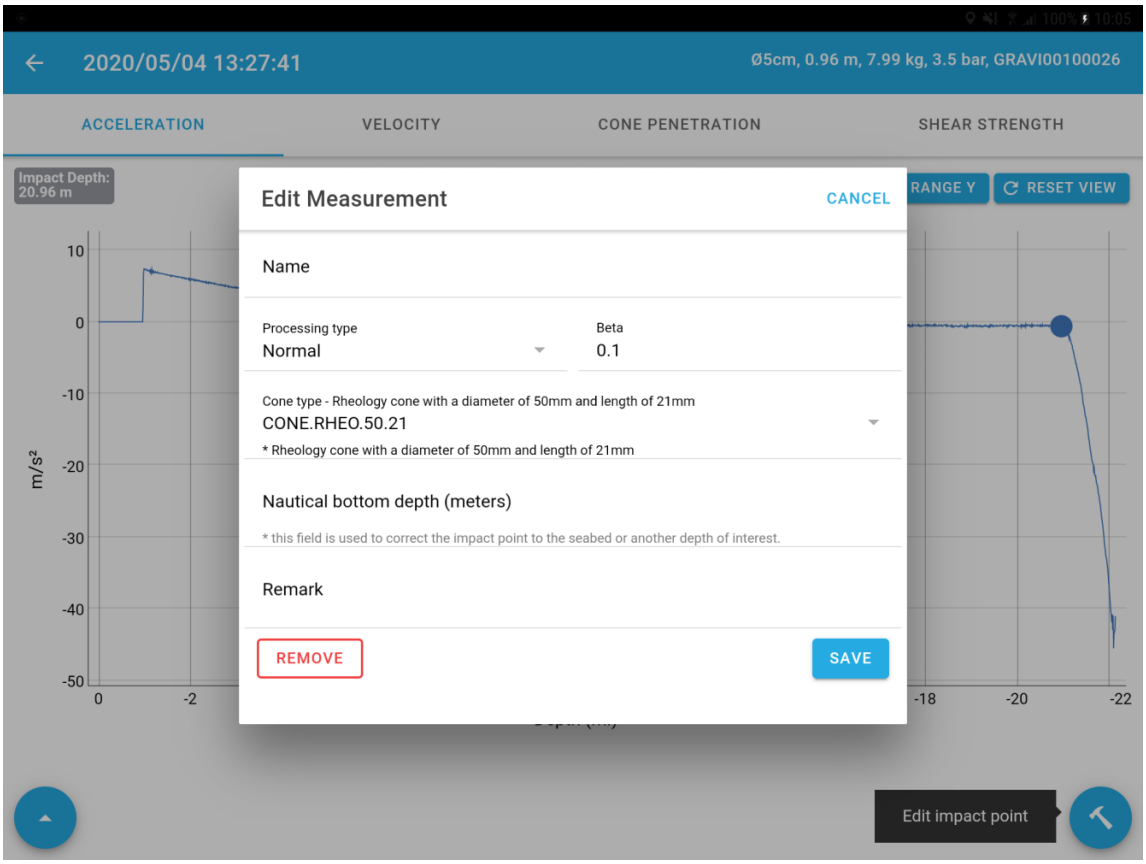


- Cone penetration (Not available with processing type: Corer)

- Shear strength



By tapping the options button  , you can change the processing profile, and add a remark to the measurement.

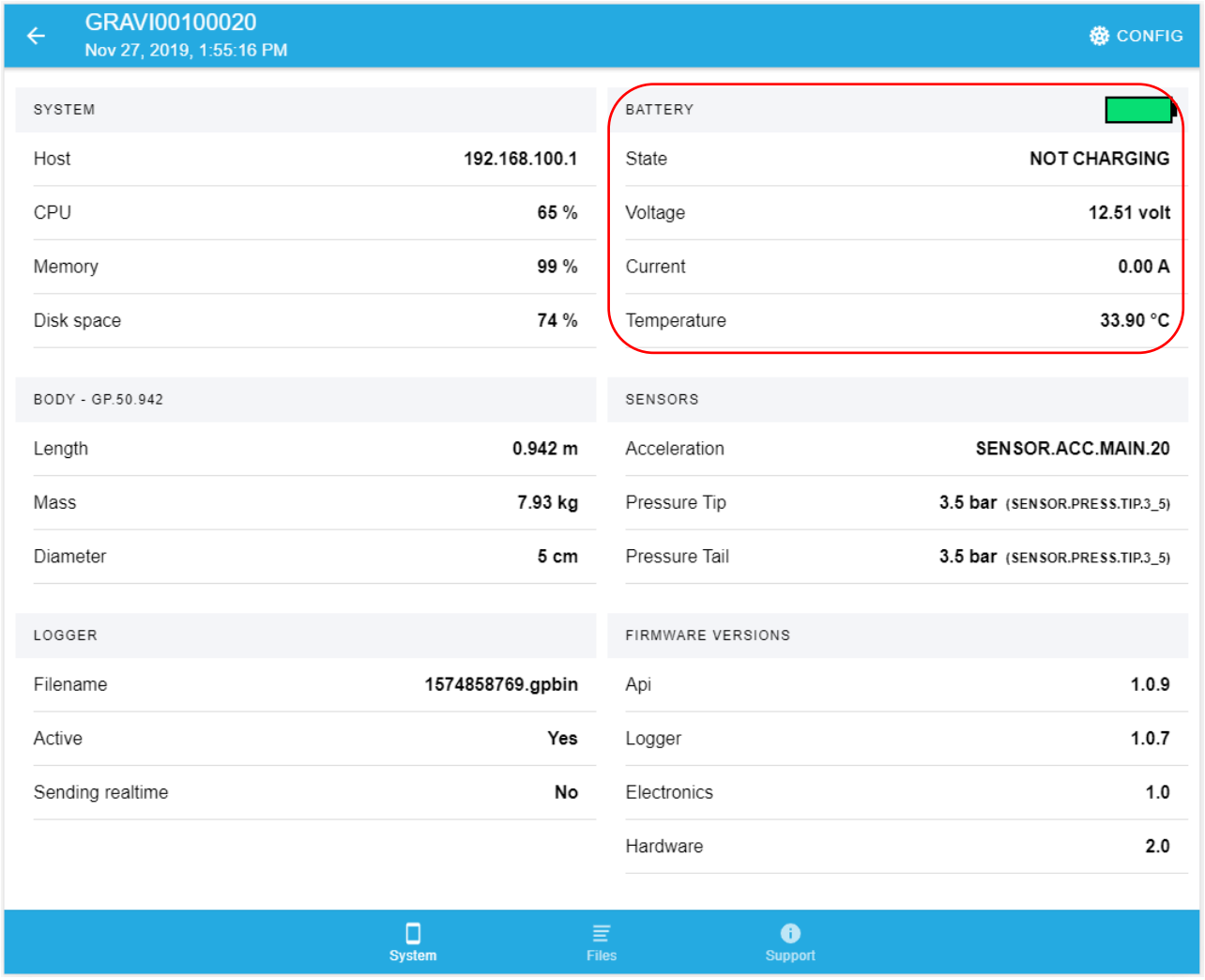


Tapping the  button will enable to set a different impact point. See p. 24 & 25.

Charging the GraviProbe 2.0

The battery capacity can be viewed in the device vitals page. When the LED's of the GraviProbe are flashing orange, the battery is low and the GraviProbe needs to be charged with the provided charger cable.

To charge the GraviProbe, put the charger cable on the connector in the GraviProbe. While charging the LED's of the GraviProbe will flash green. If the LED's of the GraviProbe have a static green colour, the GraviProbe is fully charged.



In some cases, the battery can be in depletion mode. In this situation, one should add a cable between the charger and the GraviProbe for MAXIMUM 30 minutes. The GraviProbe charger will charge the battery, but the GraviProbe will stay off. After 30 minutes, one should remove the additional cable and put the charger directly onto the GraviProbe connector. Please, ask a dotOcean engineer (support@dotocean.eu) for more information on this case.

Change hardware configuration

It is possible to change the GraviProbe hardware configuration in the device system configuration application.

This application is a website running on the device itself.

There are several ways to access the device system configuration.

