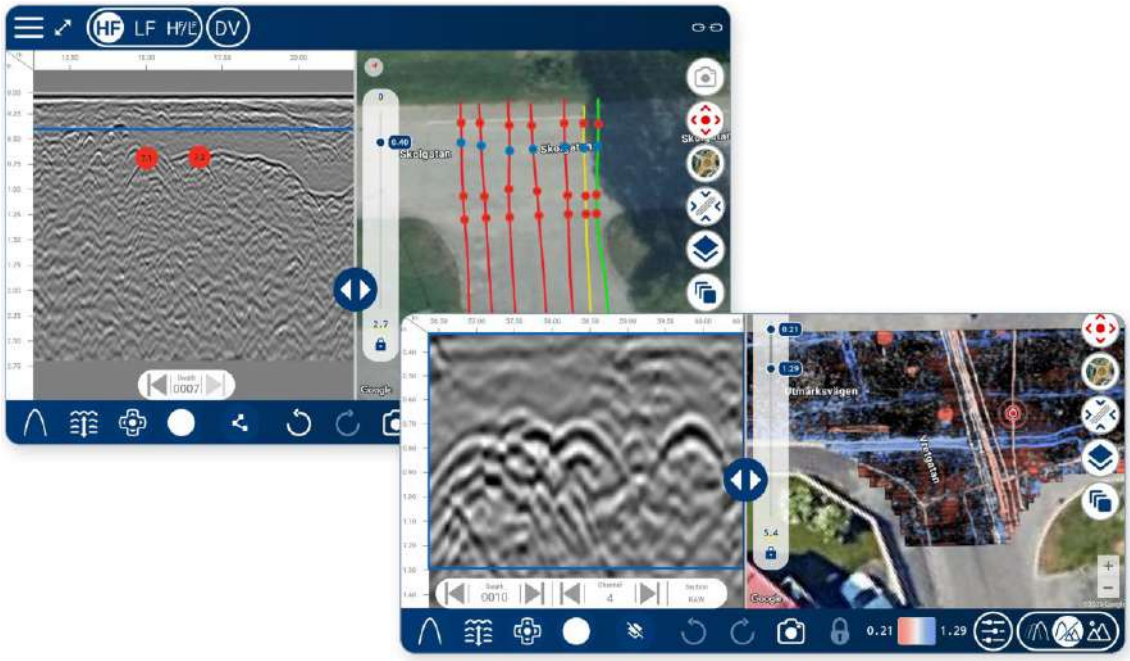
ViewPoint2

User Manual

Data acquisition and interpretation for PinPointR, CrossOver, Raptor-45 and PinPointR 3D



PINPOINTR · CROSSOVER · RAPTOR-45 PUSH CART · PINPOINTR 3D

Document information

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About This Manual

ViewPoint2 is the next generation of ViewPoint, ImpulseRadar's Android application for GPR data acquisition. It has been rebuilt from the ground up to control data acquisition with ImpulseRadar's ground penetrating radar (GPR) systems: the PinPointR and CrossOver dual-channel systems, and the Raptor-45 (450 MHz, 8-channel) and PinPointR 3D array systems. Its user-friendly interface and seamless integration with ImpulseRadar GPR systems make it easy to set up and control the system, and to perform basic data interpretation on the fly in the field.

> **NOTE** ViewPoint2 supports the Raptor-45 in its push-cart version only. Other ImpulseRadar products, and a version for iOS, will follow in future releases.

ViewPoint2 keeps the familiar ViewPoint workflow and adds a range of new capabilities. For the first time, arrays that previously needed Talon can be controlled from the same Android app as PinPointR and CrossOver.

The main upgrades from ViewPoint

- **One application for 2D and 3D systems:** collect data with ImpulseRadar's dual-channel systems and array systems from the same app, on the same Device.
- **Map imports:** add your own background layers to the map, such as ESRI shapefiles, KML files, GeoTIFF images and georeferenced PNG images.
- **Interpolated maps from 2D data:** with PinPointR and CrossOver systems, ViewPoint2 can fill the gaps between survey lines to create one continuous map of the surveyed area.
- **Map interpretation:** besides markers, draw utilities on the map, point by point on the top view or along the tops of hyperbolas on the radargram, and outline areas, measure distances and leave comments with photos, all in the field.
- **Robotic total stations:** record with a robotic total station on the GPR unit's serial port or over Bluetooth, and see the survey on a map in the instrument's own X and Y.
- **New interpretation exports:** besides the PDF Field Report and KMZ for Google Earth, DXF drawings, ESRI shapefiles, CSV tables, GeoTIFF images and georeferenced PNG images.

For information on other applications or configurations, please contact your local ImpulseRadar (IPR) representative, or our sales team at sales@impulseradar.com.

How this manual is organised

Chapters 1 to 11 cover the software, data acquisition and control. The appendices give the specifications, the file formats, and help with problems and messages.

Sections that apply to only one type of system are marked with a coloured tag:

PINPOINTR AND CROSSOVER RAPTOR-45 AND PINPOINTR 3D

References such as **section 2.2** or **Figure 4** are links: click one to jump there (in Word, hold down Ctrl while you click).

We welcome your feedback concerning this manual and its content. Please send your comments or suggestions to us at support@impulseradar.com.

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1 Software Overview

ViewPoint2 runs on a suitable Android tablet or smartphone (the “Device”), from which you set up and control your ImpulseRadar GPR system.



Figure 1 The GPR systems supported by ViewPoint2

PINPOINTR AND CROSSOVER

PinPointR and CrossOver systems are normally set up and controlled wirelessly over Wi-Fi. A CrossOver can also be connected with an Ethernet cable; a PinPointR needs a small Ethernet kit from ImpulseRadar for this. We recommend an Android tablet with a screen large enough to see and mark targets comfortably.

RAPTOR-45 AND PINPOINTR 3D

Raptor-45 and PinPointR 3D array systems connect to the Device only with an Ethernet cable, using a USB-C-to-Ethernet adapter, so the Device needs a USB-C port that supports such an adapter. Arrays collect several channels of data at the same time, so a Device with a large screen is highly recommended. While the array is connected, the Device cannot use the internet over Wi-Fi. Unless the Device has a SIM card with mobile data, load the map of your survey area before you connect (see **section 2.2.2**).

NOTE Unless a section is marked with a coloured tag for one type of system, the information in this manual applies to all systems supported by ViewPoint2, even where only one system, such as PinPointR, is named.

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Positioning your data

ViewPoint2 records where each trace was measured, so that your profiles appear on the map and in your reports. You choose the source on the Settings page (see **section 4.2.3**):

- **GPS:** the GPR unit's internal GPS (**Internal GPS**), or a GNSS receiver of your own, such as an RTK receiver (**External GPS**), connected to the unit's serial port, paired with the Device over Bluetooth, or passing its positions to Android through its own app. The survey is drawn on a map of the earth.
- **Total Station:** a robotic total station on the unit's serial port or over Bluetooth. The survey is drawn in the instrument's own X and Y (see **chapter 9**).
- **Reference Line:** no GPS; you walk parallel profiles across a straight line on the ground (see **chapter 8**).

1.1 Choosing a Device

ViewPoint2 needs **Android 10 or later**. A Device that meets or exceeds the specification in **Appendix A** will generally give better performance, both in data collection and on screen. Our recommended Device is the **Samsung Galaxy Tab Active5 Pro**, a rugged tablet with a screen large enough to see and mark targets comfortably. A smartphone can also be used, for example as a back-up, but it is not recommended: on a small screen it is harder to see and mark targets, and performance may suffer if the phone does not meet the specification.

Android devices are less standardized than PCs, so the way software is installed and operated can vary from one Device to another. You may therefore notice small differences between your Device and the descriptions in this manual. If you need clarification or further support, please contact our headquarters or your local ImpulseRadar reseller, or email us at support@impulseradar.com.

> **NOTE** The screenshots in this manual were taken on Samsung Galaxy tablets and on an Android smartphone. Menus may look slightly different on your Device, and later versions of ViewPoint2 may look slightly different from the pictures in this manual.

1.2 Coming from ViewPoint? What Has Changed

ViewPoint2 is a completely new application, but it keeps the familiar ViewPoint way of working, so you will quickly feel at home. These are the main changes to look out for:

In ViewPoint	In ViewPoint2
Two separate apps	ViewPoint and ViewPoint2 can be installed on the same Device, but do not run both at the same time (see **section 2.1**).
Non-Save mode	**Discovery mode** on the start screen. It works the same way: profiles are shown but not kept as a project.
Multi-line project	Create a normal project and choose **'Reference Line'** as the positioning source. Nothing is lost; the workflow is simply part of project creation.
Total station on the GPR unit's serial port	On the GPR unit's serial port or over Bluetooth, with the survey drawn on a map in the instrument's own X and Y (see **chapter 9**).

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In ViewPoint	In ViewPoint2
Antenna Settings and User Preferences	One **Settings** page. The GPR unit's settings appear on it when a GPR system is connected.
Saving settings in the GPR unit	Tap **'Save unit settings'** on the Settings page. A project always keeps the settings it was created with.
Connect button	The **chain icon** at the right of the top bar shows the connection and lets you connect again (see **section 2.2.3**).
Pop-up warnings	**Coloured banners** below the top bar, made to be read in sunlight: red to stop and act, yellow for something worth knowing, green when a problem is solved (see **section 3.3**).
File Explorer	The **Project Library**: your projects on the left, and the selected project's details, reports and sharing options on the right.
Project files in the ViewPoint folder	A new folder: Internal storage › Android › data › com.impulseradar.viewpoint2 › files › Viewpoint II › Projects.

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2 Installing and Connecting ViewPoint2

This chapter explains how to install ViewPoint2 on your Device and how to connect it to your GPR system.

2.1 Installing ViewPoint2

You can install ViewPoint2 from the Google Play Store or from our website.

Scan to open ViewPoint2 in the Google Play Store. Point the Device's camera at the code and tap the link that appears.

CAUTION ViewPoint and ViewPoint2 can be installed on the same Device, but never run both at the same time. Before you open ViewPoint2, close ViewPoint completely: open the list of recent apps and swipe ViewPoint away.

2.1.1 From the Google Play Store

1. Open the Play Store app on your Device.
2. Search for 'ViewPoint2'. It appears among the first few results.
3. Tap 'Install'. When the installation is finished, the ViewPoint2 icon appears on your Device's home screen.

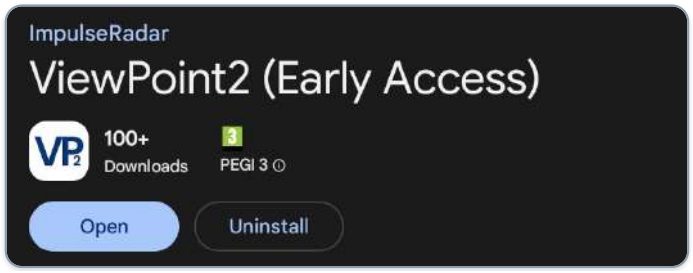


Figure 2 ViewPoint2 in the Google Play Store. Here it is already installed; before that, the button reads 'Install'

2.1.2 From Our Website

1. On your Device, download the latest version from the Resource area of our website (https://impulseradargpr.com/software/). The file name starts with 'VP' followed by the version number, for example 'VP2.0.2.apk'.
2. Open the downloaded file. You will find it in the 'Downloads' folder, using a file manager app such as 'My Files' or 'Files'.
3. Android may warn that it does not install apps from unknown sources. Tap 'Settings', allow installs from this source, then go back and tap 'Install'.

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2.1.3 Starting ViewPoint2 for the First Time

When you open ViewPoint2 for the first time, Android asks you to allow it to use some functions of the Device (**Figure 3** shows two of the questions):

- **Location:** required. Choose **Precise** and **While using the app**. ViewPoint2 uses the Device's position to show where you are on the map, and to centre the map when the GPR unit has no GPS position. With **Approximate**, ViewPoint2 cannot work and asks again.
- **Photos and videos:** required. Tap **Allow all**.
- **Nearby devices (Bluetooth):** asked at the first start on Android 12 and newer, together with Location. It is only needed for a GNSS receiver or a total station connected over Bluetooth, and ViewPoint2 works without it. We recommend allowing it: if you refuse, Android may ask again when ViewPoint2 next starts, and the Bluetooth connection cannot be chosen until you allow Nearby devices in the Device's settings.

If a required permission is missing, ViewPoint2 shows the message 'Missing required permissions'. Tap 'Allow required permissions' and allow them. If you have previously chosen not to be asked again, the button reads 'Open settings to update permissions'. Tap it and allow the permissions in the Device's settings.



Figure 3 Two first-start questions: Location (left) and Photos and videos (right)

2.1.4 Updating ViewPoint2

- If you installed ViewPoint2 from the Play Store, it is updated through the Play Store like any other app.
- If you installed ViewPoint2 from our website, download and install the new version in the same way. It replaces the old version and keeps your projects.

CAUTION Never uninstall ViewPoint2 to update it. Uninstalling also deletes all the projects stored on the Device. If you must uninstall ViewPoint2, first save your projects elsewhere (see **section 11.6**).

NOTE Installing or updating ViewPoint2 does not change the settings stored in your GPR unit. To return a unit to its factory settings, tap 'Reset unit to factory settings' on the 'Settings' page.

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2.2 Connecting to Your GPR System

How you connect depends on your GPR system. PinPointR and CrossOver systems normally connect over Wi-Fi. A CrossOver can also use an Ethernet cable, and so can a PinPointR with ImpulseRadar's Ethernet kit (see **section 2.2.2**). Raptor-45 and PinPointR 3D arrays connect only with an Ethernet cable. Once the Device is on the GPR system's Wi-Fi network, or connected by cable, ViewPoint2 finds the GPR unit and connects to it automatically. **Section 2.2.3** explains how to check that the connection is working.

Connection	Used by	What you need
Wi-Fi	PinPointR and CrossOver	An Android Device with Wi-Fi.
Ethernet cable	CrossOver, and PinPointR with the Ethernet kit; the only option for Raptor-45 and PinPointR 3D	An Ethernet cable and a USB-C-to-Ethernet adapter. The Device needs a USB-C port that supports such an adapter.

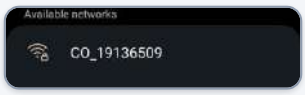
2.2.1 Connecting over Wi-Fi

PINPOINTR AND CROSSOVER

The GPR unit has its own Wi-Fi network. You connect the Device to it in the Device's Wi-Fi settings, just as you would connect to a Wi-Fi network at home or in the office.



STEP 1
Switch on the PinPointR or CrossOver system by pressing the ON/OFF button.



STEP 2
On your Device, open the Wi-Fi settings and look for the GPR unit's network in the list of available networks. Its name contains the unit's serial number, for example 'CO_19136509'.



STEP 3
Tap the network and enter the password **impulseradar** (all in lower case). Tap 'Connect'.

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STEP 4

Android may warn that the network has no internet access. This is normal, because the GPR unit is not connected to the internet. If you are asked whether to stay connected, choose to stay connected and, if offered, not to be asked again.



STEP 5

Open ViewPoint2. It finds the GPR unit and connects automatically. When it is connected, the battery icon appears in the top bar. Tap it to see the unit's details (see **section 2.2.3**).

TIP The Device remembers the GPR unit's network. The next time the unit is switched on and within range, the Device joins it automatically.

2.2.2 Connecting with an Ethernet Cable

PINPOINTR AND CROSSOVER

Most PinPointR and CrossOver users connect over Wi-Fi, but you can also use an Ethernet cable. A CrossOver can be connected by cable as it is. **A PinPointR needs a small Ethernet kit, available from ImpulseRadar**; without it, a PinPointR connects over Wi-Fi only. Connect the GPR unit to the Device's USB-C port with an Ethernet cable and a USB-C-to-Ethernet adapter, then open ViewPoint2. The Device's Ethernet connection can stay on its automatic setting (DHCP); no other settings are needed. ViewPoint2 detects the cable and connects to the unit automatically. While a cable is connected, ViewPoint2 uses the cable instead of Wi-Fi.

RAPTOR-45 AND PINPOINTR 3D

Arrays cannot connect over Wi-Fi. The array's antennas talk to ViewPoint2 over an Ethernet cable, and for this to work, the Device's Ethernet connection needs a fixed (static) IP address. You only have to set this up once on each Device.

Setting up the Device (first time only)

1. Plug the USB-C-to-Ethernet adapter into the Device's USB-C port, and connect the Ethernet cable from the array to the adapter.
2. Open the Device's Ethernet settings. Where you find them, and how they look, depends on your Device and Android version. An example is shown in **Figure 4**.
3. Select 'Static IP' and enter **IP address 10.10.255.252** and **Netmask 255.255.0.0**.
4. Tap 'Save'.

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Connecting to the array

1. Switch on the array and wait about 30 seconds for it to start. (On a Raptor-45, the antennas under the hood show flashing lights when they are ready. The PinPointR 3D is closed, so there are no lights to see.)
2. Make sure the Ethernet cable is connected to the Device, then open ViewPoint2. ViewPoint2 finds the array and connects automatically. While connecting, it detects each antenna and works out the order of the antennas in the array. This takes a few seconds, and you can follow it in the Connection Status panel (see **section 2.2.3**).
3. If ViewPoint2 does not connect, close ViewPoint2 and open it again.



Figure 4 Ethernet settings with a static IP address



Figure 5 The Unit information panel of a connected Raptor-45

TIP While the array is connected by cable, the Device cannot use the internet over Wi-Fi, so the map cannot download background images that way. There are two solutions: use a Device with a SIM card, so that ViewPoint2 uses its mobile data for the map and nothing needs to be stored in advance; or, before you plug in the cable, connect the Device to Wi-Fi with internet access, open the map over your survey area and zoom in as far as you will need in the field. ViewPoint2 stores (caches) the map images it has shown, at the zoom levels you viewed, and they remain visible during the survey.

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2.2.3 Checking the Connection

The icon at the right-hand end of the top bar shows whether ViewPoint2 is connected to your GPR unit:

Top bar	What it means
	**Not connected.** Tap the icon to try connecting again and to open the Connection Status panel.
	**Connecting.** ViewPoint2 is connecting to the unit. Tap the icon to open the Connection Status panel and follow the progress.
	**Connected.** The chain icon disappears, and the GPS and battery icons appear in its place. The GPS icon may be red at first. This is normal: either no GPS has been chosen yet, or no satellites can be seen, for example indoors. Choose the internal or external GPS on the Settings page (see **section 4.2.3**).

Battery icon

The battery icon shows how much charge is left in the GPR unit's battery. It is filled as far as the battery is charged, and its colour runs from green when the battery is full, through yellow at half, to red when it is nearly empty. At 0 % the unit switches itself off. Until the unit has reported its battery, the icon is a faint outline. Tap it to open the 'Unit information' panel with the unit's details.

Battery icon	Charge
	**Green:** well charged.
	**Yellow:** about half charged.
	**Red:** low. Charge or replace the battery soon.

- For PinPointR and CrossOver, the 'Unit information' panel shows a **Battery** card, with the charge in per cent and a bar, and a card with the unit name, its serial number and its MCU and FPGA firmware versions (see step 5 in **section 2.2.1**).
- For Raptor-45 and PinPointR 3D, it shows the **Battery** card and a card with the unit name and the number of receivers, which lists the serial number and the MCU and FPGA firmware versions of each receiver (see **Figure 5**).

Connection Status panel

The Connection Status panel lists each step of the connection as it happens: 'Searching For Unit', 'Unit Found', 'Unit Available', 'Connecting To Unit', 'Getting Version Info' and finally 'Connected'. An array is connected one receiver at a time, so for an array you see each step repeated with a counter, for example 'Connecting To Unit 2 of 4' (**Figure 6**).

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If the connection stops at ‘Searching For Unit’, check that the GPR unit is switched on and that the Device is on the unit’s Wi-Fi network or connected by cable.



Figure 6 Connection Status: searching (left) and connecting to the four receivers of a Raptor-45 (right)

2.3 Keeping a Stable Wi-Fi Connection

PINPOINTR AND CROSSOVER

The GPR unit’s built-in Wi-Fi works like a small Wi-Fi router that your Device connects to. Its network name (also called SSID) includes the unit’s serial number, so you can tell it apart from other networks (**Figure 7**).



Figure 7 The GPR unit’s network in the Device’s Wi-Fi list

After a Device has connected to a GPR unit once, ‘Auto reconnect’ is switched on for that network. The Device then joins the GPR unit automatically whenever the unit is within range. This stays in place until you switch ‘Auto reconnect’ off, or tell the Device to ‘Forget’ the network.

‘Auto reconnect’ is also switched on for every other Wi-Fi network the Device has used before. Unless you work in a remote area, some of these networks may be within range, and the Device may leave the GPR unit’s network to join one of them. To prevent this, switch off ‘Auto reconnect’ for all saved networks other than your GPR unit:

1. Open the Device’s ‘Settings’ and go to ‘Wi-Fi’.
2. Open the list of saved networks (‘Manage networks’ on Samsung Devices, see **Figure 8**).
3. Tap each network that is not your GPR unit and switch off ‘Auto reconnect’ (see **Figure 9**).

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Figure 8 Saved Wi-Fi networks ('Manage networks')



Figure 9 A saved network: 'Auto reconnect' and 'Forget'

2.4 If the Connection Is Lost

ViewPoint2 checks the connection to the GPR unit every second. If it hears nothing from the unit for **12 seconds when you are not recording**, or, with a Raptor-45 or PinPointR 3D, for **6 seconds while you are recording**, for example because the Wi-Fi drops or the Ethernet cable comes loose, it decides that the connection is lost. It then stops any recording, shows the red banner 'Connection lost' and keeps trying to reconnect, every few seconds, for as long as it takes. A PinPointR or CrossOver recording is never stopped this way (see below). As soon as the unit answers again, ViewPoint2 connects to it automatically and shows the green banner 'Connected again', which closes by itself after 5 seconds. Reconnecting takes a few seconds; with an array it takes a little longer, because each receiver is connected in turn:

Banner	What it means
Connection lost Not recording. Reconnecting to the unit.	**The connection is lost.** Nothing is being recorded, and ViewPoint2 is trying to reconnect. Check the Wi-Fi or the cable. You can close the banner with its cross; it comes back if the connection is lost again.
Connected again The unit is connected again.	**The unit is back.** You can continue your work.

ViewPoint2 does not stop the Device from joining other Wi-Fi networks. If the Wi-Fi connection to the GPR unit drops and a saved network with 'Auto reconnect' switched on is nearby, the Device may join that network instead, and ViewPoint2 cannot reach the GPR unit. In that case, connect the Device to the GPR unit's network again in the Wi-Fi settings. This is why it is important to switch off 'Auto reconnect' for other saved networks (see **section 2.3**).

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PINPOINTR AND CROSSOVER

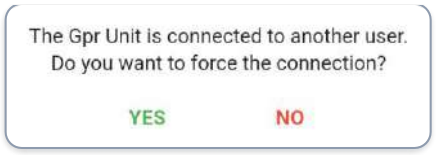
A PinPointR or CrossOver keeps recording when the Wi-Fi link drops. While a profile is being recorded or paused, ViewPoint2 does not end it because the GPR unit has gone quiet, and the traces that did not reach the Device meanwhile are fetched from the GPR unit when you tap **Stop** (see **section 5.3**).

Banner	What it means
	**The Device has left the GPR unit's Wi-Fi** during a profile, at the time shown, and the unit records on. Bring the Device back within range, or choose the unit's network again in the Wi-Fi settings. The banner closes by itself when the Device is back.

Off the unit's Wi-Fi, nothing you tap reaches the GPR unit. **Pause** and **Resume** are refused, and a **Stop** ends the profile on the Device only: the traces missed meanwhile are not fetched, and the GPR unit records on until the next **Play**. So wait until the Device is back on the unit's Wi-Fi and the banner has closed, push the GPR system on for a few metres, so that ViewPoint2 can find the missed traces from the ones that follow them, and then tap **Stop**.

2.5 Using More Than One Device

You may have more than one Device with you during a survey, and more than one Device may be set up to collect data from the same GPR unit. However, only one Device can be connected to a GPR unit at a time.

Message	What to do
	Another Device is already connected to the GPR unit. Tap **YES** to take over the unit, for example when you want to change Devices; the other Device then loses its connection. Tap **NO** to leave the unit with the other Device.
'The Gpr Unit is measuring for another user. Impossible to connect.'	The GPR unit is in the middle of a measurement for another Device. Wait until that measurement is stopped.

If two Devices keep taking the GPR unit over from each other, the connection becomes unstable and the data will have many missed traces. Switch off Wi-Fi on any Device you are not using.

2.6 Using More Than One GPR Unit

If you have more than one GPR unit, we recommend that you use one main Device for each unit, to avoid the problems described above. On each Device, switch off 'Auto reconnect' for the Wi-Fi networks of the other GPR units.

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2.7 Wi-Fi Checklist

PINPOINTR AND CROSSOVER

Before you start measuring:

- ☐ It is recommended to use one main Android Device for each GPR unit.
- ☐ Switch off ‘Auto reconnect’ for all saved Wi-Fi networks except the network of the GPR unit you are using.
- ☐ If you have another Device with you while measuring, for example a smartphone in your pocket, switch off its Wi-Fi, and do the same for any other Devices nearby.

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3 Getting Started: The Start Screen

To open ViewPoint2, tap the ViewPoint2 icon on your Device's home screen. ViewPoint2 opens on its start screen, which gives you access to all the main functions. This chapter explains what is on the start screen, how to move around ViewPoint2, and how to use Discovery mode for a quick look at a site.

3.1 The Start Screen

The numbers in **Figure 10** are explained in the table below the figure.

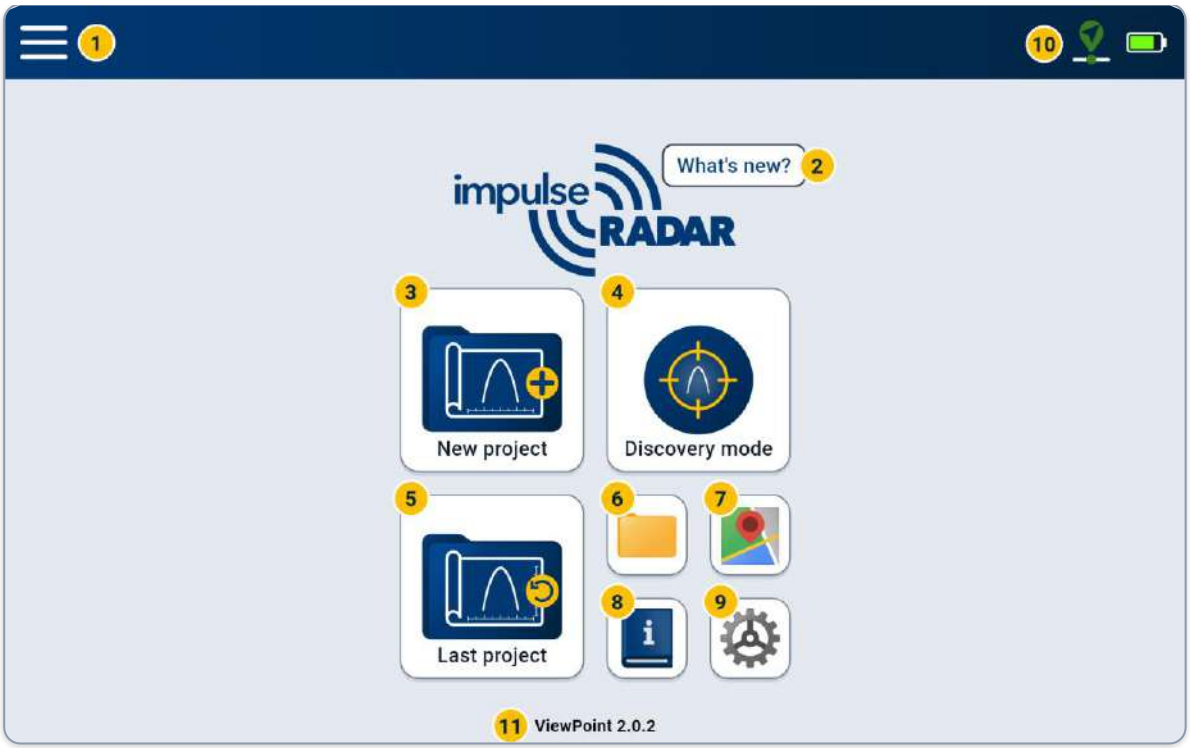


Figure 10 The start screen of ViewPoint2, with a GPR unit connected

	Item	What it does
1	**Menu**	Opens the side menu, which takes you to any page of ViewPoint2 (see **section 3.2**).
2	**What's new?**	Opens a window that offers the video tutorials (**Watch on YouTube**, needs internet) and the user manual (**Read** it on the Device, no internet needed, or **Share a copy** by email, Drive or another app).
3	**New project**	Starts a new project. You give the project a name and check its settings before you start measuring.
4	**Discovery mode**	Opens the project screen straight away, without creating a project, ready to record when you tap Play. Use it for a quick look at a site (see **section 3.4**).

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	Item	What it does
5	**Last project**	Opens the project you worked on most recently, ready to continue.
6	**Project Library**	Lists all your projects. Here you can see a project's details, create and share reports, and zip or share whole projects.
7	**Map**	Shows your position and all your projects on the map. Opening the map over an area while you have internet access also stores the map images, so they are available later without internet.
8	**About**	Shows the ViewPoint2 version and lets you check for updates and contact support (see **section 3.5**).
9	**Settings**	Opens the Settings page: the settings of the connected GPR unit, and your ViewPoint2 preferences.
10	**Status icons**	Show whether a GPR unit is connected, its battery level and the GPS status (see **section 2.2.3**).
11	**Version**	The version of ViewPoint2. Please mention it whenever you contact support.

When tiles are greyed out



Figure 11 Greyed-out tiles

New project and **Discovery mode** are greyed out until a GPR unit is connected (see **section 2.2**).

Last project, the **Project Library**, the **Map**, **About** and **Settings** work without a GPR unit, so you can review your projects and prepare your settings anywhere. The **Map** is greyed out while the Device has no internet and no stored map; tap it to see what to do.

Last project is also greyed out until you have saved at least one project.

With a Raptor-45 that uses External GPS, **New project**, **Discovery mode** and **Last project** also stay greyed out after the array has connected, until the radar has GPS time sync. This usually takes a few minutes (see 'GPS time sync' in **section 4.2.3**). Tap one of them to see why (**Figure 28**).

TIP If the Device has no internet access and no stored map of your area, ViewPoint2 shows the message 'Map Unavailable' when you start or open a GPS project. Tap **'Open anyway'** to continue: you can still measure, and markers and interpretations work as normal; only the Google satellite picture is missing. The profile tracks, the top view and everything else are still shown, on a plain background. Tap **'Go Back'** if you would rather store the map first. Reference Line and Total Station projects have no background map, so the message is not shown for them.

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3.2 Finding Your Way Around: The Side Menu

Tap the menu icon at the top left of the screen to open the side menu (**Figure 12**).

The menu is available on every page, so you can always get back to the start screen, your projects or the settings in two taps. Tap anywhere outside the menu to close it.

The table below explains each item. **Reports** appears in the menu only when a saved project is open.



Figure 12 The side menu

	Menu item	What it does
	Project name	Takes you back to the open project. Shows 'No Project' when no project is open. In Discovery mode, it lets you save the data as a project (see **section 3.4**).
	Home	Returns to the start screen.
	Settings	Opens the Settings page.
	Library	Opens the Project Library.
	Map	Opens the map with all your projects.
	Info	Opens the About page (see **section 3.5**).
	Reports	Creates reports for the open project. It appears only inside a saved project, and not while you are recording.

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3.3 Messages on the Screen

ViewPoint2 tells you what is happening with coloured banners across the screen, just below the top bar. They are made to be read in bright sunlight, and each colour has its own symbol, so you can tell them apart at a glance (**Figure 13**).

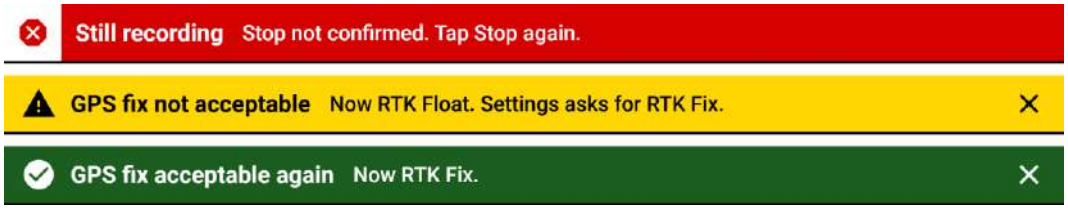


Figure 13 The three kinds of banner: red, yellow and green

	Banner	What it means
	Red: stop and act	Something needs your attention now, for example the connection to the GPR unit is lost. A red banner stays until the problem is solved. Some can be closed with their cross.
	Yellow: worth knowing	Keep working. For example, your GPS fix is below the fix you asked for. A yellow banner closes by itself after 5 seconds, or when you tap its cross.
	Green: solved	It follows a red or yellow banner when the problem is over, for example 'Connected again'. It closes by itself after 5 seconds, or when you tap its cross.
42%	**Blue: working**	The progress of a longer task, such as PROCESS or importing a map layer, in per cent.

Each banner has a short title in bold, then what has happened or what to do. When there are several, they are shown one under the other, red ones first. Appendix C lists the messages you are most likely to see, with what to do (see **section C.2**).

3.4 Discovery Mode: A Quick Look

Discovery mode is the quickest way to check a site or test your GPR system. Tap **Discovery mode** on the start screen, and ViewPoint2 opens the project screen straight away with the current settings, ready to record: tap **Play**. You do not need to name a project first. Discovery mode replaces 'Non-Save mode' in ViewPoint.