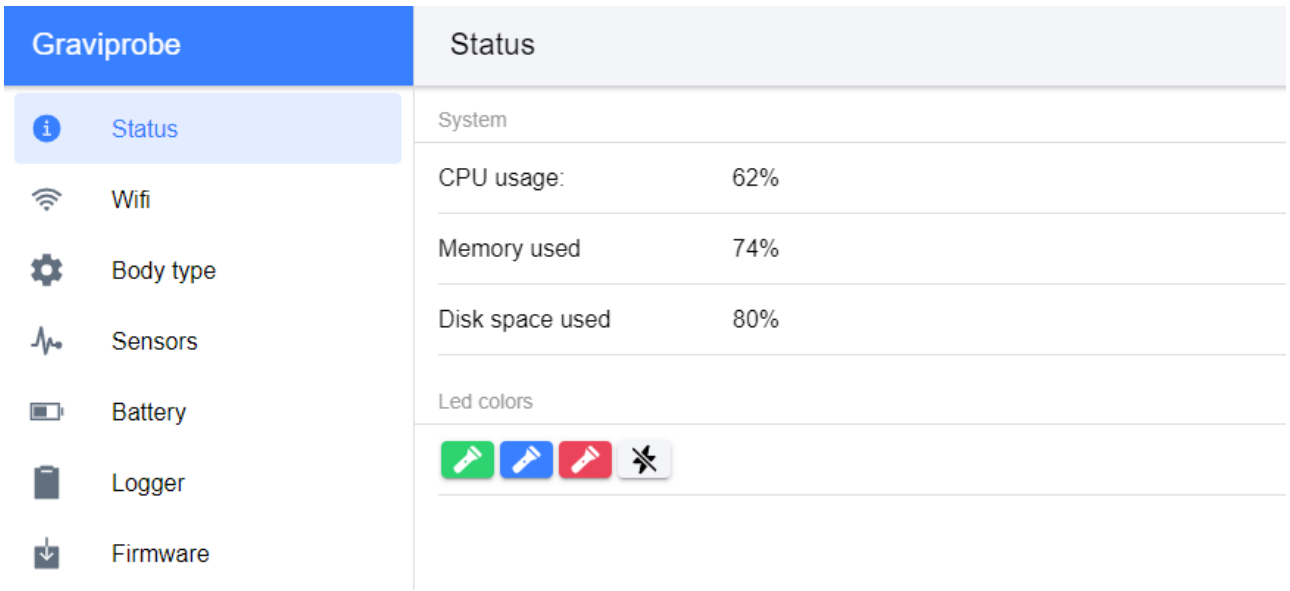
- Connect a device (pc, laptop, …) to the GraviProbe by Wi-Fi & open a browser and surf to http://192.168.100.1
- Go to the device info page on the tablet app and click the config button CONFIG in the top right corner.

After changing a configuration, restart the device with the web application to make sure the settings are saved correctly.

Disclaimer: These settings are for qualified personnel only!!

Status

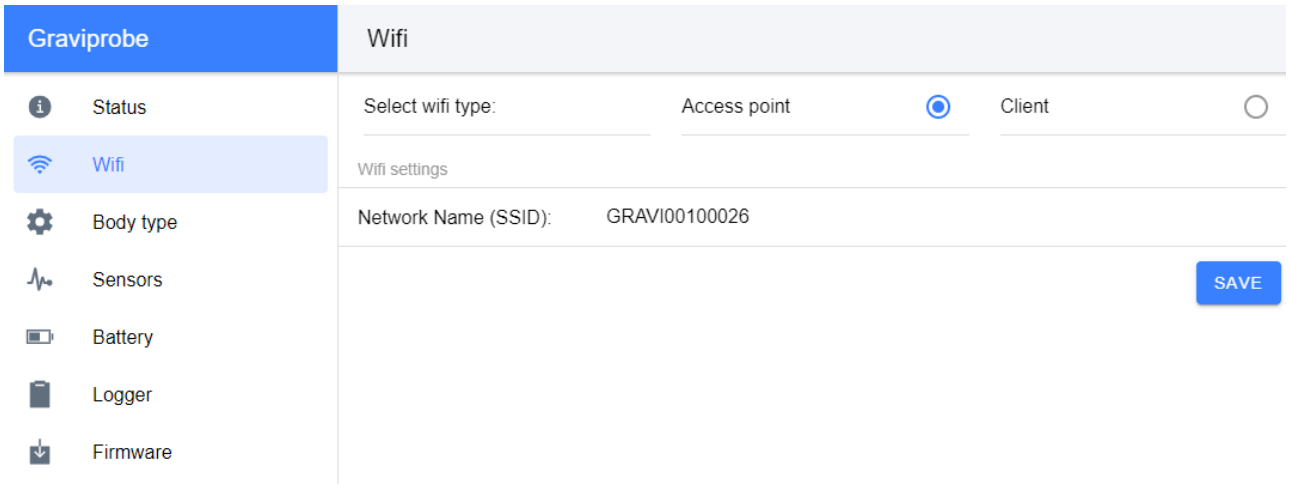
Here you can see the status of the GraviProbe. System info and errors will be displayed here. It is also possible to test the LED's.



Wifi

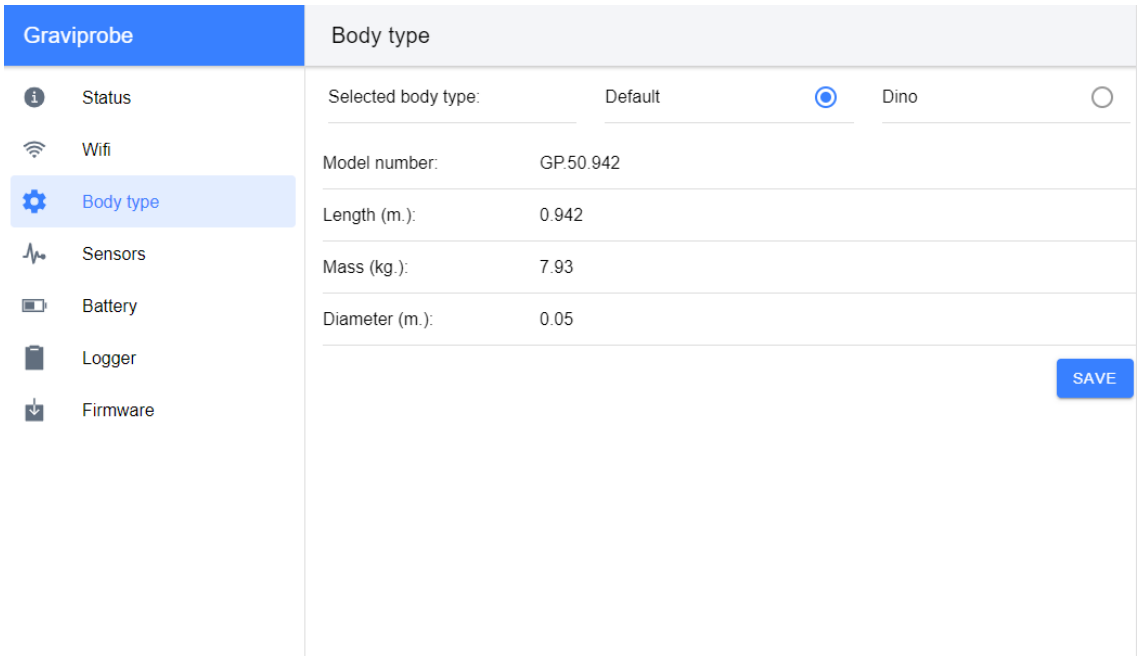
Do not adjust these settings!

If you use incorrect wifi settings, the connection isn't automatically restored to the default connection type.



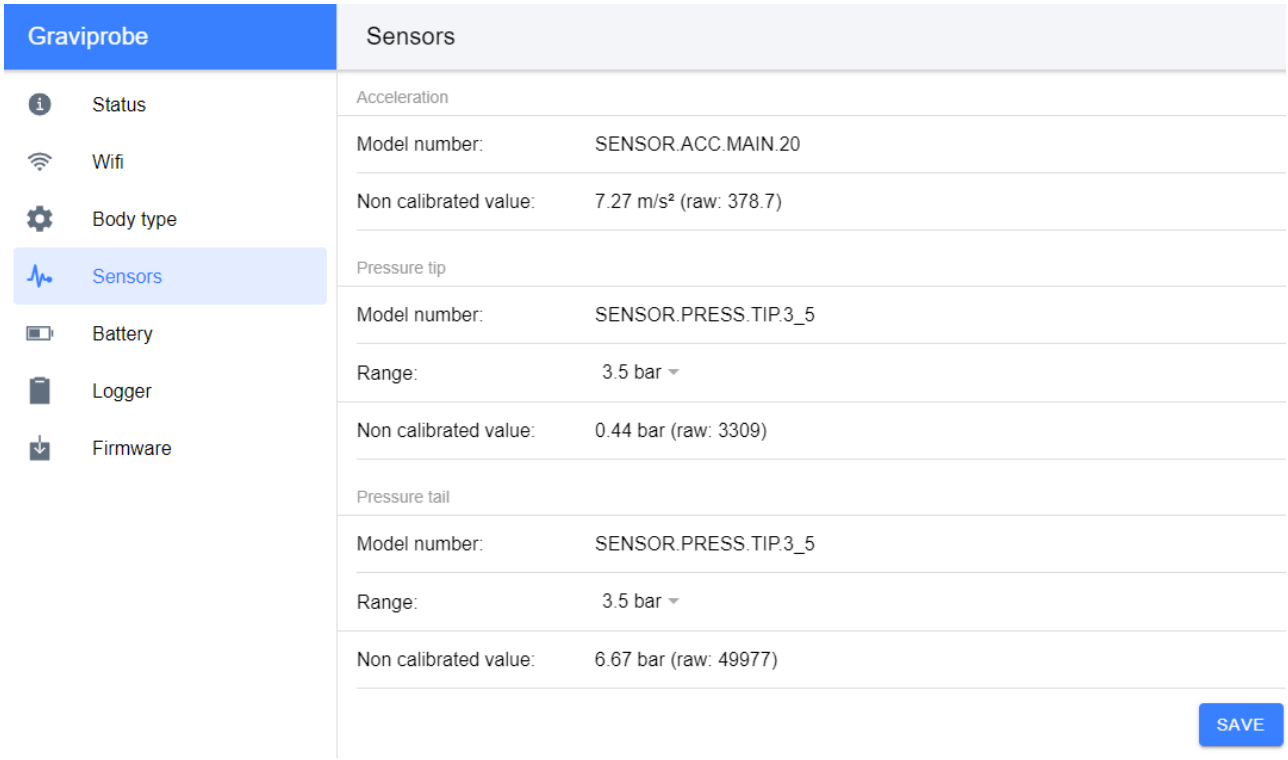
Body type

Change these setting according the body type you have configured.