- Each time you start Discovery mode, the previous Discovery data is replaced. It starts with the display settings of a new project and the soil velocity set in Settings.
- Discovery data does not appear under **Last project** or on the map, and you cannot create reports from it or share it.

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Keeping Discovery data as a project

If you find something worth keeping, you can turn the Discovery data into a normal project at any time:

1. Open the side menu and tap the project item at the top.
2. ViewPoint2 asks 'Convert discovery data to a project?'. Enter a project name.
3. Tap **YES**. The data is saved as a project under that name and stays open, so you can carry on working. If you are recording, the recording is stopped first.

> **CAUTION** Starting Discovery mode again deletes the previous Discovery data. Save it as a project first if you want to keep it.

3.5 The About Page

Tap **About** on the start screen, or **Info** in the side menu, to open the About page. It shows:

- **Version** and **Release Date** of your ViewPoint2.
- The **support email address**. Tapping it opens an email to our support team with your ViewPoint2 version already filled in.
- **Check for updates**: opens ViewPoint2 in the Google Play Store, where you can install the latest version.
- **Send logs to support**: sends ViewPoint2's log files to our support team. Whenever you report a problem with the app or the GPR unit, please send the logs as well: they help us find the cause much sooner.
- Buttons that open our Instagram, LinkedIn and YouTube pages, and one that writes an email to info@impulseradargpr.com.



Figure 14 The About page

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4 Settings

The Settings page holds the settings of your GPR unit and your ViewPoint2 preferences. Open it with **Settings** on the start screen or in the side menu.

4.1 The Settings Page

The Settings page has two columns (**Figure 15**):

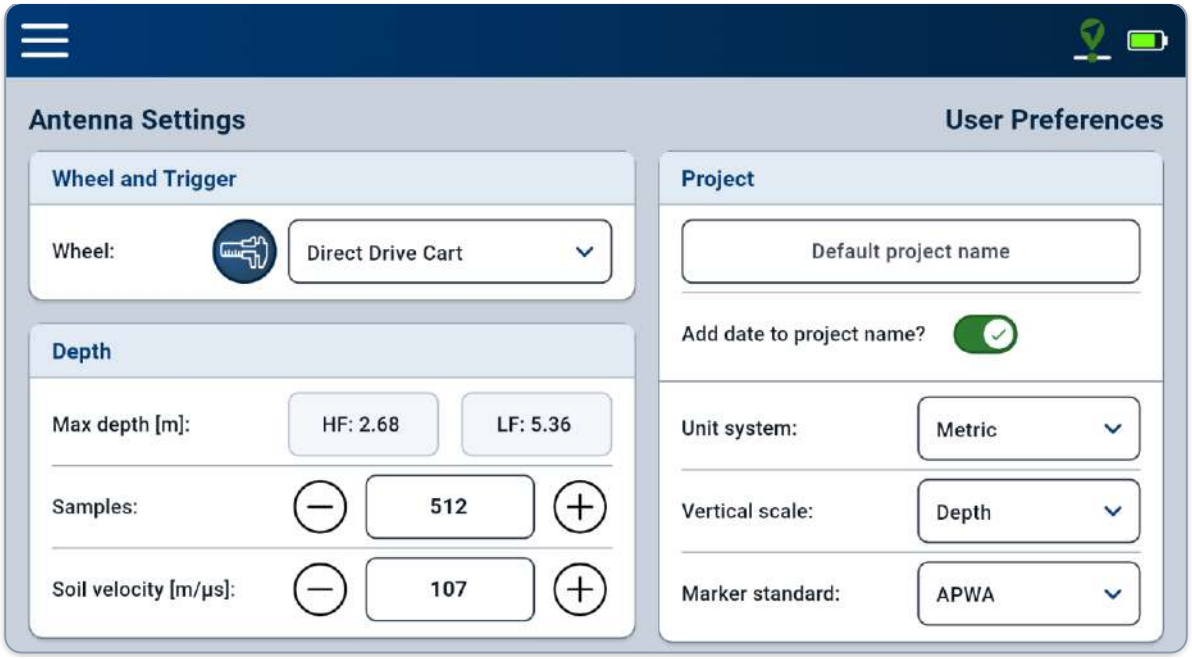


Figure 15 The Settings page with a PinPointR connected

Column	What it contains
Antenna Settings	The settings of the connected GPR unit: wheel, depth, positioning and, for arrays, zero levels. They are greyed out until a GPR unit is connected. While a project is open, a change to a recording setting is kept for your next new project (see the note below).
User Preferences	Your ViewPoint2 preferences: project names, units, map, Field Summary report, and the Settings Control buttons. They are available at any time and are saved when you leave the page.

Each column scrolls on its own: swipe up and down on the column you want to see.

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NOTE A project always keeps the settings it was created with: samples, data mode, trigger, interval, wheel, profile spacing, zero levels and marker standard. Once you have opened or created a project, ViewPoint2 keeps it ready until you open or create another, also while you are on the start screen. A change to one of these settings made meanwhile is kept for your next new project and for Discovery mode, and the open project goes on recording with its own. The soil velocity and the display settings apply to the open project straight away, and the GPS pole height from its next profile. When you open a project, ViewPoint2 puts the project's own settings on the GPR unit before you record.

NOTE Before you open a project, changes to the antenna settings are sent to the GPR unit straight away, but the GPR unit forgets them when it is switched off. To keep them as the unit's defaults, tap **Save unit settings** (see **section 4.4**).

Some settings are shown only when **Advanced configuration** is switched on (see **section 4.4**). In this chapter they are marked with a grey ADVANCED label.

4.2 Antenna Settings

This section describes each card in the Antenna Settings column, from top to bottom.

4.2.1 Wheel and Trigger

The wheel (odometer) measures the distance you travel, so that ViewPoint2 can record a trace at a fixed interval along the profile. Choose the wheel or cart you are using from the **Wheel** list.

Wheel The wheel or cart in use. Each wheel has a calibration, the number of wheel ticks per metre.

Wheel icon Opens 'Edit wheel', where you can rename and calibrate the selected wheel (see below).



Figure 16 The Wheel and Trigger card

ADVANCED CONFIGURATION ONLY

Trigger **Wheel** records a trace every set distance; **Time** records traces at a fixed time interval, without a wheel.

Interval The distance between traces, 1–100 cm (wheel trigger), or the time between traces, 1–1000 ms (time trigger).

Measurement direction Leave it on **Automatic**, the default: the direction icon in the top bar then shows which way the wheel turns.



Figure 17 The Wheel and Trigger card with Advanced configuration on

With Advanced configuration switched off, ViewPoint2 always records with the wheel trigger, at the interval for your GPR system: 2 cm for PinPointR and CrossOver CO4080, 5 cm for CrossOver CO1760, 1 cm for CrossOver CO730, and 4 cm for Raptor-45 and PinPointR 3D.

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> **TIP** We recommend keeping the default trace interval, number of samples (time window) and data mode. They are chosen to suit nearly all soil conditions. A shorter trace interval or 32-bit data rarely improves the result noticeably; it mostly makes the files bigger.

Built-in wheels

GPR system	Built-in wheels	Wheels are stored
PinPointR	Belt Drive Cart, Direct Drive Cart	In the GPR unit (up to 8 wheels)
CrossOver CO1760, CO4080	Wheel 150 mm, Wheel 250 mm, Belt Drive Cart, Direct Drive Cart	In the GPR unit (up to 8 wheels)
CrossOver CO730	Wheel 250 mm, Wheel 150 mm	In the GPR unit (up to 8 wheels)
Raptor-45	Push Cart (3-Wheel), Push Cart (4-Wheel)	On the Device
PinPointR 3D	Direct Drive Cart	On the Device

Belt Drive Cart is only for a few very old units. To check yours, look at the rear right wheel: if a belt runs between the wheel and the wheel shaft, choose Belt Drive Cart; otherwise keep the default.

Adding or calibrating a wheel

You will rarely need this. The built-in wheels are calibrated at the factory, so we strongly recommend keeping the default. Calibrate a wheel only if distances no longer come out right, for example because the measuring wheel is badly worn.

To add a wheel of your own, open the **Wheel** list and choose **New Wheel** at the bottom.



Figure 18 The Wheel list, with 'New Wheel' last

1. To add a wheel, choose **New Wheel** in the Wheel list. To calibrate an existing wheel, select it and tap the wheel icon. The 'Add a new wheel' or 'Edit wheel' window opens.
2. Enter a **Name** for the wheel. Under **Calibration distance [m]**, enter the length of a straight line you have measured on the ground (10 m by default).
3. Place the wheel at the start of the line, tap **Start**, push the wheel exactly to the end of the line, and tap **Stop**. ViewPoint2 calculates the **Calibration [tick/meter]**. If you already know the calibration value, you can type it in instead.
4. Tap the green tick to save the wheel.

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To delete a wheel, open it with the wheel icon, unlock the three lock icons, then tap the bin, which turns red once they are unlocked. The last wheel cannot be deleted.

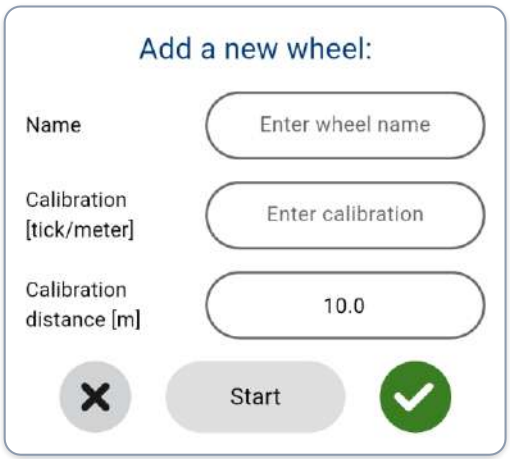


Figure 19 The 'Add a new wheel' window

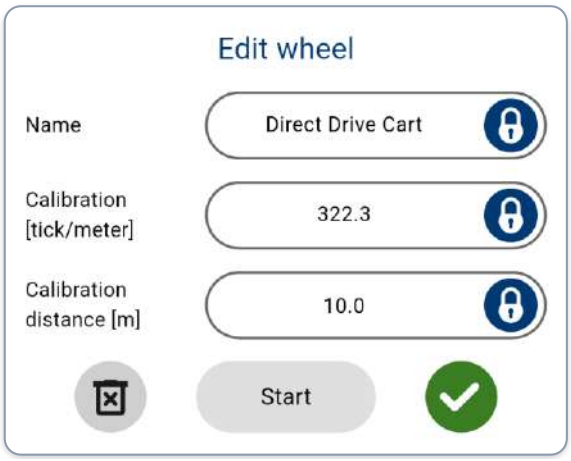


Figure 20 The 'Edit wheel' window, with the lock icons

4.2.2 Depth

Max depth [m] Read-only. The deepest depth ViewPoint2 can show with the current settings. PinPointR and CrossOver show one value for each frequency (HF and LF); arrays show one value.

Samples The number of samples in each trace: 80–1984 for PinPointR and CrossOver, 64–1984 for Raptor-45 and PinPointR 3D. More samples give a longer time window, so you see deeper, but each trace becomes larger.

Soil velocity [m/µs] The speed of the radar waves in the ground, 10–300 m/µs (100 by default). ViewPoint2 uses it to convert time to depth. It is not sent to the GPR unit, and you can change it later when you review the data. New projects and Discovery mode start with the value set here; with a project open, a change here also applies to that project.

Data mode [bit] ADVANCED 16 or 32 bits per sample. 32-bit data has a larger dynamic range but takes twice the storage space. For PinPointR, CrossOver CO4080, Raptor-45 and PinPointR 3D we strongly recommend the default 16-bit: 32-bit gives no better data, it only uses more storage.

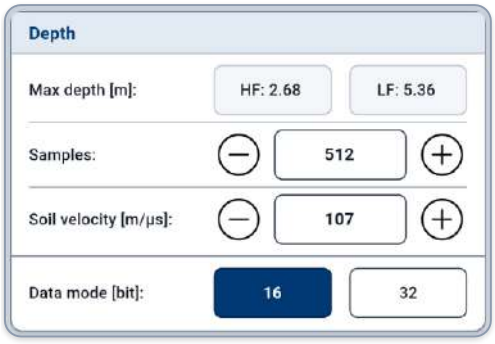


Figure 21 The Depth card

> **TIP** If you do not know the soil velocity, start with 100 m/µs and calibrate it on site with a target at a known depth or with the hyperbola tool (see **section 6.5**).

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4.2.3 Positioning

The Positioning card sets where ViewPoint2 gets the position of each trace from. Choose the **Source** first; the card then shows the settings for that source.

Internal GPS The GPS receiver built into the GPR unit. Accuracy from about 0.5 m to a few metres, depending on where you are and the time of day (how the satellites are spread across the sky).

External GPS A GNSS receiver of your own, for example an RTK receiver. Set **Connection** to how its positions reach ViewPoint2: **Cable**, **Bluetooth** or **App (mock location)** (see the table below).

Total Station A robotic total station, on the GPR unit's serial port (**Cable**) or paired with the Device over **Bluetooth** (see **chapter 9**).

Reference Line No GPS. You survey parallel lines from a reference line on the ground (see **chapter 8**).

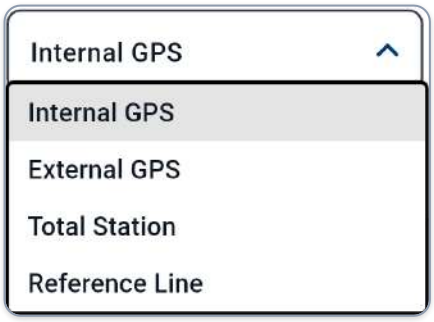


Figure 22 The positioning sources

Depending on the source, the card shows the following settings:

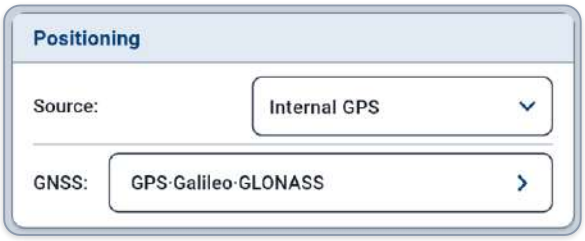


Figure 23 Internal GPS

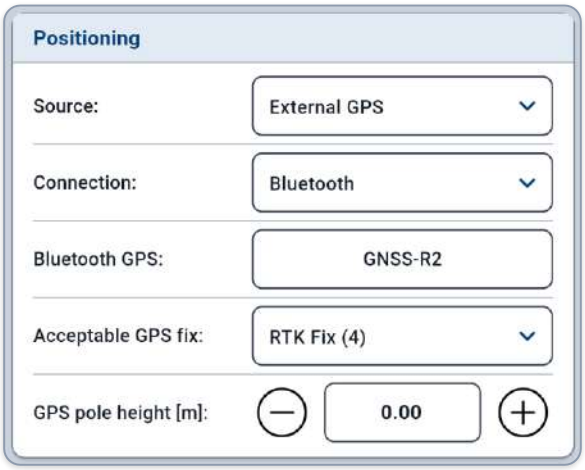


Figure 24 External GPS on Bluetooth

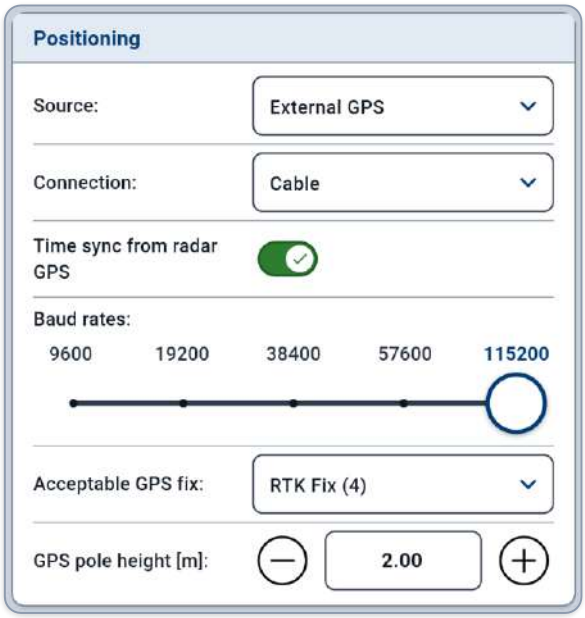


Figure 25 External GPS on Cable, with Advanced configuration on

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Setting	Shown for	What it does
GNSS	Internal GPS (PinPointR and CrossOver)	Shows which satellite systems the internal GPS uses. Tap the arrow to open 'GNSS Configuration' and choose the satellite systems (GPS, Galileo, GLONASS, BeiDou) and augmentation systems (QZSS, IMES, SBAS and the SBAS area). **DEFAULT** restores GPS + GLONASS & QZSS; **SUBMIT** sends your choice to the GPR unit. We strongly recommend keeping the default: changing the satellite systems rarely improves the internal GPS.
Connection	External GPS; Total Station	**Cable**: the receiver, or the total station's radio, is connected to the GPR unit's serial port. **Bluetooth**: the receiver, or the total station or its controller, is paired with the Device. **App (mock location)**, External GPS only: the receiver's own app, for example Lefebure or Trimble Mobile Manager, passes its positions to Android; choose that app as the mock location app in the Device's Developer options. ViewPoint2 uses only the positions with a fix from it.
Time sync from radar GPS ADVANCED	External GPS on Cable	On, the default: the GPR unit's own GPS gives the radar its time, as with every other connection. Switch it off only when the radar's GPS cannot get its time, for example a Raptor-45 that never gets GPS time sync (see 'GPS time sync' below). The Device's clock then times the traces.
Baud rates	External GPS and Total Station on Cable	The communication speed of the receiver: 9600, 19200, 38400, 57600 or 115200. It must match the setting of your receiver. 115200 by default.
Bluetooth GPS, Bluetooth device	External GPS and Total Station on Bluetooth	Tap to choose your receiver, or the total station, from the devices paired with the Device. Pair it in the Android Bluetooth settings first.
Acceptable GPS fix	External GPS	The poorest position quality you accept (see below). It decides the colour of the GPS icon.
GPS pole height [m]	External GPS on Cable or Bluetooth	The height of the GPS antenna above the ground, 0–5 m. ViewPoint2 subtracts it so that recorded elevations are at ground level. A change made while a project is open is used from that project's next profile.
Profile spacing [m]	Reference Line	The distance between the parallel lines of your survey, 0.1–10 m (1 m by default).