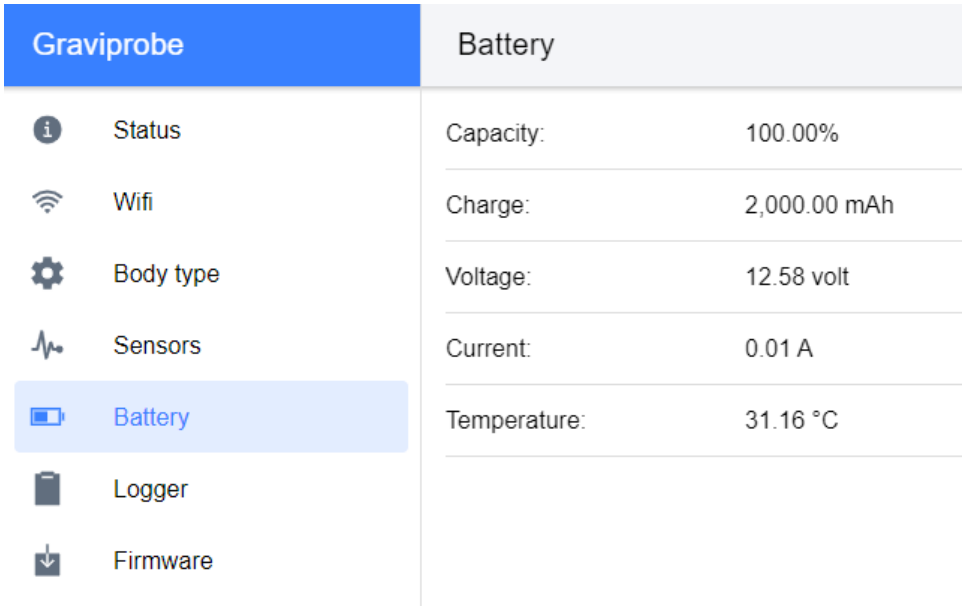
Sensors

Change the range of the pressure sensors to the pressure sensors that are installed.



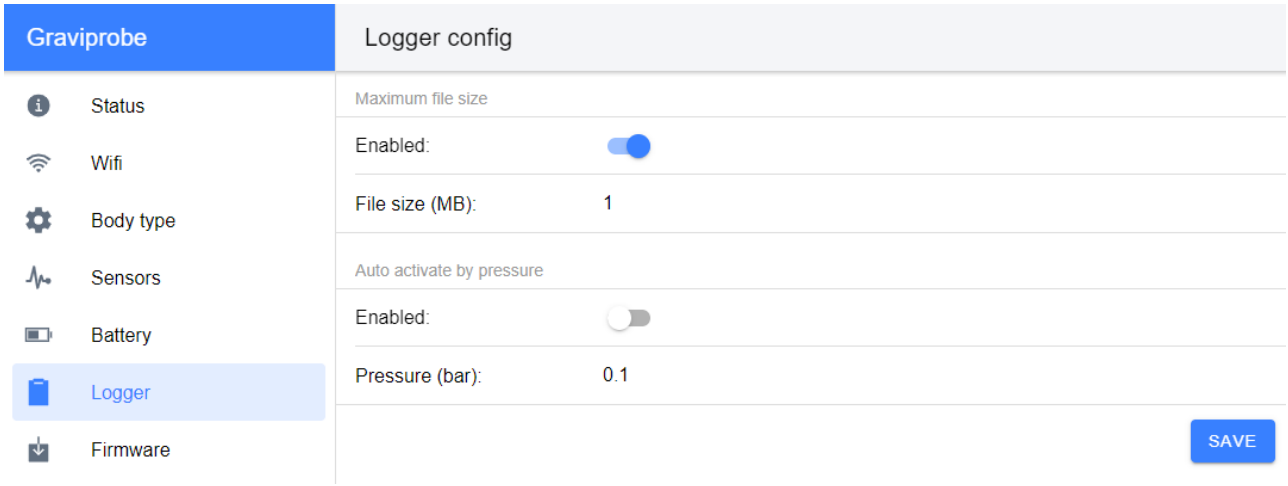
Battery

Info about the battery



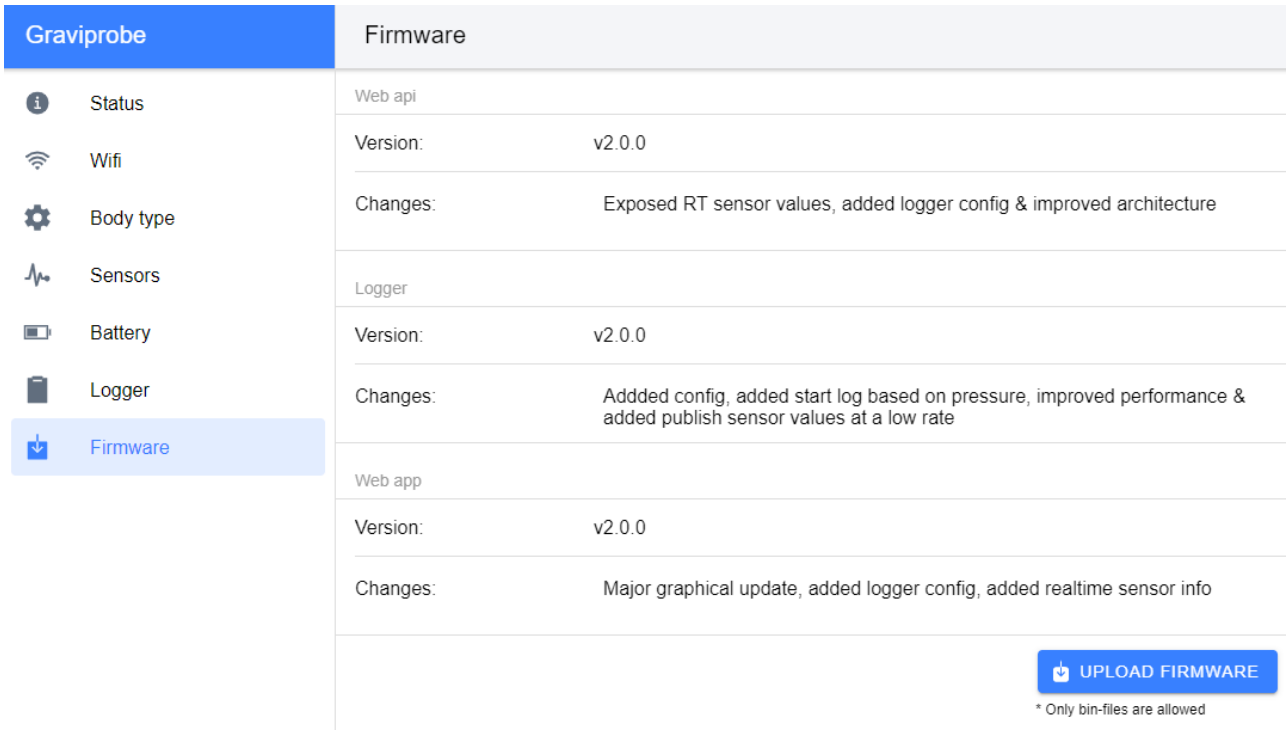
Logger

Here it is possible to set a maximum file size for the log files whether or not auto activated by pressure.



Firmware

Current versions of the firmware are displayed here. It is also possible to upload new firmware. Only bin-files are supported.



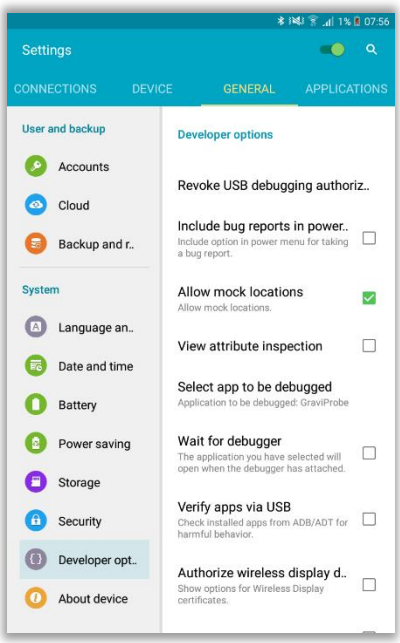
Connecting the external GPS

By default, the internal GPS of the tablet is used, in order to achieve greater accuracy, the external GPS can be positioned closer the GraviProbe.