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Figure 26 The GNSS Configuration page, with the allowed combinations listed on the right

One kind of positioning per project

A project is recorded with one kind of positioning from its first profile to its last: GPS (Internal GPS, or External GPS on any of its connections), Total Station, or Reference Line. In a GPS project you can switch between Internal GPS and External GPS, and between the connections of External GPS. While a profile is being recorded, **Source** cannot be changed to another kind of positioning; stop the profile first. With a PinPointR or CrossOver, **Source**, **Connection**, **Baud rates** and **GNSS** cannot be changed at all while a profile is being recorded or paused; change them after **Stop**.

Acceptable GPS fix and the GPS icon

Every position your receiver sends has a fix quality. In **Acceptable GPS fix**, choose the poorest quality that is good enough for your survey. For survey-grade accuracy, choose **RTK Fix (4)**, the default.

Fix quality	Meaning
RTK Fix (4)	Real-time kinematic with fixed ambiguities: centimetre accuracy. The best quality.
RTK Float (5)	Real-time kinematic, not yet fixed: decimetre accuracy.
Differential Fix (2)	Corrected position, for example with SBAS: around a metre.
Fix (1)	Standard GPS position: a few metres.
Dead Reckoning (6)	Position estimated by the receiver without satellites.
No GPS (0)	No position.

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The GPS icon in the top bar shows how the current position compares with your choice:

GPS icon	Meaning
	**Green:** the position meets your acceptable fix.
	**Yellow:** a valid position is received, but its quality is below your acceptable fix.
	**Red with a cross:** no valid position is received.
	**Green and yellow, blinking:** the position meets your acceptable fix, but the GPR unit's own GPS is not giving the radar its time yet. Raptor-45 and PinPointR 3D, with External GPS. Wait until the icon is solid green.

If the fix drops below your acceptable fix and stays there for 5 seconds, the yellow banner 'GPS fix not acceptable' says which fix you have and which you asked for (**Figure 13**). When the fix has been back at your acceptable fix for 5 seconds, the green banner 'GPS fix acceptable again' follows. A short dip, or a change that stays on the same side of your acceptable fix, gives no banner; the GPS icon shows every change as it happens. With Internal GPS, any position counts as acceptable, and there are no fix banners.

With a total station, the icon is green while positions arrive and red when they stop; it is never yellow (see **section 9.3**).

The GPS status panel

Tap the GPS icon to open the GPS status panel (**Figure 27**).

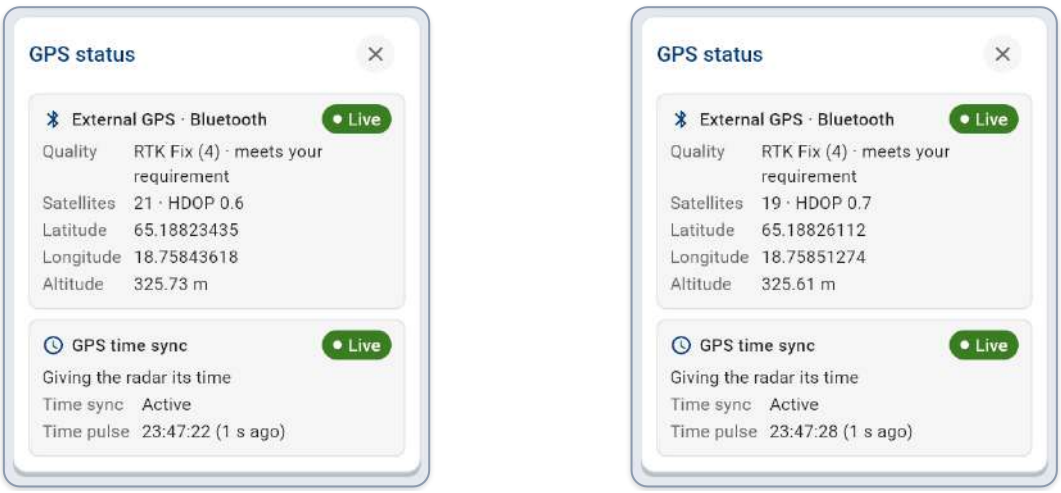


Figure 27 The GPS status panel: External GPS on Bluetooth with a PinPointR (left) and with a PinPointR 3D (right)

- The card's title is the source, as Settings names it, for example **External GPS · Bluetooth**. The coloured label at its right says whether positions arrive: **Live**, **Waiting** for the first one, or **Stopped**.
- **Quality**: the fix quality (see the table above), and whether it meets your acceptable GPS fix.
- **Satellites**, with the HDOP (horizontal dilution of precision): the more satellites and the lower the HDOP, the better the geometry.

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- **Latitude**, **Longitude** and **Altitude** of the latest position.
- **Time sync** and **Time pulse**: whether the GPR unit's clock is synchronised with GPS time, so that each trace is matched to the right position.

On every ViewPoint2 system, the internal GPS of the GPR unit gives the radar its time, also when the position comes from an External GPS receiver. This is what matches each trace to the right position. With Internal GPS, the panel shows one card, with the position and the time. With External GPS, it shows two cards: the receiver that gives the position, and below it **GPS time sync**, the radar's own GPS, which gives the time. Its label reads **Live** when it gives the radar its time, and **Waiting** or **No fix yet** until then; with **Time sync from radar GPS** switched off, it reads **Off**. On a Raptor-45, the **GPS time sync** card has more lines (see below).

With a total station, the panel shows the last sentence the instrument sent, exactly as it arrived (see **section 9.3**).

GPS time sync

RAPTOR-45

With External GPS, a Raptor-45 can record only once the radar has **GPS time sync**: the radar's own GPS, its timing GPS, has locked onto satellites and gives each trace its time. Until then, **New project**, **Discovery mode**, **Last project** and **Play** are greyed out. Tap one of them, and ViewPoint2 tells you why (**Figure 28**).



Figure 28 The message shown when you tap a greyed-out button while a Raptor-45 waits for GPS time sync

Keep the array under open sky and wait until the line at the top of the **GPS time sync** card (**Figure 29**) turns green. This usually takes a few minutes. The wait starts again each time the array connects, also after a lost connection. While the radar waits, the GPS icon blinks green and yellow if your position meets your acceptable fix, and it turns solid green when the radar has its time. If the timing GPS has no fix when the array connects, ViewPoint2 switches the array's transmitters off, so that the timing GPS can find satellites sooner. It switches them on again as soon as the timing GPS has a fix, and while the Trace View is open.

The coloured line at the top of the **GPS time sync** card tells you how far it has got:

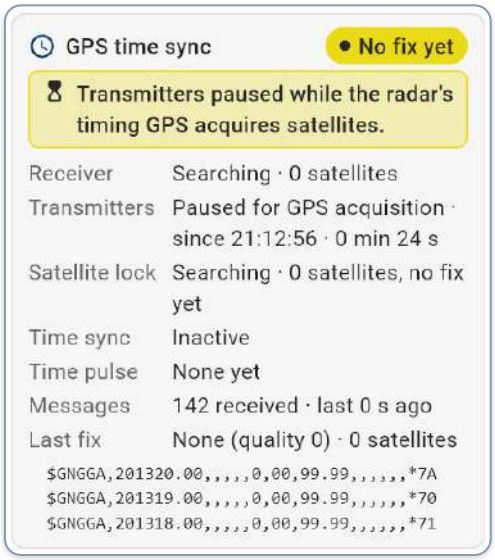


Figure 29 The GPS time sync card while the timing GPS looks for satellites

- **Amber:** 'Transmitters paused while the radar's timing GPS acquires satellites.' The timing GPS is looking for satellites.

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- **Amber:** 'Timing GPS locked, transmitters on. Waiting for GPS time sync.' The timing GPS has a fix, and the radar is waiting for its time.
- **Amber:** 'Transmitters on. Waiting for GPS time sync.' The timing GPS has no fix, for example in the first seconds after the array connects, or when it has lost its fix again. Keep waiting.
- **Green:** 'GPS time sync ready. You can start a project.' You can start. The GPS icon is solid green if your position meets your acceptable fix.
- **Blue:** 'Trace View open: transmitters on, timing GPS search paused.' The search carries on when you close the Trace View.
- **Red:** something is wrong. If the line says what to do, do it, for example 'Switch the radar off and on.' If it does not, see below.

Below the line, the card lists the timing GPS's satellites, the transmitters, **Time sync** and **Time pulse**, and the last messages from the timing GPS.

If the line has not turned green after about 10 minutes, make sure the array has open sky above it, away from buildings and trees. Then switch the radar off and on, and wait again. If it still does not turn green and the receiver is on the GPR unit's serial port (**Connection**: **Cable**), switch on **Advanced configuration** and switch off **Time sync from radar GPS** under Positioning. The Raptor-45 then records without waiting for GPS time sync, and the Device's clock times the traces.

4.2.4 Zero Level

RAPTOR-45 AND PINPOINTR 3D

ADVANCED CONFIGURATION ONLY

The zero level is the sample in each trace at which the radar signal leaves the antenna, the starting point for measuring depth. A correct zero level makes depths and the ground surface line up in the radargram. The Zero Level card is shown for Raptor-45 and PinPointR 3D arrays, and shows the zero level of each channel of the array. PinPointR and CrossOver set their zero level themselves, so they have no Zero Level card.

MCU Address The receiver the channel belongs to. Each receiver of an array records two channels.

Channel / Zero Level The zero level of each channel. Tap a value to change it; it must be between 0 and the number of samples minus 1.

Trace View Raptor-45 only: tap **Open** to set the zero levels while watching live traces (see below).

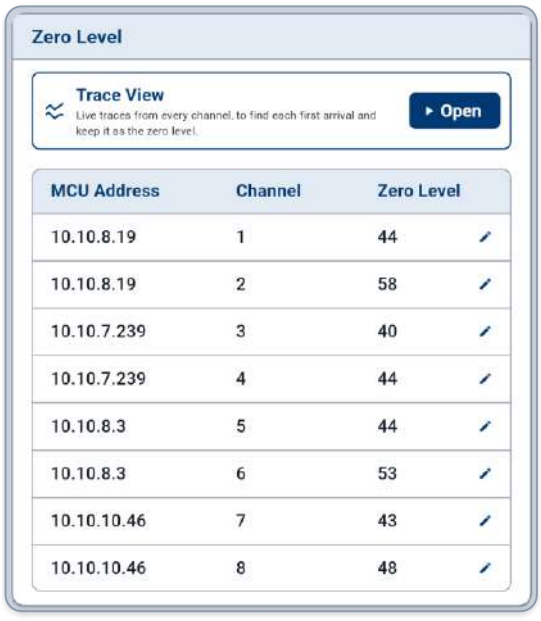


Figure 30 Zero levels of a Raptor-45

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Where the zero levels come from depends on the array:

- **PinPointR 3D:** the zero levels are set at the factory and stored in the array. ViewPoint2 reads them from the array each time it connects, so normally there is nothing for you to do.
- **Raptor-45:** the zero levels must be set with the Trace View before you survey (see below). Normally this is done only once: ViewPoint2 remembers them for that set of receivers and uses them every time you connect the same array. Set them again if a receiver has been swapped, if the array now rides much higher above the ground than when they were set, or after ViewPoint2 has been uninstalled and installed again, which deletes them.

4.2.5 Setting Zero Levels with the Trace View

RAPTOR-45

The Trace View shows a live trace from every channel of the array, so that you can find each channel's first arrival and keep it as the zero level. Nothing is recorded while the Trace View is open. If the timing GPS of the Raptor-45 is still looking for satellites (see 'GPS time sync' in **section 4.2.3**), the Trace View switches the transmitters on, and a blue line at the top reads 'Timing GPS search paused while this view is open.' The search carries on when you close the Trace View.

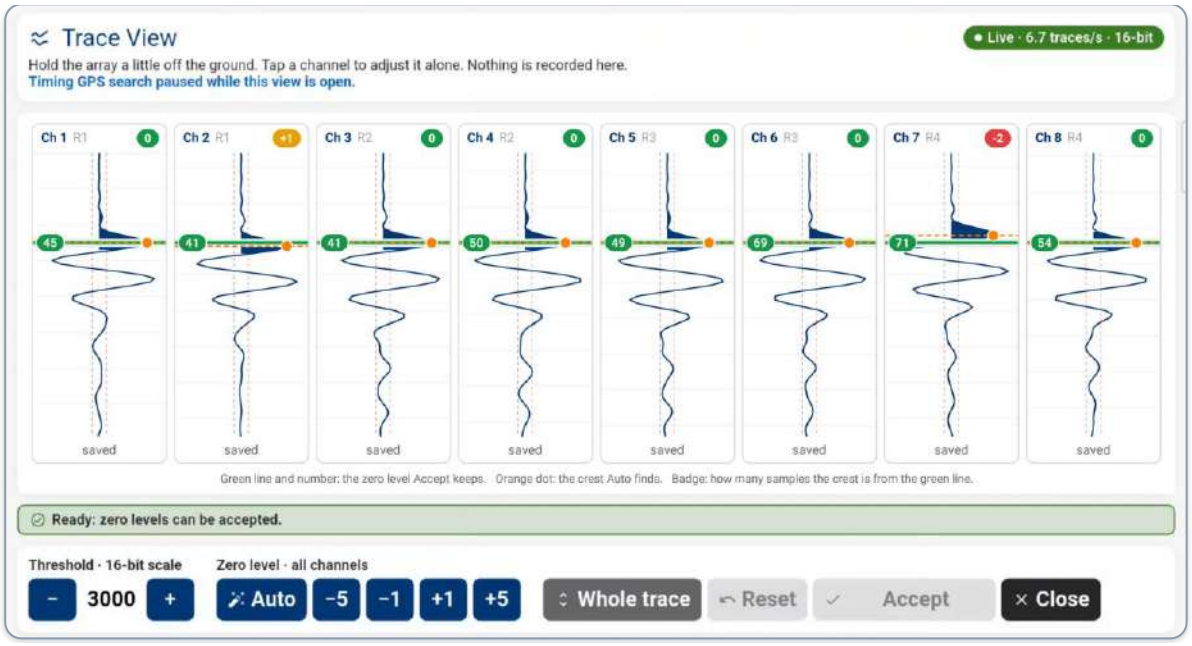


Figure 31 The Trace View of an 8-channel Raptor-45

1. Leave any open project, connect the array and switch on **Advanced configuration**.
2. On the Settings page, tap **Open** in the Zero Level card.
3. Hold the array a little off the ground, so that the first arrival is not mixed with the ground reflection.
4. If **Accept** shows a countdown (Accept in 0:16), wait until it ends. For 30 seconds after the array's transmitters switch on, **Auto**, −5, −1, +1, +5 and **Accept** are greyed out while the transmitters warm up.
5. Tap **Auto**. ViewPoint2 places each green zero level on the orange crest it finds, and the traces line up on it. If a channel shows no badge, no crest was found: lower the **Threshold** or lift the array further.

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6. Check each channel. To adjust all channels by hand, tap −5, −1, +1 or +5. To adjust one channel alone, tap that channel first; tap it again to return to all channels.
7. Tap **Accept** to save the zero levels, then **Close**.

Control	What it does
Threshold	The signal level a first arrival must exceed (on the 16-bit scale), adjusted with − and + in steps of 500.
Auto	Moves the zero level of every channel, or of the selected channel, onto the crest it finds. Greyed out during the countdown.
−5, −1, +1, +5	Move the zero level up or down by that many samples. Greyed out during the countdown.
Whole trace	Switches between the whole trace and the top of the trace, where the crest is. The button then reads **Top of trace**.
Reset	Returns to the saved zero levels.
Accept	Saves the zero levels. Every new project with this array records them, until a receiver is changed. A project that is already open keeps its own zero levels. Greyed out during the countdown.
Close	Leaves the Trace View. If you have unsaved changes, ViewPoint2 warns you first: tap Accept to keep them, or Close again to leave without them.

In each channel, the **orange** dot and dashed line mark the crest that Auto finds, and the **green** line, with its number in a green label, is the zero level that Accept keeps. The badge at the top of the channel says how many samples the crest is from the green line: 0 in green, one sample in amber, more in red. The faint red dashed lines are the threshold. Under each channel, ‘saved’ means the zero level is the one saved; ‘was …’ gives the saved value when you have changed it. A line under the channels repeats what the marks mean.

> **TIP** At a completely new site, check the zero levels in the Trace View before you start, so that they match the first arrival on that ground and no useful data is cut off. After you have recorded the first profile, step through all the channels on the radargram: each one should show a short empty band, about 20–30 samples, before the real data starts.

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4.3 User Preferences

The User Preferences column holds your ViewPoint2 preferences. They do not depend on the GPR unit and can be changed at any time.

4.3.1 Project

Default project name The name the New Project window proposes. With a PinPointR or CrossOver, ViewPoint2 fills it in at every connect with PPR_ or CO_ and the unit's serial number, for example 'CO_19136509', unless you have typed a name of your own. With a Raptor-45 or PinPointR 3D, it is the unit's serial number while the field is empty.

Add date to project name? Adds the date and time to the project name, for example 'Site_2026-10-12_14-30-05', so that every project name is unique.

Unit system **Metric** or **Imperial**. It changes only how lengths and depths are shown; ViewPoint2 always records your data in metric (see the note below).

Vertical scale Shows the radargram's vertical axis as **Depth** (m or ft) or as **Time** (ns).

Marker standard The utility colour codes used for markers: **APWA**, **AS5488** or **JUPEM**. Each project keeps the standard it was created with; a change here applies to your next new project.

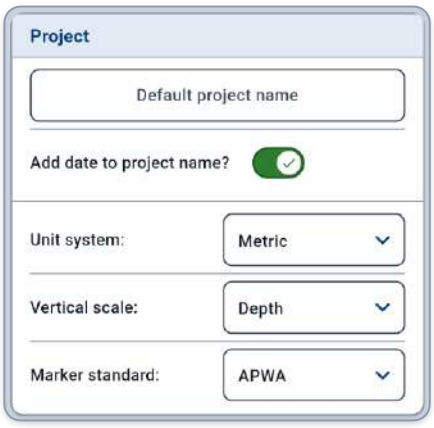


Figure 32 The Project card

> **NOTE** Some values stay metric even when Imperial is selected, because other software or the GPR unit expects them that way: the position and coordinate grid of the GeoTIFF and PNG + world pictures, in UTM metres; the CSV, KMZ, DXF and shapefile exports; the measuring ruler, its lengths and its X and Y; wheel calibration, in ticks per metre; and the recorded project files, whose settings the Project Library shows as recorded.

4.3.2 Map

Top view **Enabled** shows the depth-slice image of your data on the map, with its depth slider. **Disabled** shows only the survey lines.



Figure 33 The Map card

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4.3.3 Field Summary

Logo Your company logo on the Field Report. Tap it to choose a .png or .jpg image. First copy the image to Internal storage › Android › data › com.impulseradar.viewpoint2 › files › Viewpoint II › Corporate Logo.

Operator name, Company name Printed on the Field Report as the person and company who prepared it.

Take automatic marker screenshot? Saves a picture of the radargram each time you place a marker, for use in the report.

Marker table grouping Sorts the marker table of the report by marker **Id** or by marker **Type**.

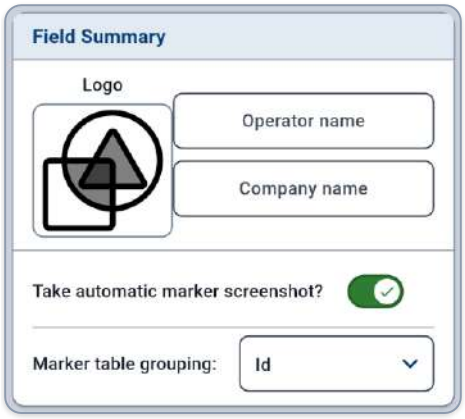


Figure 34 The Field Summary card

4.4 Settings Control

The Settings Control card at the bottom of the User Preferences column switches the advanced settings on and off, and holds the buttons that reset, save or update. Every button asks you to confirm with **YES** or **NO** before anything happens, except **Update unit firmware**, which opens its own window where you choose the file and tap **Update**.

Advanced configuration Shows the settings marked ADVANCED in this chapter: Trigger, Interval, Measurement direction, Data mode, Time sync from radar GPS and, for arrays, the Zero Level card. It is switched off again each time ViewPoint2 starts. Leave it off unless you need these settings; with it off, ViewPoint2 always records with the wheel trigger.



Figure 35 The Settings Control card

	Button	What it does
	Reset ViewPoint2 to default settings	Returns your ViewPoint2 preferences to their defaults. Your projects and the GPR unit are not affected.
	Clear projects folder	Deletes **all** projects on the Device. This cannot be undone.

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	Button	What it does
	**Save unit settings**	Stores the current antenna settings and wheels in the GPR unit as its defaults, so that they are kept when the unit is switched off. Available when a GPR unit is connected, and not while a profile is being recorded. An open project keeps its own settings.
	**Update unit firmware**	Installs new firmware in the GPR unit, and in every receiver of a Raptor-45 or PinPointR 3D. The window lists the firmware files made for the connected unit; choose the file supplied by ImpulseRadar support and tap **Update**. ViewPoint2 sends the file, the unit restarts by itself, and ViewPoint2 connects to it again and says how the update ended, for example 'Firmware updated'; then tap **Close**. When an update is not possible, for example while recording or with a low battery, the window says why. Available when a GPR unit is connected.
	**Reset unit to factory settings**	Returns the GPR unit and ViewPoint2 to their factory settings, including the default wheels. Available when a GPR unit is connected, and not while a profile is being recorded. An open project keeps its own settings.

CAUTION **Clear projects folder** permanently deletes every project on the Device. Save or share any projects you want to keep before you use it.

CAUTION Update the firmware only when ImpulseRadar support advises you to. **Make sure the GPR unit's battery is well charged before you start**: the unit draws more power while it restarts than when it is measuring. ViewPoint2 starts an update only when a PinPointR or CrossOver has at least 40 % charge, or a Raptor-45 or PinPointR 3D about 48 % (10 V). Keep the unit switched on and close to the Device until ViewPoint2 says it is done; the restart can take a few minutes. If the battery runs out while the unit writes the firmware and restarts, the unit can be left unusable, and it can then only be repaired at ImpulseRadar's headquarters in Sweden. Firmware files supplied by support go in Internal storage › Android › data › com.impulseradar.viewpoint2 › files › Viewpoint II › Firmware.

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5 Projects and Data Collection

In ViewPoint2, all the data you collect is stored in projects. A project holds the profiles you record at one site, together with your markers, interpretations and reports. This chapter explains how to create a project, what you see on the project screen, and how to record profiles.

> **NOTE** A profile is called a **swath** on the project screen. For PinPointR and CrossOver, each swath is one profile with two channels (HF and LF). For Raptor-45 and PinPointR 3D, each swath holds all the channels of the array. Their channels are 8.4 cm apart, so an 8-channel array covers a strip about 67 cm wide in one pass.

5.1 Creating a New Project

Before you create a project, check the settings on the Settings page (see **chapter 4**).

Tap **New project** on the start screen. The **New Project** window opens. It shows a summary of the settings the project will be recorded with:

- **Trigger:** the wheel and the distance between traces.
- **Trace:** the number of samples, the soil velocity and the data mode.
- **Positioning:** the positioning source, with the acceptable GPS fix, the profile spacing for a Reference Line project, or, for a total station, the baud rate or the Bluetooth device.

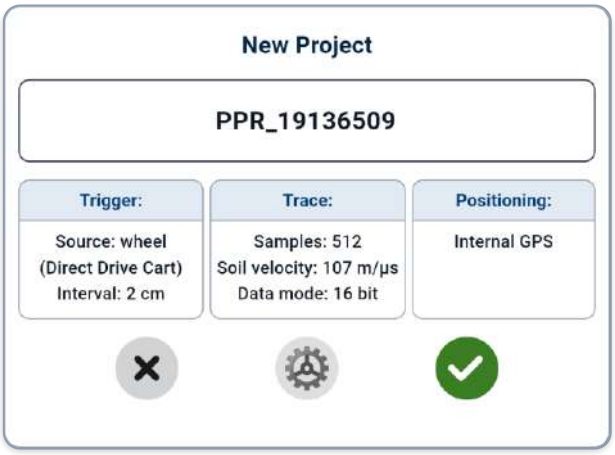


Figure 36 The New Project window

1. The name box shows the default project name from the Settings page (see **section 4.3.1**). Keep it, or type another **project name**. Spaces are replaced by underscores, and the date and time are added if this is switched on in Settings.
2. Check the summary. To change a setting, tap the **gear** button. The Settings page opens; when you return, the New Project window opens again.
3. Tap the green **tick** to create the project. Tap the grey **cross** to cancel.

While ViewPoint2 puts the settings on the GPR unit, 'Setting up the unit...' covers the screen for a few seconds. The project then opens on the project screen, ready to record. ViewPoint2 does not start recording until you tap Play.

Message	What to do
A project with the name "..." already exists. Do you want to replace it?	Tap **NO** and choose another name. **YES** deletes the existing project and all its data.

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Message	What to do
No wheel selected	Choose a wheel in Settings › Wheel and Trigger, then create the project again.
Map Unavailable	GPS projects only. The Device has no internet and no stored map of the area. Tap **Open anyway** to record without a background map, or **Go Back** to store the map first.

CAUTION Replacing a project permanently deletes the old project, including all its profiles and markers.

TIP For a quick test, without creating a project, use Discovery mode (see **section 3.4**).

5.2 The Project Screen

The project screen is where you record and review your data. It is shown in **Figure 37**. The numbers are explained in the table below.

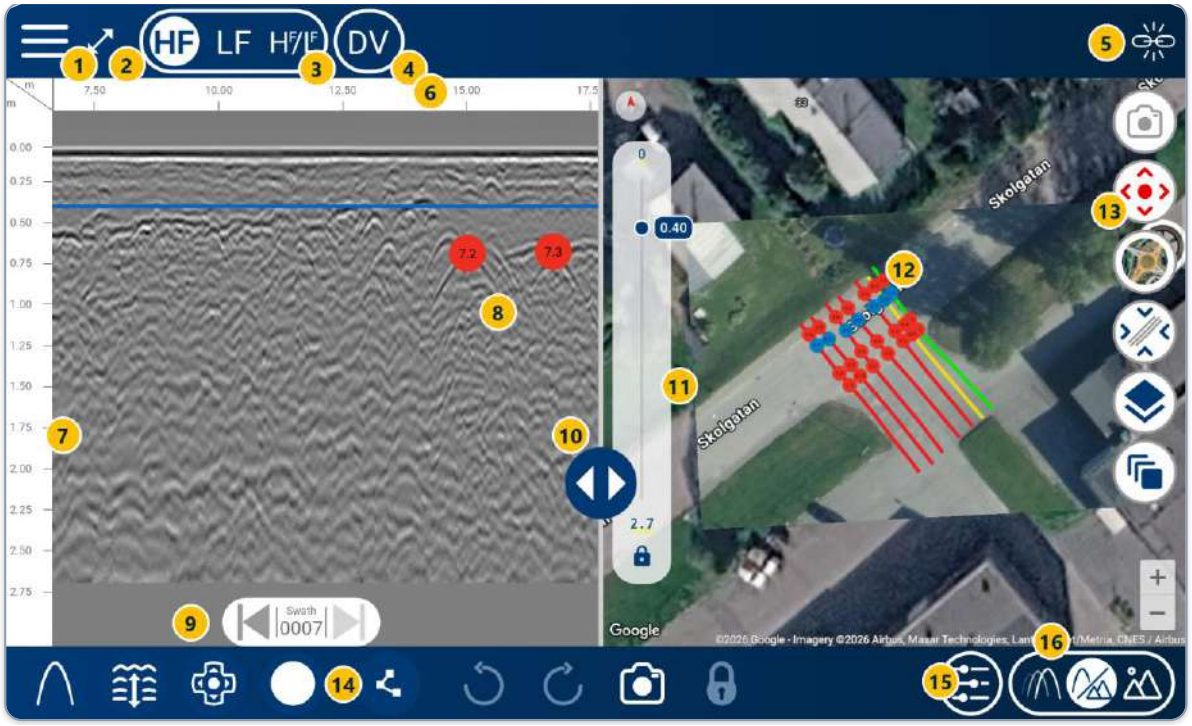


Figure 37 The project screen in split view: radargram on the left, map on the right

	Item	What it does
1	**Menu**	Opens the side menu (see **section 3.2**).
2	**Hide toolbars**	Hides the top and bottom bars, so that the radargram and map use the whole screen.

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	Item	What it does
3	**Channel selection**	Chooses which channel the radargram shows: HF, LF, or both (see **section 5.4**).
4	**DV (dual view)**	Shows the current profile together with the previous one (see **section 5.4**).
5	**Status icons**	Connection, GPS and battery (see **section 2.2.3**).
6	**Distance scale**	The distance along the profile, in metres or feet.
7	**Depth scale**	The depth below the surface, calculated with the soil velocity. In Settings you can show time (ns) instead.
8	**Markers**	Markers you have placed on the radargram, numbered by profile and marker (7.2 = profile 7, marker 2).
9	**Swath navigator**	Shows the number of the profile on screen. Tap the arrows to move to the previous or next profile.
10	**Split-view handle**	Drag it left or right to change how much of the screen the radargram and the map use.
11	**Depth slider**	Chooses the depth of the top view on the map (see **section 5.5**).
12	**Map**	Your survey lines, markers and position on the map (see **section 5.5**).
13	**Map buttons**	Screenshot, follow position, map type, zoom to the survey, layers and depth slider (see **section 5.5**).
14	**Tools**	The bottom bar: velocity, depth, cursor, markers, interpretation, undo/redo, screenshot and cursor lock (see **section 5.2.2**).
15	**Display settings**	Contrast, gain, filters, PROCESS and colour scales (see **section 6.2**).
16	**View switcher**	Switches between radargram, split and map view (see **section 5.2.1**).

5.2.1 Choosing the View

The view switcher at the bottom right of the screen has three buttons:

	View	When to use it
	**Radargram**	The radargram fills the screen. Best for looking closely at the data.
	**Split view**	Radargram and map side by side. Best while you record, so that you see the data and where you are.
	**Map**	The map fills the screen. Best for checking the coverage of your survey.

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TIP With the Device held upright, the view switcher is a single button that steps through split view, radargram and map. A smartphone shows one view at a time, the radargram or the map, so its view switcher has no split view.

5.2.2 The Bottom Bar

The bottom bar holds the tools you use most while recording and reviewing. On a small screen, swipe the bar sideways to see all of them.

	Control	What it does
	**Hyperbola**	Shows a hyperbola that you match to a target, to find the soil velocity.
	**Known depth**	Calibrates the depth scale with a target at a known depth.
	**Fine control**	A pad with arrows to move the cursor precisely, buttons to zoom in and out, and a button to place a marker.
	**Markers**	Places markers on targets. The colour of the button is the selected marker type (see **section 7.1**).
	**Interpretation**	Draws lines, areas, measurements and comments on the map (see **section 7.2**).
	**Undo / Redo**	Undoes or redoes your last marker changes on the profile on screen.
	**Screenshot**	Saves a picture of the radargram in the project.
	**Cursor lock**	Keeps the cursor on the newest trace while you record, so that you can place markers as you go. Available only while recording.
	**Display settings**	Opens the contrast, gain, filter and PROCESS settings.

The hyperbola, known depth and fine control tools are described in **chapter 6**.

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5.3 Recording Profiles

When a GPR unit is connected, the recording buttons appear in the middle of the top bar:

	Button	What it does
	**Play**	Starts recording a new profile. Touch and hold to continue the profile you have just recorded. Play is greyed out, and tells you why when you tap it, when the open project cannot be recorded into as things are: **Positioning** is set to another kind of positioning than the project's, another GPR system is connected than the one that recorded it, or a Raptor-45 that uses External GPS is still waiting for GPS time sync (see 'GPS time sync' in **section 4.2.3**).
	**Pause**	Pauses the recording, for example to get past an obstacle. The profile stays open.
	**Resume**	Continues recording on the same profile.
	**Stop**	Ends the profile. The profile is saved automatically.

Recording a profile

1. Place the GPR system at the start of your survey line.
2. Tap **Play**. Wait until the radargram starts to scroll.
3. Push the GPR system along the line at a normal walking pace. The radargram shows the data as it is recorded, and your track appears on the map.
4. At the end of the line, tap **Stop**.
5. Move to the start of the next line and tap **Play** again. Each profile gets the next number.