The following steps are required in order to use the external GPS:

1 On the tablet, open the settings page, and navigate to the developers' options.

2 Scroll down to "allow mock-up locations" and activate the feature.

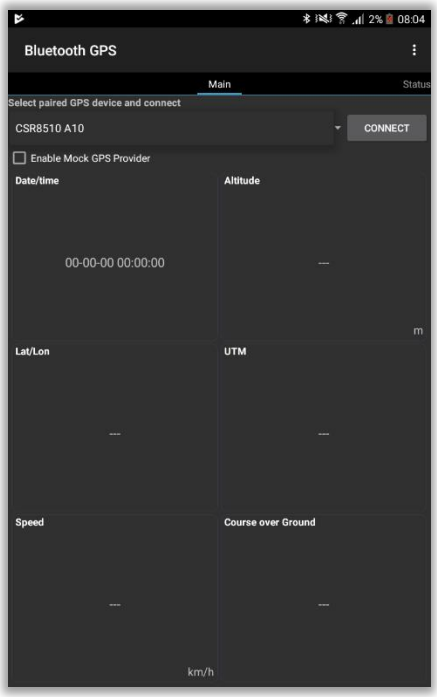


3 Connect the external GPS to the tablet with Bluetooth. By pressing the red button on the GPS for a few seconds, the GPS becomes visible to other devices.

4 The PIN pair code of the GPS is: 0000

5 Open the Bluetooth GPS app.

6 Connect to Qstarz GPS and enable mock GPS provider.



7 Open the GraviProbe app.

8 The GraviProbe app will now use the external GPS coordinates.

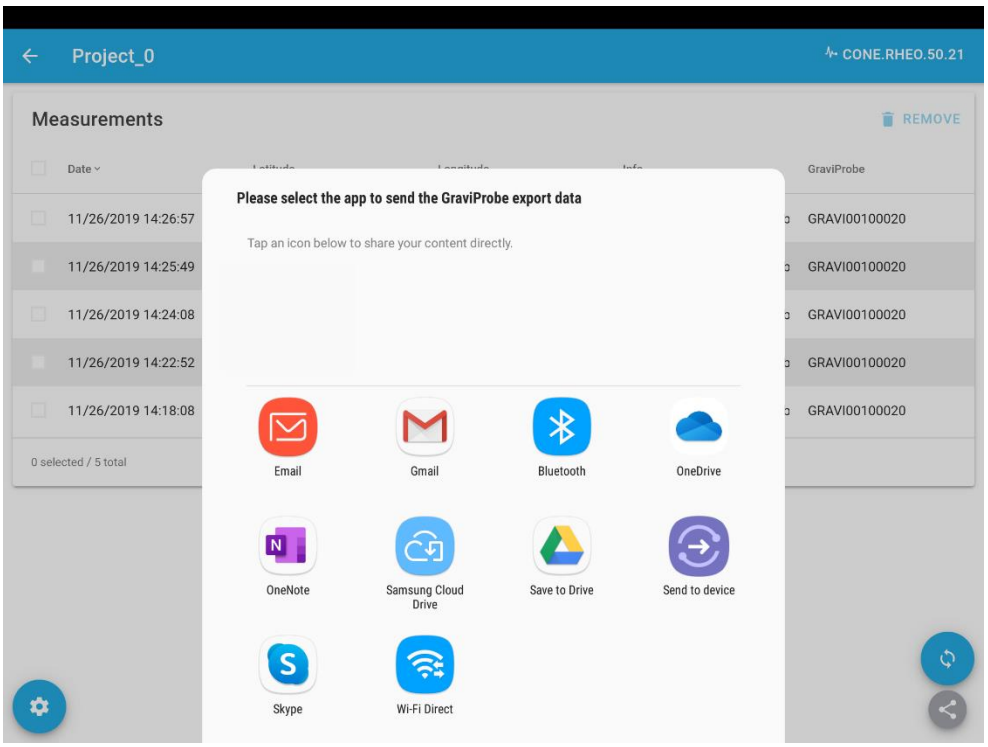
Downloading the drop CSV file

While processing a file, the GraviProbe app will analyse the data, and if a successful drop has been made, a CSV-file will be created in a separate folder. In order to access the CSV-file, one of the following methods can be executed:

Method 1, using the export function:

1. In the project page tap the  button.

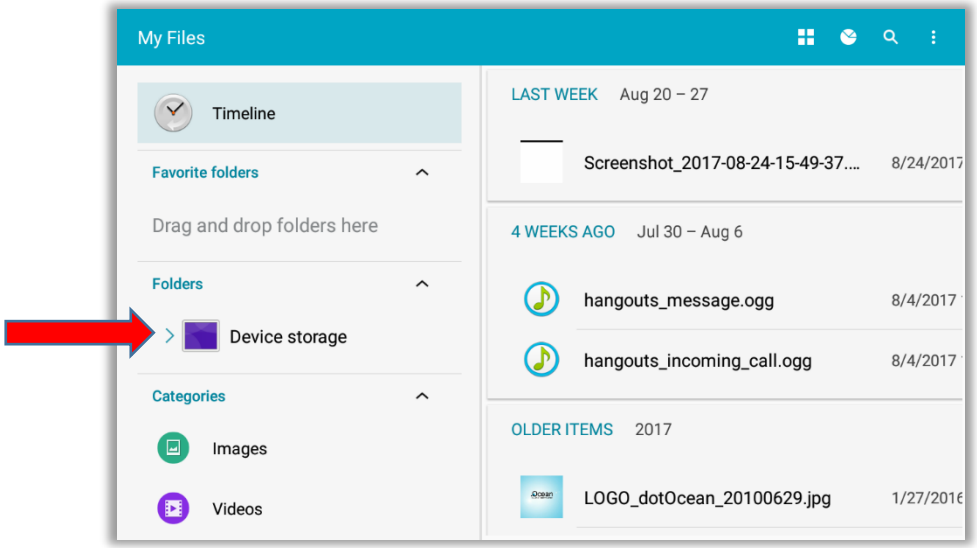
2. Choose an application to share the newly created zip-file, containing the data.



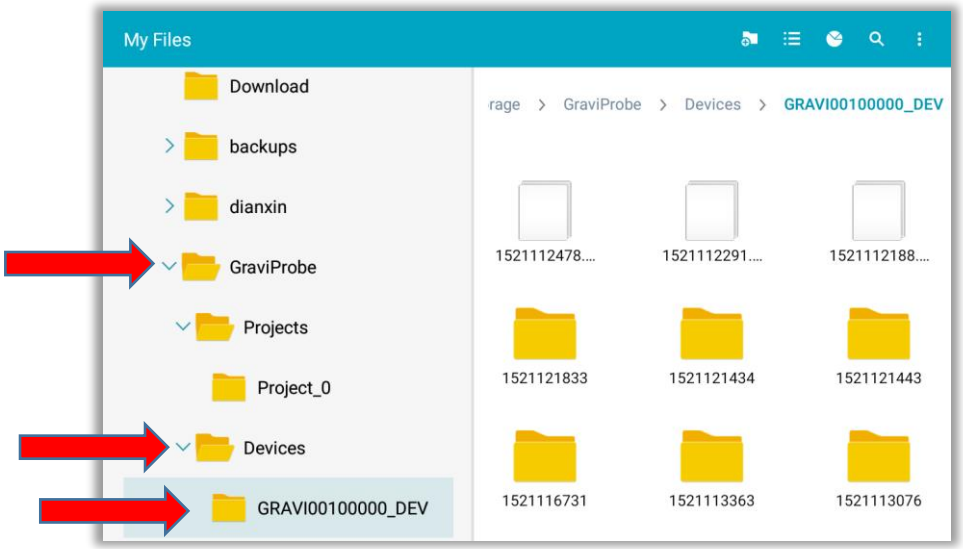
Method 2, share the files on the tablet:

1. In the tablet's main screen tap the "my files" icon.

2. In the following screen tap device storage, the file structure will expand.



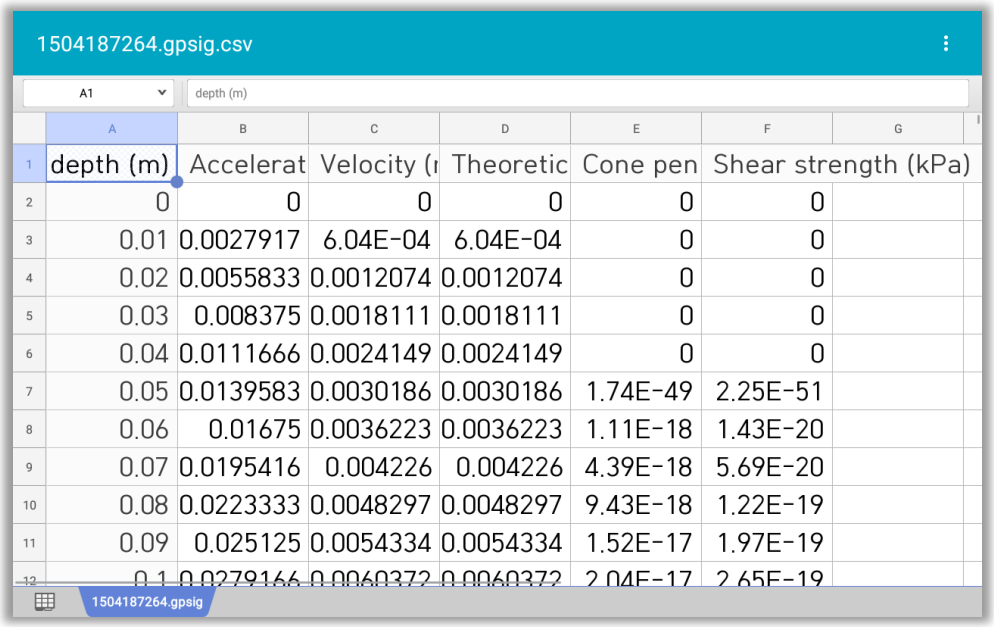
3. Tap the data folder
4. Tap the Graviprobe
5. Tap the Devices folder
6. Tap the GraviProbe folder with which you performed the drop
7. This folder contains the downloaded drop-files:



8. The folders contain the csv files of the processed drop

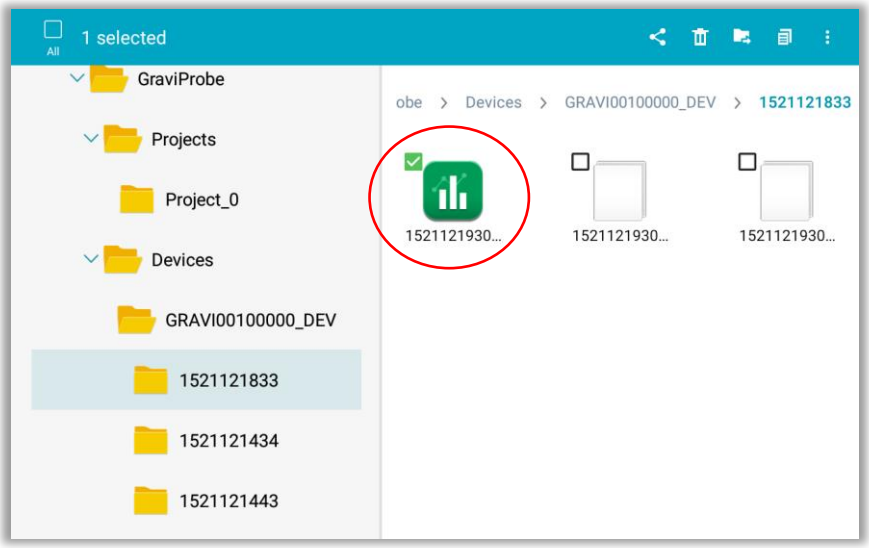
   a. Tapping it will open the file

   * Depth will can negative if the seabed depth is entered. Negative depth in this case means “outside” of the water.

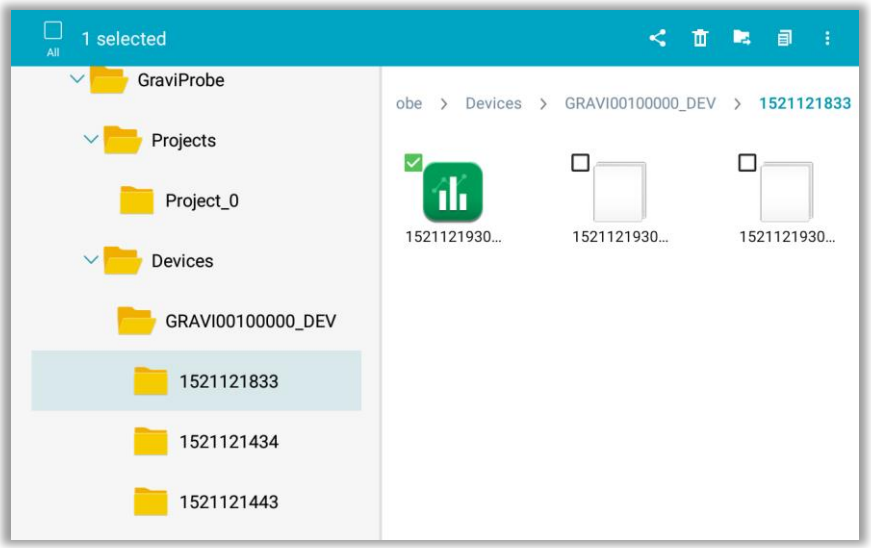


	A	B	C	D	E	F	G
1	depth (m)	Accelerat	Velocity (r	Theoretic	Cone pen	Shear strength (kPa)	
2	0	0	0	0	0	0	
3	0.01	0.0027917	6.04E-04	6.04E-04	0	0	
4	0.02	0.0055833	0.0012074	0.0012074	0	0	
5	0.03	0.008375	0.0018111	0.0018111	0	0	
6	0.04	0.0111666	0.0024149	0.0024149	0	0	
7	0.05	0.0139583	0.0030186	0.0030186	1.74E-49	2.25E-51	
8	0.06	0.01675	0.0036223	0.0036223	1.11E-18	1.43E-20	
9	0.07	0.0195416	0.004226	0.004226	4.39E-18	5.69E-20	
10	0.08	0.0223333	0.0048297	0.0048297	9.43E-18	1.22E-19	
11	0.09	0.025125	0.0054334	0.0054334	1.52E-17	1.97E-19	
12	0.1	0.0279166	0.0060372	0.0060372	2.04E-17	2.65E-19	

   b. Tap and hold to select the file



9. Tap the share button to send the file via email or another program.

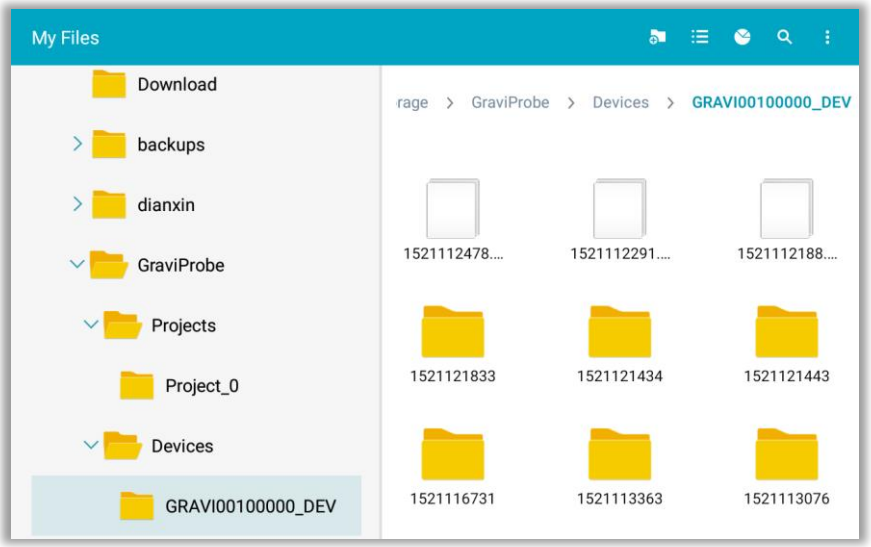


Method 3, using a flash drive:

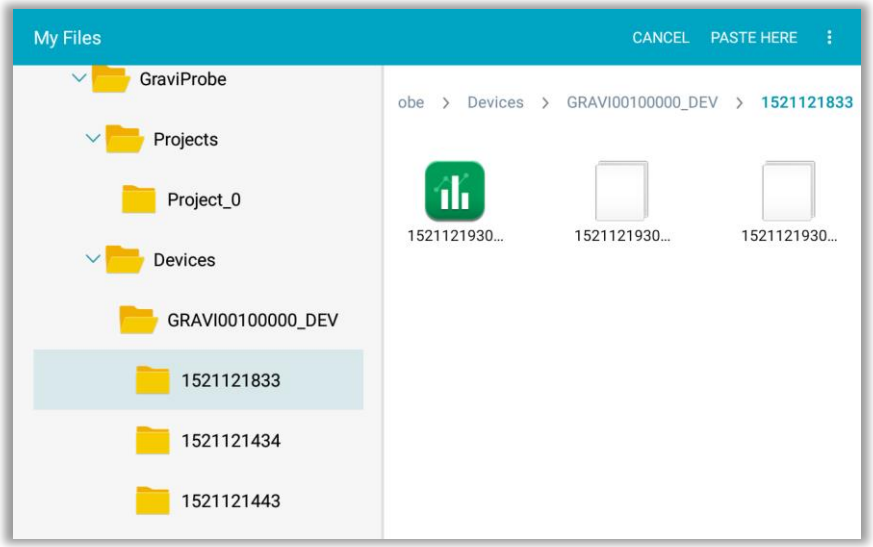
1. Connect a USB stick to the tablet using the OTG cable, navigate to the folder containing the desired CSV-file as described in method 1.