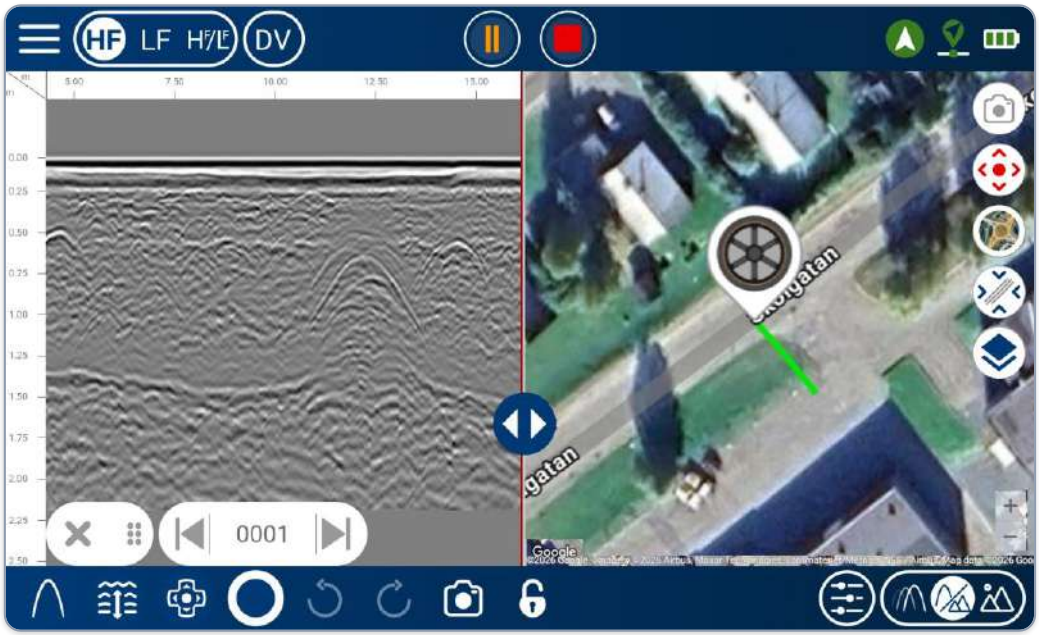


Figure 38 Recording with a PinPointR: the pause and stop buttons in the top bar, the profile on the radargram, and the cart with its green track on the map

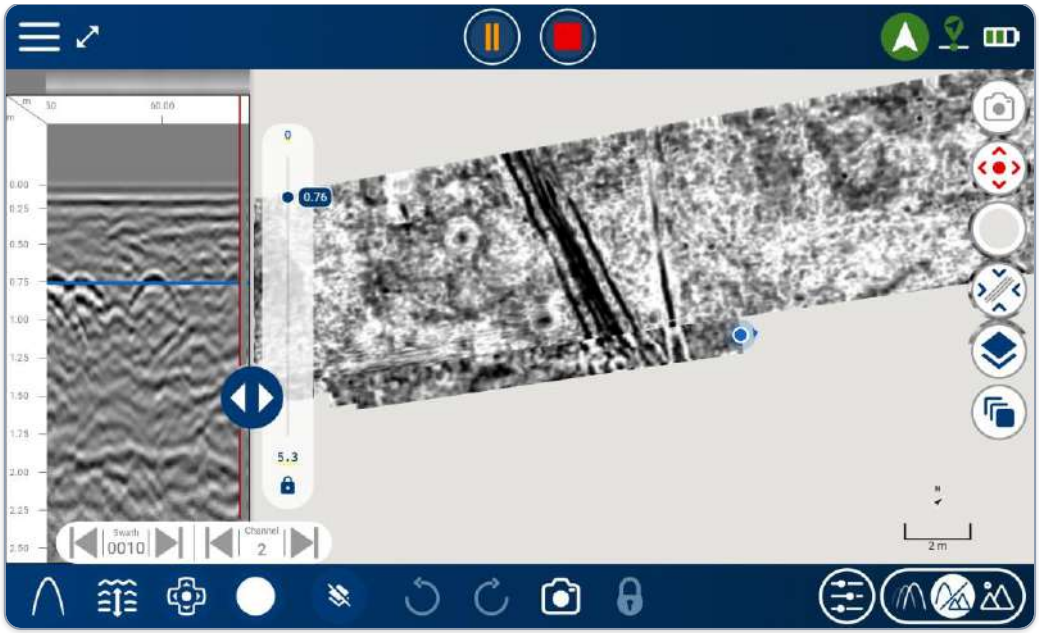


Figure 39 Recording with an array: the passes already recorded show as a top view on the map, and the pass being recorded is added in front of the array (blue dot)

TIP If you stopped a profile too early, touch and hold **Play** straight away to continue it. Only the profile you have just recorded can be continued: after you have moved to another profile or opened another project, start a new profile.

Measurement direction

The direction icon in the top bar shows which way the wheel is moving. It is an indicator only; you do not need to tap it.

	Icon	Meaning
	**Not known yet**	At the start of a profile, before the wheel has moved 5 cm.
	**Forward**	The wheel is moving forward. The radargram grows.
	**Backward**	The wheel is moving backward. Nothing is recorded until you move forward again past the point where you started reversing.

Messages while recording

Message	Meaning and what to do
Recording did not start	Nothing was recorded. The banner says why and what to do, for example 'The unit did not answer Start. Tap Play again.'
No positions	No position has arrived for a few seconds; the profile is recorded without positions. Check your GPS receiver or total station and its connection.

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Message	Meaning and what to do
GPS fix not acceptable, GPS fix acceptable again	Your GPS fix has gone below, or come back to, your acceptable GPS fix (see **section 4.2.3**).
Connection lost	Raptor-45 and PinPointR 3D: the GPR unit stopped answering, and the recording was stopped. ViewPoint2 reconnects automatically (see **section 2.4**).
Off the unit's Wi-Fi	PinPointR and CrossOver: the Device has left the GPR unit's Wi-Fi, and the unit records on. Get the Device back on the unit's network and wait until the banner has closed before you tap Stop, Pause or Resume.
Still recording	Raptor-45 and PinPointR 3D: the GPR unit did not confirm the stop, so the recording goes on. Tap Stop again.
Profile not continued	You touched and held Play on another profile than the one just recorded. Nothing was recorded; tap Play to start a new profile.
A profile is being recorded	PinPointR and CrossOver: you tapped another profile, or tried to open or create another project, while a profile is being recorded or paused, or while its missed traces are being restored. Tap Stop and wait until 'Restoring missed traces' has closed.
Restoring missed traces	After you tap Stop, ViewPoint2 fetches any traces it missed from the GPR unit, counting down what is left on HF and LF. Wait until it closes, or tap CANCEL. (PinPointR and CrossOver.)

NOTE PinPointR and CrossOver: while a profile is being recorded or paused, and while its missed traces are being restored, **Back** does nothing on the project screen; tap **Stop** to end the profile. From Settings, or another page opened over the project screen, Back returns to the project screen and the recording goes on. Raptor-45 and PinPointR 3D: if you press Back while recording, ViewPoint2 stops the recording first. Your data is saved.

5.3.1 Survey Speed and Settings

GPR systems produce a lot of data. How fast you can survey depends mostly on how quickly that data reaches the Device. Three settings decide how much data you collect for every metre. Choose them to suit the survey, and you can survey faster without missing traces:

- **Data mode:** 16-bit data is enough for almost every survey, and it is half the size of 32-bit data.
- **Samples:** more samples let you see deeper, but they make every trace larger. Choose a time window that just covers the depth you need.
- **Trace interval:** a GPR sees less fine detail the deeper it looks, so recording traces closer together than your targets need does not help. A longer interval means less data. The shortest interval is 1 cm.

Samples and data mode are set on the Depth card (see **section 4.2.2**), and the interval on the Wheel and Trigger card (see **section 4.2.1**). Data mode and interval are advanced settings: with Advanced configuration switched off, ViewPoint2 uses values that suit your GPR system.

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Recommended settings

These settings suit nearly all soils and surveys. We recommend that you keep them:

GPR system	Data mode	Samples	Trace interval
PinPointR, CrossOver CO4080	16-bit	512	2 cm
Raptor-45, PinPointR 3D	16-bit	512	4 cm

For CrossOver CO1760 and CO730, keep the factory settings of the GPR unit.

PINPOINTR AND CROSSOVER

PinPointR and CrossOver send their data over Wi-Fi, which is the main limit on survey speed. If the Wi-Fi link cannot keep up, or is interrupted, some traces are missed. They are not lost: the recording goes on, and after you tap Stop, with the Device on the unit's Wi-Fi, ViewPoint2 fetches them from the GPR unit, and the window 'Restoring missed traces' counts down what is left. If you often see this window, slow down, keep the Device close to the GPR unit, or record with fewer samples or a longer interval. Missed traces are rare, but they can also happen near strong sources of electromagnetic interference, for example under or near high-voltage power lines, where there are many Wi-Fi hotspots, or at some large industrial sites.

RAPTOR-45 AND PINPOINTR 3D

Raptor-45 and PinPointR 3D send their data over the Ethernet cable, which is much faster than Wi-Fi. An array records several channels at once, though, so the same advice applies: use 16-bit data and a time window that suits the survey.

5.4 Channels and Dual View

PINPOINTR AND CROSSOVER

PinPointR and CrossOver record two frequencies at the same time. The **high frequency (HF)** shows more detail, so small objects close together, such as two cables, appear as separate hyperbolas; but the ground absorbs it sooner, so it does not reach as deep. The **low frequency (LF)** reaches deeper, but its longer waves show less detail, so close objects can merge into one hyperbola. Recording both gives you the detail near the surface and the reach at depth in one pass.

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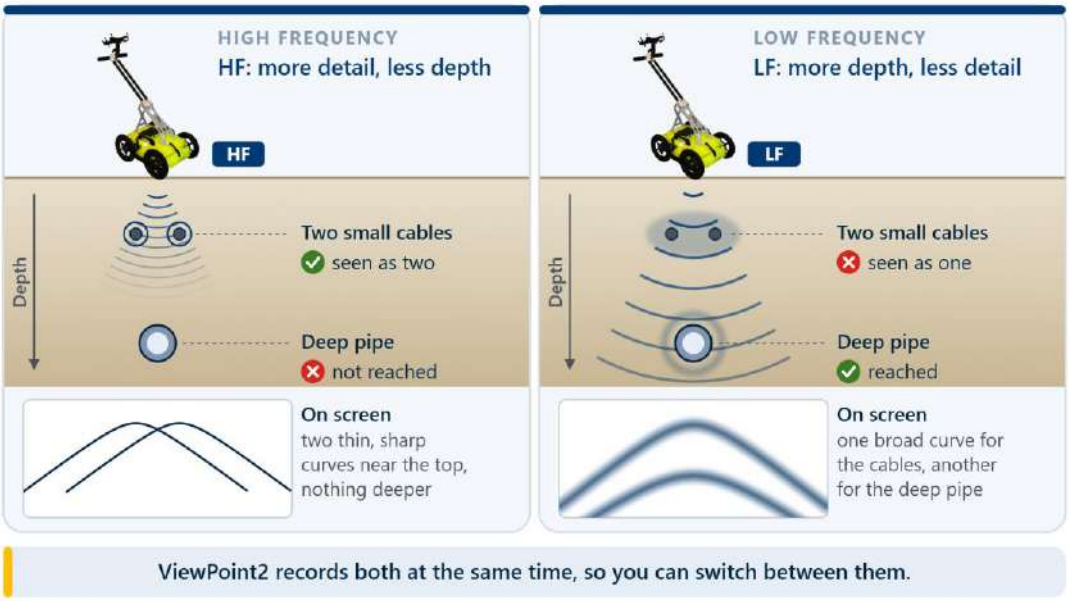


Figure 40 What the high and low frequencies each show in the same ground

The frequencies are 800 and 400 MHz for PinPointR and CrossOver CO4080, 600 and 170 MHz for CrossOver CO1760, and 300 and 70 MHz for CrossOver CO730. Choose what the radargram shows with the buttons at the top left:

	Button	What it shows
HF	**HF**	Shows the high-frequency channel.
LF	**LF**	Shows the low-frequency channel.
HF/LF	**HF + LF**	Shows both channels, one above the other.
DV	**DV**	Dual view: shows the current profile above the previous one, at the same frequency. Use it to follow a target from one line to the next. A reversed profile is marked (R); tap its number to flip it.

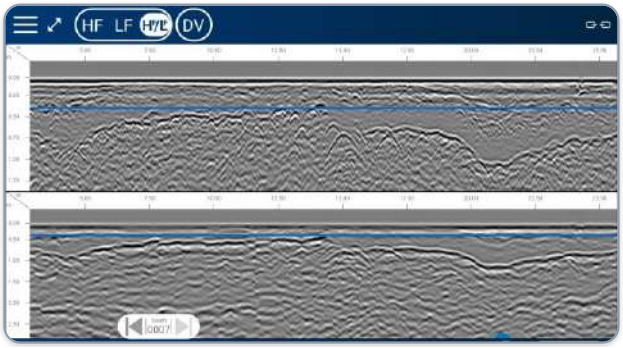


Figure 41 HF + LF: both channels of one profile

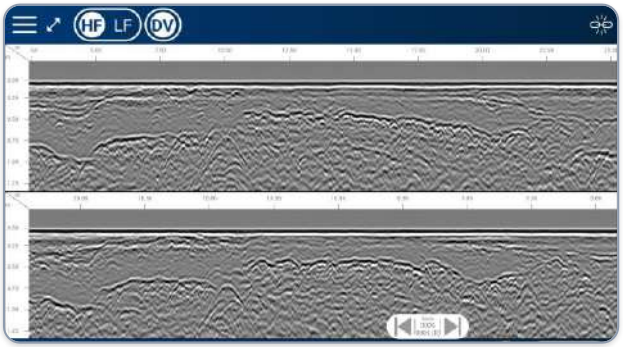


Figure 42 DV: the current profile above the previous one, marked (R) because it was recorded in the other direction

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RAPTOR-45 AND PINPOINTR 3D

Arrays record many channels at once. The channel buttons are not shown; instead, the swath navigator has a **Channel** row with arrows to step through the channels of the swath.



Figure 43 The swath navigator of an array: swath 10, channel 2

5.5 The Map View

The map shows where you have surveyed (**Figure 44**).

In Reference Line and Total Station projects, the map is drawn on a plain background in the survey's own metres, with no background map (see **chapter 8** and **chapter 9**).

PINPOINTR AND CROSSOVER

While you record with PinPointR or CrossOver, each profile is drawn as a line. To see a top view of your data between the lines, switch on **Interpolate** in the display settings; for the clearest picture, switch on **PROCESS** as well (a single tap, no expertise needed), so that the map shows processed and interpolated data. ViewPoint2 then fills the space between the profiles and shows the data at the depth chosen with the depth slider (see **section 6.4.1**).



Figure 44 The map view of a PinPointR project

	Item	What it shows
1	**Depth slider**	Chooses the depth window of the top view. Drag the two handles to set the top and bottom of the slice; tap the lock to keep the slice thickness while you move it.
2	**Current profile**	The profile you are recording or viewing is drawn in green, the previous profile in yellow and older profiles in red.
3	**Imported layer**	A background layer you have imported, here an orthophoto of the site (image courtesy of Lantmäteriet).
4	**Markers**	Your markers, in the colours of their marker types.
5	**Position**	The position of the GPR system. When there is no GPS position, the map shows the Device's own location.
6	**Map buttons**	See the table below.

Map buttons

	Button	What it does
	**Map screenshot**	Saves a picture of the map in the project.
	**Follow position**	Keeps the map centred on your position while you record. Tap again to move the map freely. While it follows, the map turns with the direction you record in; with a survey grid shown, it turns so that the grid lines run straight up the screen. The map of a Total Station project does not turn.
	**Map type**	Chooses the background map: none, normal, satellite, terrain or hybrid (satellite with road names). Not shown in Reference Line and Total Station projects.
	**Zoom to survey**	Centres the map on your survey.
	**Layers**	Imports your own background layers, lays out a survey grid, and shows or hides them (see below). Not shown in Reference Line projects; in a Total Station project, it offers the survey grid only.
	**Depth slider**	Shows or hides the depth slider. Available when Top view is enabled in Settings.

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Importing map layers

You can show your own drawings and images on the map, for example a utility plan or an orthophoto of the site:

- **KML** files and **GeoTIFF** images: choose the file directly.
- **ESRI shapefiles** and **PNG images with a world file**: put all their files in one ZIP file, then choose the ZIP file.

Tap the **Layers** button, then **Add layer**, and choose the file. Tap the eye icon to show or hide a layer, or the bin to remove it from the map.