2. Tap and hold to select the file

3. Press the copy button

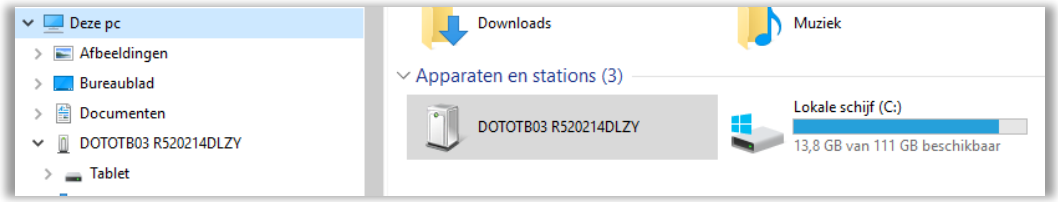


4. Navigate to the connected USB stick and press the paste here PASTE HERE button

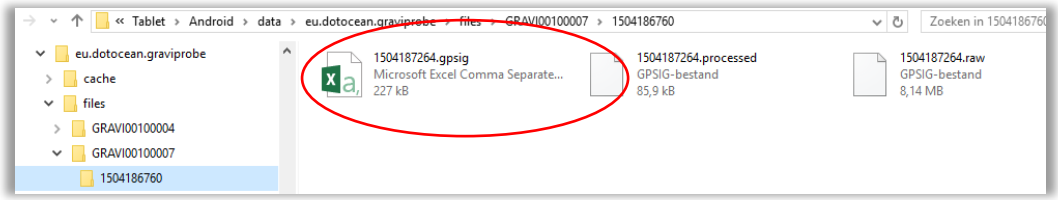


Method 4, connect the tablet with a computer:

1. Connect the tablet to a PC or laptop using the USB to micro USB cable.
2. On the PC or laptop, in the file explorer select the tablet



3. Navigate to the folder containing the CSV-file. The file path is identical as described in method 1



4. Copy the CSV-file to the desired folder

Addendum

Addendum A: Tips and Tricks

Before measuring, please pay attention to these actions:

1. If you want to make sure the GraviProbe is fully charged, check the device details in the app while charging to make sure the power consumption is less than 0.4. Then you can be sure the battery of the GraviProbe will be able to last 8-hours. Also, the voltage must be over 12v. After the charge is completed, disconnect the cable from the GraviProbe. Because, if the charger is connected and the power adapter isn't in/powered, then the battery will be drained!
2. Before each measurement, make sure the blue light on the GraviProbe is flashing, if the blue light isn't flashing or flashes blue/red, no data will be recorded. This can happen when the GraviProbe is started, but didn't first connected with the tablet. On first connection after a reboot, the date & time will be automatically synchronized, allowing the GraviProbe to start logging.
3. Take a few test measurements before going on the survey. This to make sure everything is still ok.
4. After a few measurements, connect the tablet to the GraviProbe and push the synchronization button inside project detail. Also do this as soon as possible at the end of the survey!

Tips and tricks for the shallow water processing:

1. Only hold the tip under water until all the holes are under.
2. The drops need to be at least 5 seconds apart from each other to detected the measurements.
3. Keep the GraviProbe as vertical as you can. You can achieve this by holding the GraviProbe at the rope and not at the body.
4. Get comfortable with the device before going out on a survey (practise a bit), this also apply for a normal measurement.
5. Sometimes the weight could improve the measurement, but other times it could be worse. Chose to use the weight appropriacy.
6. There could be false detections when washing the GraviProbe or when you accidently lower the GraviProbe too much into the water. Please keep this in mind.

Addendum B: GraviProbe Release mechanisms

1. Release hook on deck

The idea is to follow the following steps:

1. First lower the GraviProbe onto the sea floor.
2. Then raise it over a length equal to 4 or 6 times the height of the A-frame.
3. We then clamp the rope to keep the GraviProbe into position (see 2 in Figure 1).
4. The winch then slowly unwinds, and the extra rope slack is rolled into loops on the deck. Loops should have a diameter similar to the height of the A-frame and there can be several loops (4 or 6 for example).

5. The loops (see 3 in Figure 1) are hung onto a U-clamp (see 1 in Figure 1) and raised up on the A-frame using a small winch (this could be a manual winch).

Upon release, the clamp 2 and the U-clamp 1 are opened at the same moment, and the GraviProbe falls down, using up the free rope length that is held in the loops, which will now unwind.

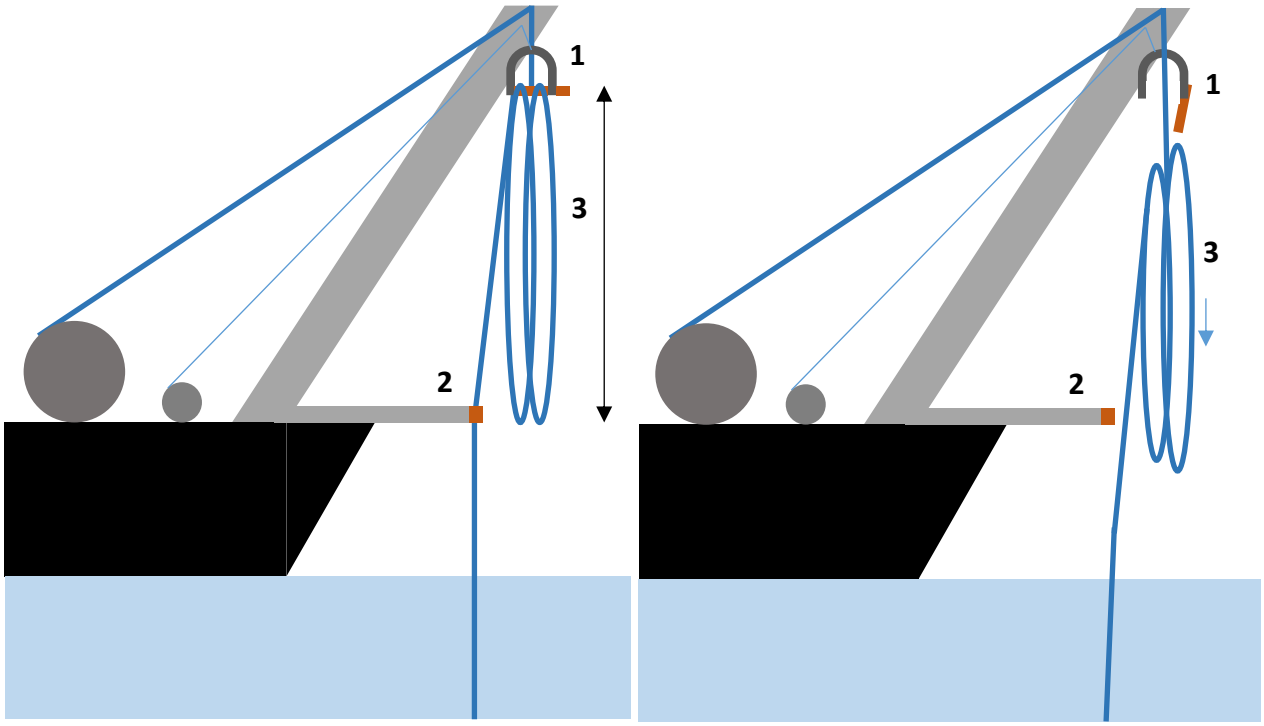
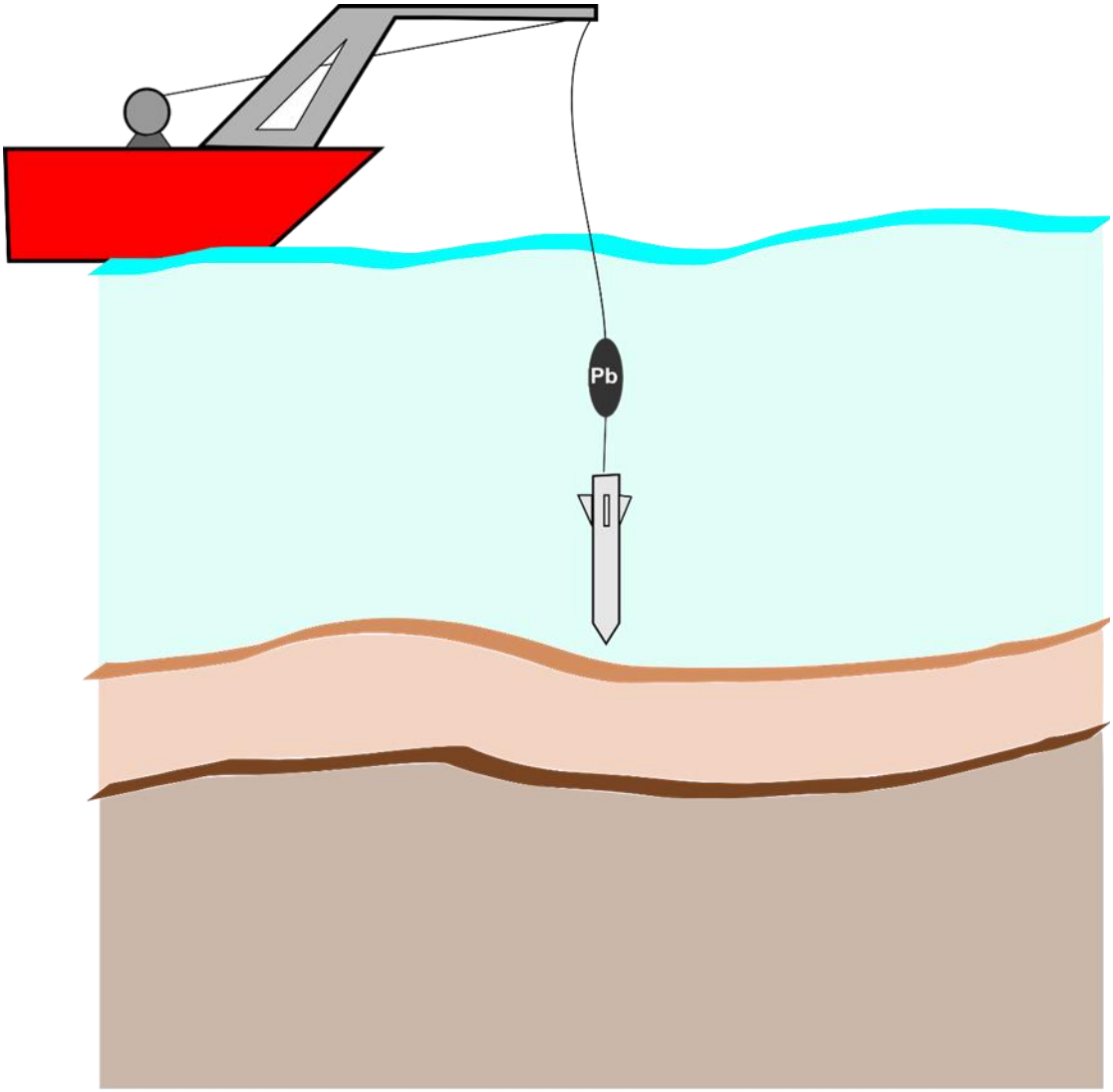