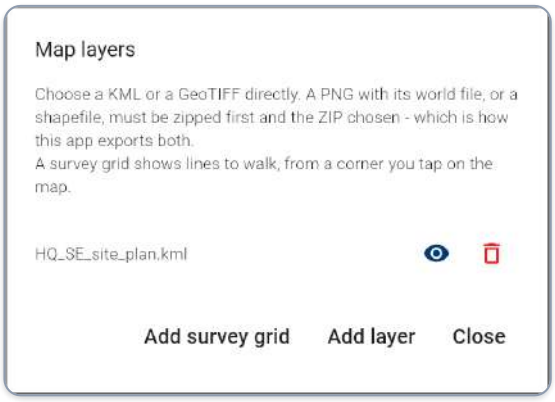


Figure 45 The Map layers window

TIP Copy the files to the Device first, for example to the Downloads folder. ViewPoint2 copies each layer into the project, so you can then delete the original. The bin removes the layer for good, with the project's copy; your original file is not touched. Each project keeps its own layers.

NOTE A GeoTIFF or PNG picture can be up to 60 megapixels, and the map shows it at up to 4000 pixels along its longer side, so crop a large orthophoto to your site before you import it; it also opens faster. A GeoTIFF must be in a projected coordinate system, such as UTM. The background map itself needs internet access the first time you view an area; ViewPoint2 then stores it for use without internet (see **section 2.2.2**).

Laying out a survey grid

A survey grid draws guide lines on the project map for you to walk, so that you need no tapes or lines on the ground. Use it with an accurate position, such as an RTK fix, or with a total station.

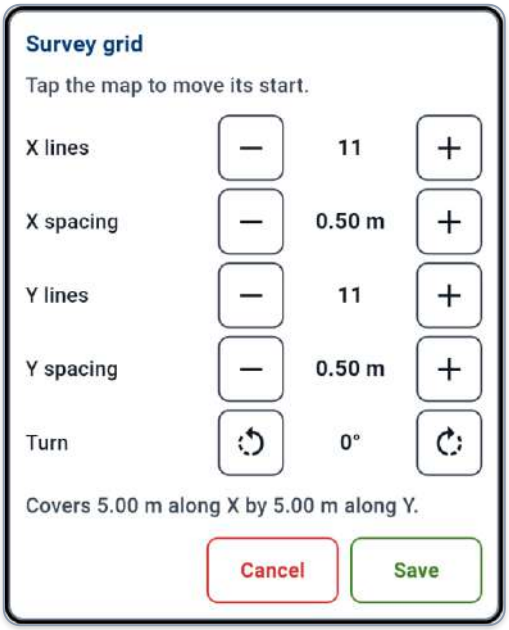


Figure 46 The Survey grid card

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1. Tap the **Layers** button, then **Add survey grid**. The **Survey grid** card opens over the map.
2. Tap the map where the grid starts, at its corner, or tap **Use my position** if you are standing on the corner with the GPR system.
3. Set the grid with − and +: **X lines** and **Y lines**, how many lines run each way (11 by default); **X spacing** and **Y spacing**, how far apart they are (0.50 m by default); and **Turn**, clockwise from north, or from the instrument's Y axis in a Total Station project. The card shows how much ground the grid covers. Tap the map again to move the start.
4. Tap **Save** to keep the grid, or **Cancel**.

The grid is drawn as thin cyan lines, above the background map and below your profiles, markers and drawings, and it is saved with the project. In the Map layers window it is listed as **Survey grid**, with the eye to hide or show it and the bin to delete it. A project has one survey grid: to change it, delete it and lay out another. The grid is a guide only: it is not in the Field Report or the exports. In a Total Station project, a grid can be laid out once the total station has measured a first position.

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6 Viewing and Adjusting Data

This chapter explains how to look at your data: how to move around the radargram, how to adjust what you see, how to process the data so that targets stand out, how to read the top view on the map, and how to calibrate the depth scale. None of these settings change the data you have recorded; they only change how it is shown.

> **NOTE** **Processing needs no geophysical expertise.** It is a single button: tap PROCESS, and ViewPoint2 does the rest automatically.

6.1 Moving Around the Radargram

Gesture	What it does
Tap	Moves the cursor to that point. The depth of the cursor is shown in a box on the depth scale, and its position is shown on the map.
Drag	Scrolls the radargram. If you start the drag on the cursor, you move the cursor instead.
Pinch	Zooms in or out, up to 8 times.
Double-tap	Shows or hides the cursor.
Tap a marker	Shows the marker's depth, with a bin to delete it.

Fine control

Tap the fine control button in the bottom bar to open a pad for precise work, for example to put the cursor exactly on the top of a target:

- **Arrows:** move the cursor one trace left or right, or one sample up or down. Hold an arrow to keep moving.
- **− and +:** zoom out and in around the cursor.
- **Centre button:** places a marker at the cursor, in the selected marker colour.
- **Handle (⁝⁝):** drag the pad to another place on the screen. Tap **X** to close it.

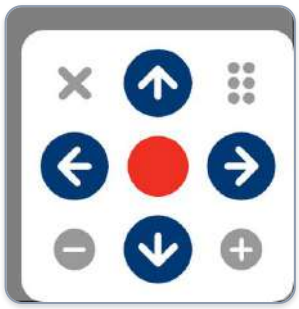


Figure 47 The fine control pad, with red as the selected marker colour

6.2 Display Settings

Tap the display settings button at the bottom right of the screen to adjust how the data is shown (**Figure 48**).

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PINPOINTR AND CROSSOVER

Dynamic gain Balances weak and strong signals automatically, so that deep targets are as visible as shallow ones. The **Dynamic gain [%]** slider sets how strong the effect is.

Background removal Removes horizontal bands, such as ringing from the antenna, so that hyperbolas stand out.

PROCESS Processes the data so that targets become sharper. One tap; no expertise is needed (see **section 6.3.1**).

Interpolate Fills the space between the profiles on the map (see **section 6.4.1**).

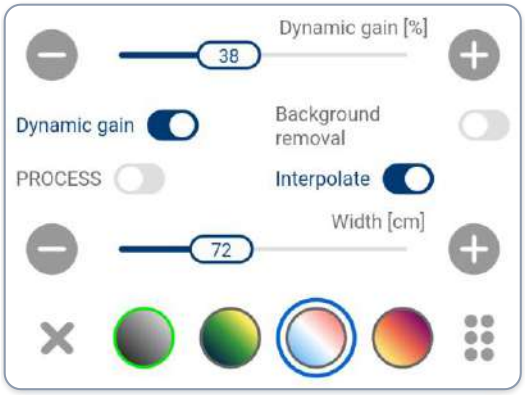


Figure 48 Display settings for the PinPointR and CrossOver family

Manual gain and background removal

Switch **Dynamic gain** off to set the gain yourself; the switch then reads **Manual gain** and two sliders appear. Switch on **Background removal** to show its width slider.

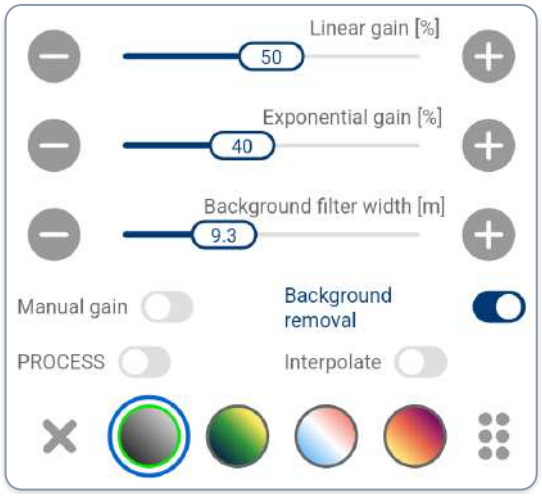


Figure 49 Manual gain with Background removal on

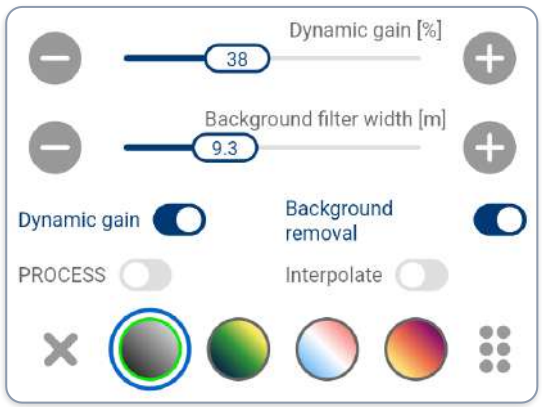


Figure 50 Dynamic gain with Background removal on

Setting	Range (default)	What it does
Dynamic gain [%]	0–100 % (38)	Strength of the automatic gain. Shown when Dynamic gain is on.
Linear gain [%]	0–100 % (50)	Amplifies the whole trace evenly. Shown with Manual gain.
Exponential gain [%]	0–100 % (40)	Amplifies deeper parts of the trace more than shallow parts, to make up for the signal getting weaker with depth. Shown with Manual gain.

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Setting	Range (default)	What it does
Background filter width [m]	From 50 traces to the profile length (500 traces)	The stretch of profile that is averaged and removed. A shorter width removes more, but can also remove long flat targets such as a pipe running along the profile. Shown when Background removal is on.
Contrast [%]	0–100 % (50)	Contrast of the processed data. Shown instead of the gain settings while PROCESS is on.
Width [cm]	2–200 cm (100)	The total width of the band drawn around each profile when Interpolate is on; half of it lies on each side.

> **TIP** Tap − or + on a slider to change it in small steps, or hold the button to keep changing. Drag the slider for large changes.

Colour scales

The four round buttons choose the colour scale: grey, green–yellow, red–white–blue and orange. **Tap** a colour scale to use it for the map; **double-tap** it to use it for the radargram. The map's colour scale is marked with a blue ring, the radargram's with a green border.

> **NOTE** Display settings are saved with each project, so a project opens the way you left it. They never change the recorded data.

6.3 Processing the Data

Processing makes targets easier to recognise: the hyperbola of a pipe or cable is focused back to the point it came from, and noise is reduced. The processed data is stored beside your recorded data; the recorded data itself is never changed, so you can always switch back to it.

You do not need any knowledge of geophysics or GPR processing to use it. There is nothing to set up: tap **PROCESS**, and ViewPoint2 chooses and runs every step for you.

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6.3.1 PROCESS for PinPointR and CrossOver

PINPOINTR AND CROSSOVER

Switch on **PROCESS** in the display settings. ViewPoint2 filters each profile (bandpass), focuses the hyperbolas (migration) and shows the signal strength on the map. The first time, each profile takes a moment to process; a banner shows the progress. While PROCESS is on, the display settings show a **Contrast** slider instead of the gain settings.

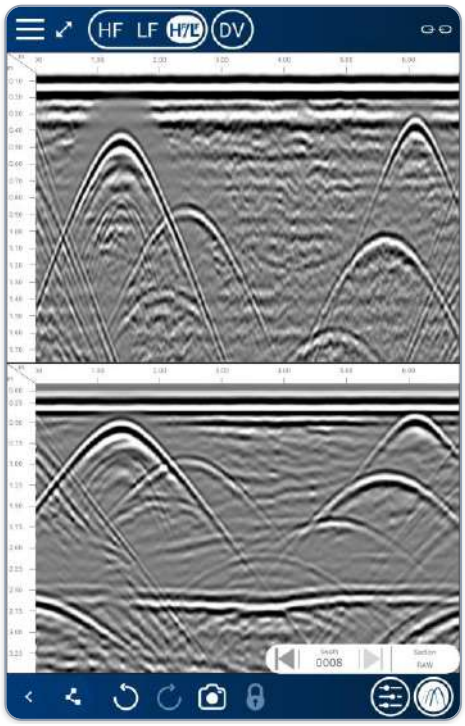


Figure 51 Raw (Section: RAW), HF above LF: targets show as hyperbolas

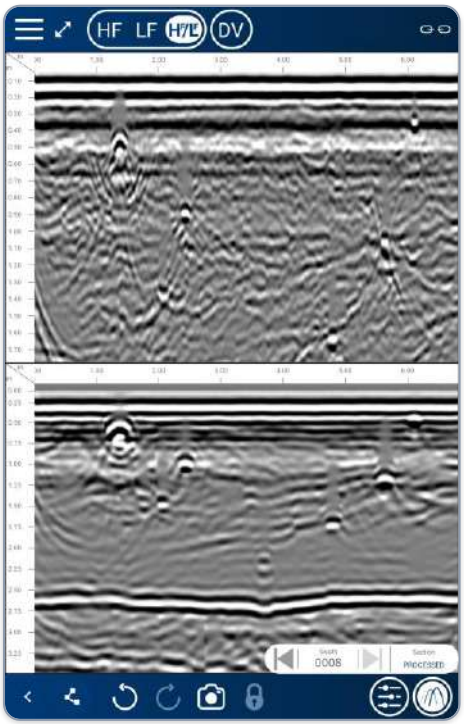


Figure 52 Processed (Section: PROCESSED): hyperbolas focused into points

Raw and processed hyperbolas. In raw data, a pipe or cable that crosses the profile shows as a hyperbola: an arch whose top is the target, with long arms on both sides. Processing collapses each arch back onto its top, so in processed data the target becomes a small, bright point at its true position and depth, and targets close together are easier to tell apart (compare **Figure 51** and **Figure 52**). A utility that runs along the profile, instead of across it, makes no hyperbola, so processing does not sharpen it.

While PROCESS is on, tap **Section** in the swath navigator to switch the radargram between **PROCESSED** and **RAW**. It changes only the radargram, not the map, so you can compare the two at a tap; both use the same Contrast slider, and your markers stay in place. Switching PROCESS off returns the radargram to RAW.

Which picture to look at

We suggest looking at the **radargram RAW** and the **map PROCESSED**, with Interpolate on for PinPointR and CrossOver. On the radargram, a raw hyperbola has a familiar shape that is easy to recognise as a real target, while a processed target is a small spot that can look like any other spot. On the map it is the other way round: processing focuses each hyperbola into a spot, and the spots of neighbouring profiles line up into a sharp, narrow line that is easy to follow. This is a suggestion, not a rule; use whichever you find easiest to read.

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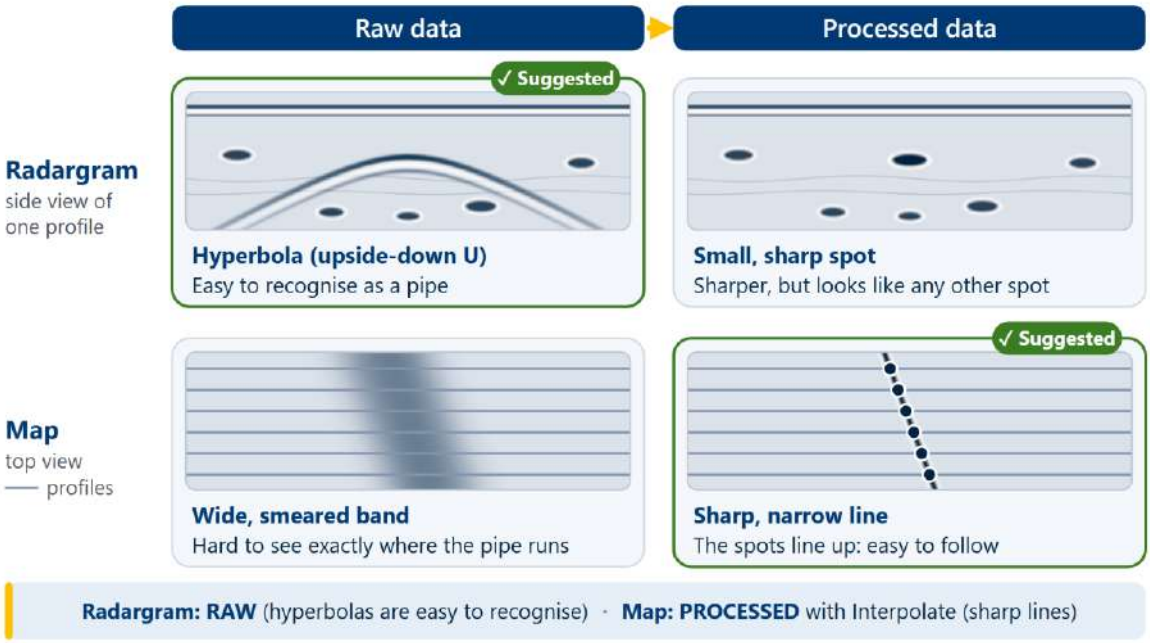


Figure 53 Raw and processed data compared: the raw radargram shows the familiar hyperbola, the processed map shows a sharp line

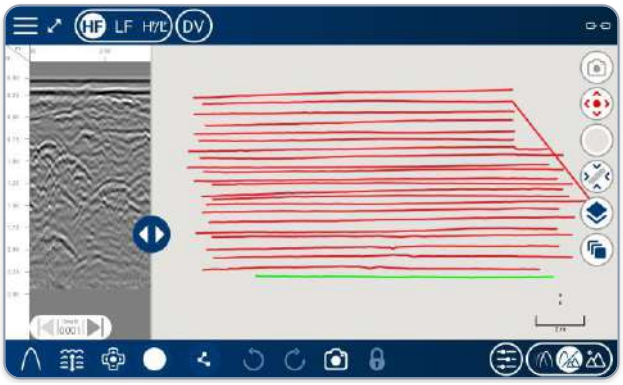


Figure 54 Top view, not processed and not interpolated: the profiles are drawn as lines

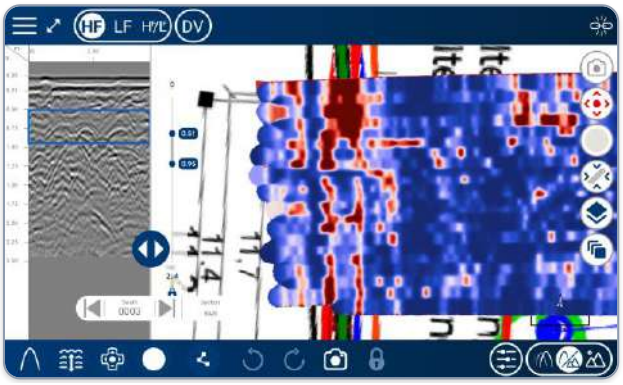


Figure 55 Top view, processed and interpolated 35 cm on each side of every profile

Processing uses the soil velocity. Calibrate it before you rely on processed depths (see **section 6.5**).