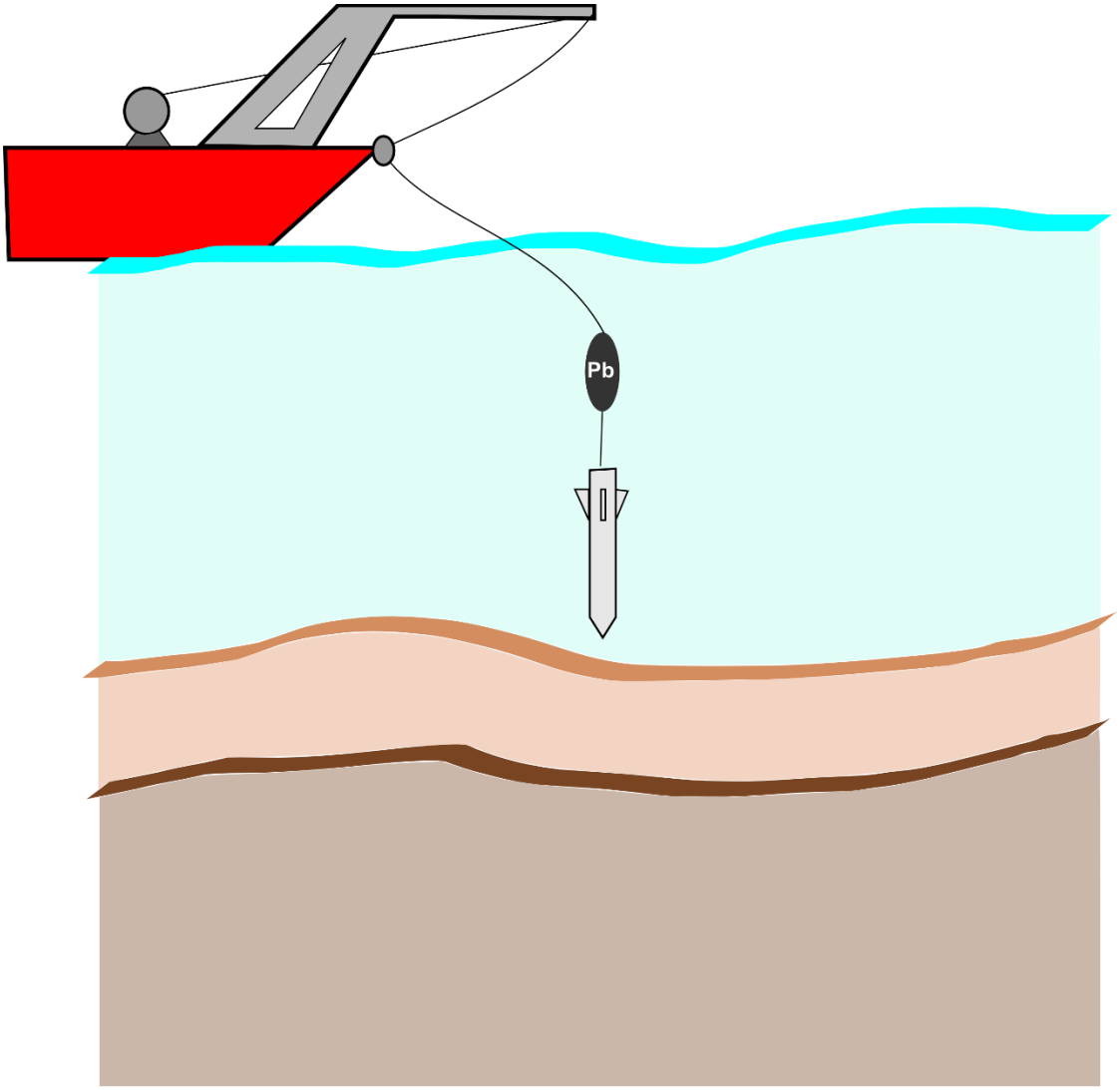
Figure 1: Release method

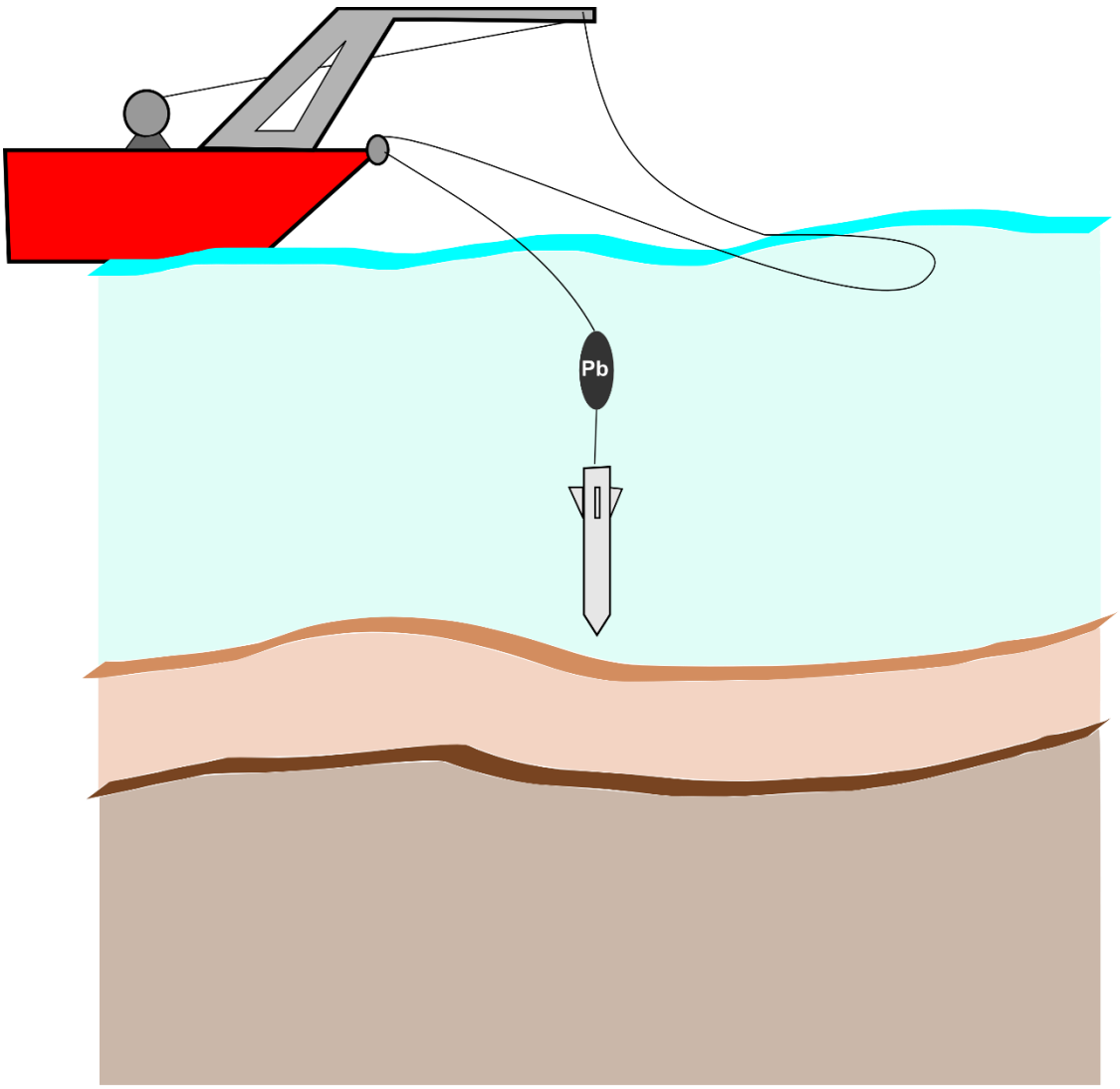
In this way, the GraviProbe can fall over a distance equal to 4 or 6 times the A-frame height. For example, at an A-frame height of 3 meters, with 2 loops we get 4x3 = 12 meters, and with 3 loops we get 6x3 = 18 meters of free fall.

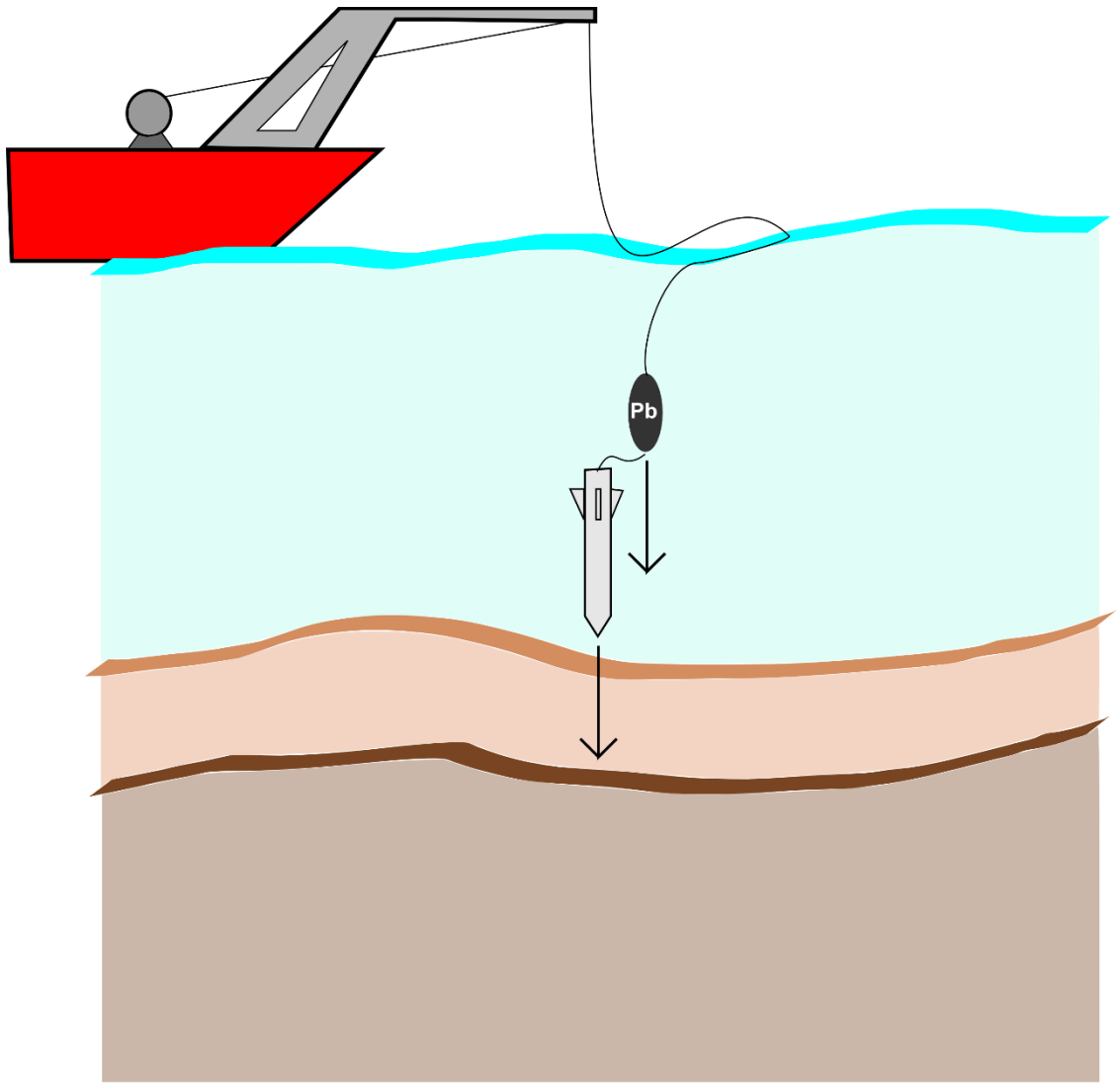
2. Covering rope resistance by a double weight

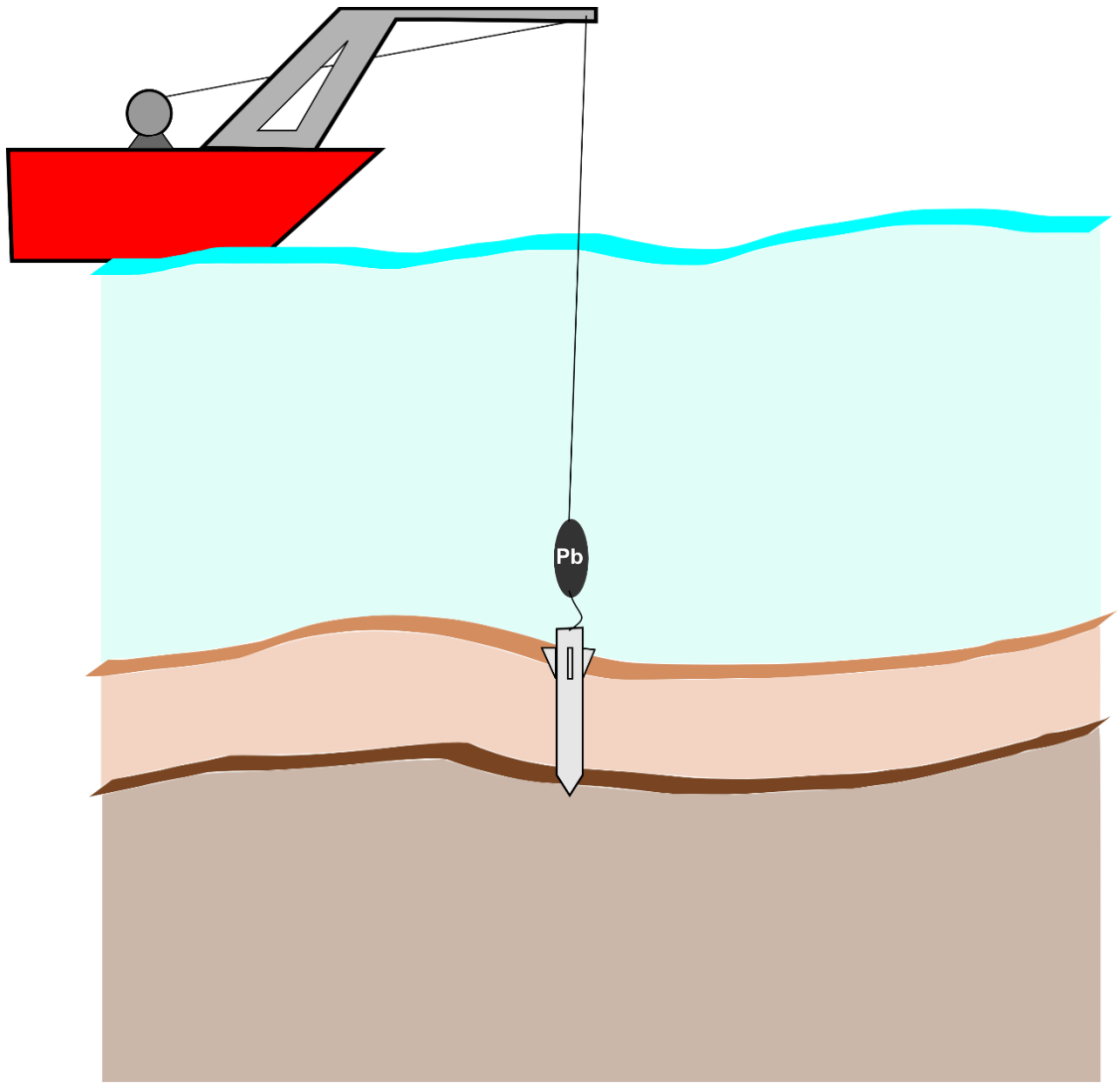
- Two free falling objects with different terminal velocity.
- Lead weight falls at higher velocity then the GraviProbe.
- The lead weight is taking all resistance of the rope on deck and the friction of the water along the rope.




Pb


Pb


Pb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