If you change the soil velocity after a project has been processed, ViewPoint2 asks: 'Change the velocity?'. Tap **Rebuild** to process the whole project again with the new velocity, which takes as long as the first time, or **Keep previous** to keep the existing processing.

6.3.2 PROCESS for Raptor-45 and PinPointR 3D

RAPTOR-45 AND PINPOINTR 3D

For an array, ViewPoint2 processes the whole survey at once into a 3D volume, which gives sharp top views and sections. Tap the **PROCESS** button in the display settings to start it. A banner shows 'Processing the survey' and the progress in per cent. You can keep working while it runs. That is all there is to it: no settings, no expertise. It is usually quick, a few tens of seconds even for a large survey; only very long surveys, such as a road several kilometres long, take some minutes.

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Figure 56 An array survey, unprocessed

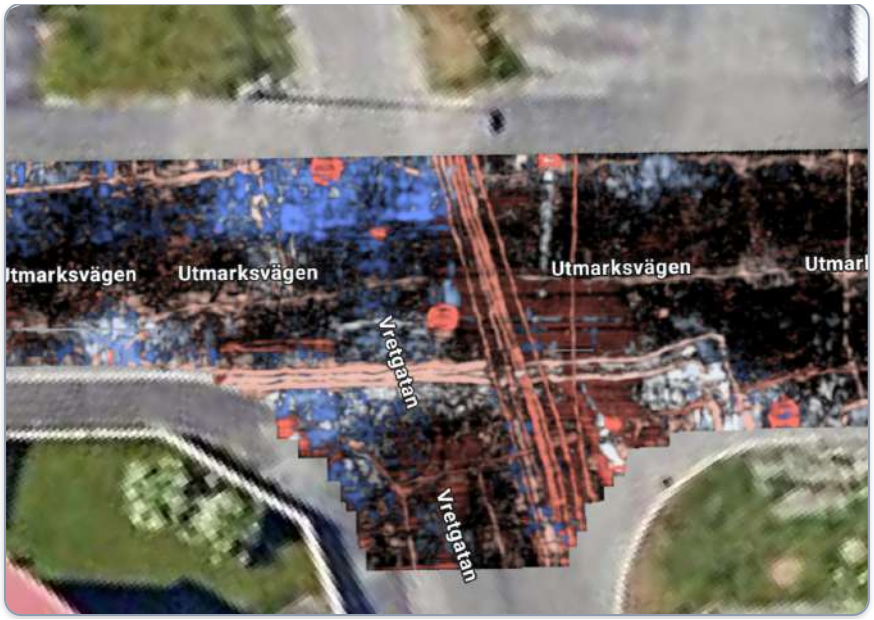


Figure 57 The same survey processed: utilities crossing the road are clearly visible

The PROCESS button tells you the state of the survey:

Button	Meaning
PROCESS	The survey has not been processed yet, or new passes are waiting. The line under it says how many passes are waiting.
PROCESSING	The survey is being processed; the line under it shows the progress.
PROCESSED	The whole survey is processed. The line under it shows the soil velocity it was processed with.
REPROCESS	The soil velocity has changed since the survey was processed (the line under it shows the old value, 'was …'). Tap to process the survey again.

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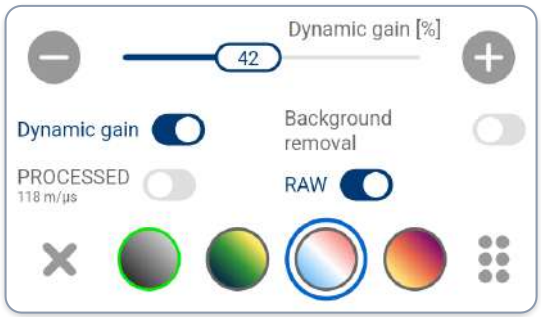


Figure 58 Display settings, RAW on

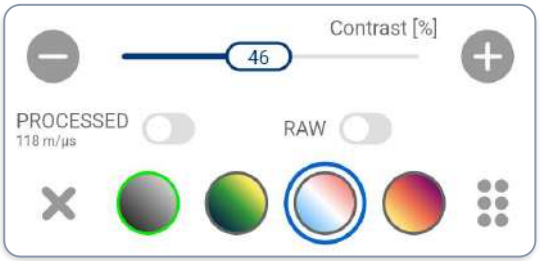


Figure 59 Display settings, RAW off: the processed survey with its Contrast slider

Use the **RAW** switch to choose which picture you see: RAW on shows the survey as recorded, with all the display settings; RAW off shows the processed survey, with a **Contrast** slider. The **Section** button in the swath navigator switches the radargram between PROCESSED and RAW.

> **NOTE** A survey cannot be processed while a pass is being recorded: the button shows 'finish the pass first'. Stop the pass, then tap PROCESS.

6.4 The Top View and the Depth Slider

The top view shows your data on the map as seen from above, at the depth you choose with the **depth slider** beside the map. It shows where targets run between and along your profiles.



Figure 60 The depth slider

- **Two handles:** the top handle sets the top of the depth window and the bottom handle its bottom. With the two together you see a thin slice, also called a time slice: all the data cut at one depth, as if seen from above. With a thicker window you see the strongest reflection in it, which makes targets at slightly different depths easier to follow.
- **Lock:** tap the lock to keep the window thickness, then drag to move the whole window up or down.
- **Double-tap** the slider to collapse the window to a single slice.

The window can be up to 3 m thick. When the colours of the top view stand for depth, a depth scale appears in the bottom bar, from the top to the bottom of the window:



Without a depth scale, the colours show how strong the reflections are, not their depth. This is the case for PinPointR and CrossOver with PROCESS on, where the colours are chosen to show the pipes as clearly as possible; for an array in the grey colour scale; and for a processed array survey seen as a single slice or a window less than 10 cm thick.

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6.4.1 Interpolating Between Profiles

PINPOINTR AND CROSSOVER

PinPointR and CrossOver profiles are drawn on the map as lines (**Figure 54**). To turn them into a continuous top view, switch on **Interpolate** in the display settings: ViewPoint2 then fills the space on both sides of each profile (**Figure 55**).

The **Width [cm]** slider sets the total width of the band around each profile, from 2 to 200 cm; half of it lies on each side of the profile. A Width of 70, for example, covers 35 cm on each side, as in **Figure 55**. Set it to about the distance between your profiles, so that the bands meet. The − and + buttons change it in steps of 20; drag the slider for other values.

> **TIP** For a good top view, record parallel profiles close together at a constant spacing, for example every 25 cm, and set the Width to the same distance. Interpolation is applied to profiles after they are stopped.

How good the interpolated top view is depends on your data. Interpolation fills each gap by assuming that what one profile shows carries on to the next. It works best when the profiles are close together, their positions are accurate (an RTK fix), and the pipes stand out clearly from the soil around them. In soil with many small reflectors or layers, or with positions that are off, a pipe can zigzag or break up between profiles, and false blobs can appear. Treat the interpolated top view as a guide, and check anything important on the radargram.

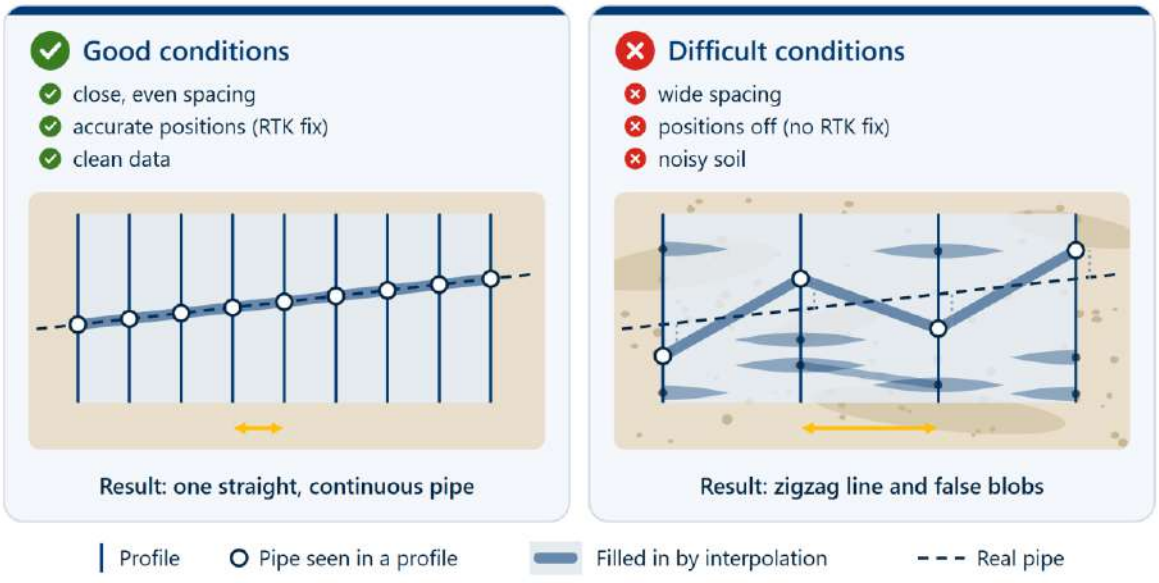


Figure 61 How the interpolated top view fills the gaps between profiles, and what it depends on

6.5 Calibrating the Soil Velocity

The radar does not measure depth directly. It sends a pulse into the ground and times how long the echo from a target takes to come back, in nanoseconds (ns, billionths of a second). To turn that time into a depth, ViewPoint2 needs to know how fast the waves travel in your soil: the **soil velocity**. In dry, sandy soil they travel fast, so an echo after 20 ns comes from about 1.5 m down. In wet clay they travel slowly, so the same echo comes from only about 0.7 m down.

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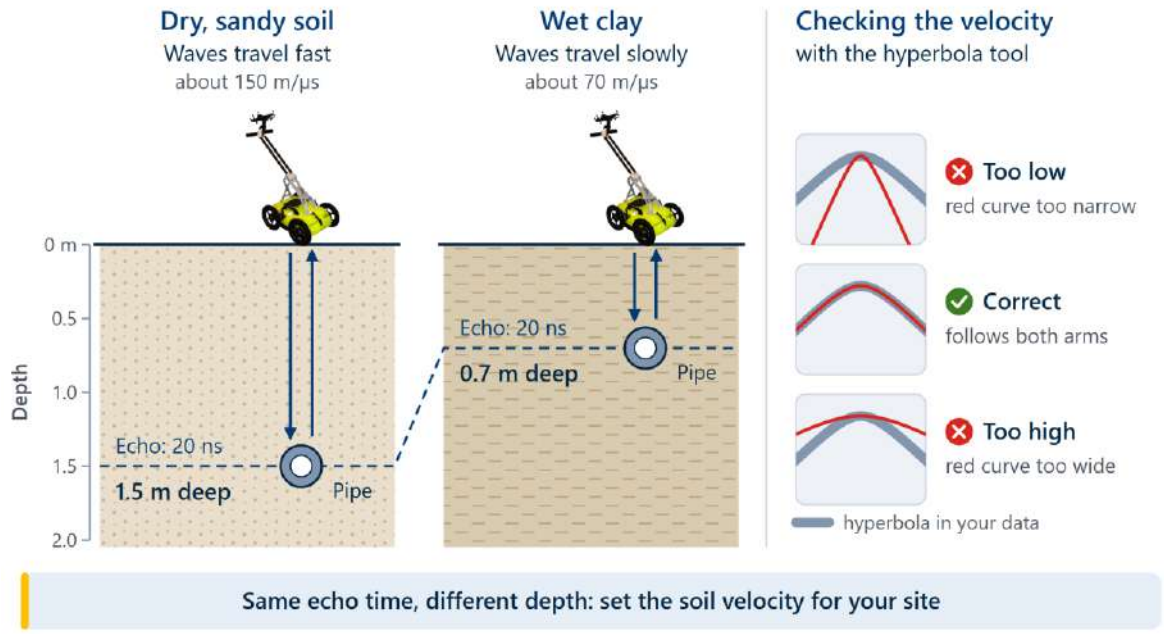


Figure 62 The same echo time means a different depth in a different soil

A wrong velocity therefore gives wrong depths for every target. Calibrate the velocity on site, with one of the two tools below. The value is used by the whole project, and also appears on the Settings page.

6.5.1 Matching a Hyperbola

A pipe or cable crossed at right angles shows up as a hyperbola. Its shape depends on the soil velocity, so matching a hyperbola to it gives the velocity.

1. Tap the hyperbola button in the bottom bar. A red hyperbola and the **Soil velocity [m/µs]** slider appear.
2. Put the cursor exactly on the top of a clear hyperbola in your data. Use the fine control pad for precision.
3. Change the velocity with the slider or the − and + buttons until the red hyperbola follows both arms of the hyperbola in the data.
4. Tap **X** to close the tool. The new velocity is used for all depths in the project.

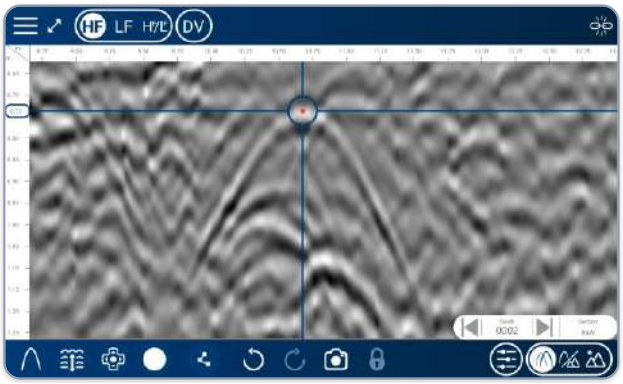


Figure 63 The cursor on the top of a hyperbola

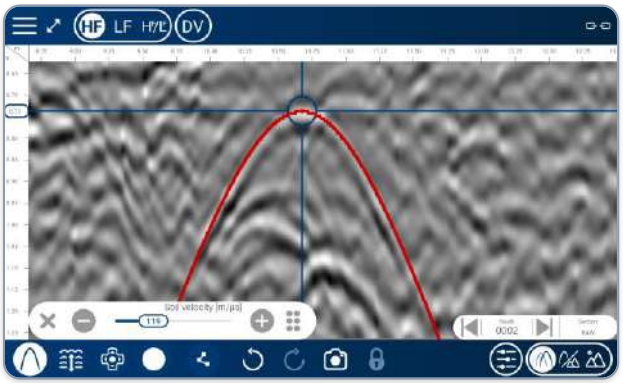


Figure 64 Matched: the red curve follows both arms of the hyperbola, here at 119 m/µs on the Soil velocity slider

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6.5.2 Using a Known Depth

If you know the depth of a target, for example a pipe you have uncovered, you can calibrate with it directly.

1. Tap the known depth button in the bottom bar. The **Known depth [m]** slider appears.
2. Put the cursor on the target in the radargram.
3. Set the slider to the real depth of the target. ViewPoint2 calculates the soil velocity from it.
4. Tap **X** to close the tool.



Figure 65 The known depth slider

NOTE After you change the soil velocity in a processed project, process it again so that the processed data uses the new velocity. PinPointR and CrossOver ask you when you close the tool; for arrays, the PROCESS button shows REPROCESS.

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7 Markers and Interpretation

When you find a target, you record it so that it ends up on the map and in your reports. ViewPoint2 gives you two ways to do this:

- **Markers** are points you place on the radargram, on top of a target. Each marker has a colour for the type of utility, and records its depth and position.
- **Map interpretation** is drawing on the map: lines along utilities, areas, measurements and comments.

Everything you record is saved in the project straight away, and is included in the Field Report and in the KMZ, DXF, shapefile and CSV exports. A total station project has no KMZ (see **section 9.6**).

7.1 Markers

7.1.1 Choosing the Utility Type

Tap the **marker** button in the bottom bar. A row of coloured circles opens. Each colour stands for a type of utility, according to the project's marker standard, the one chosen in Settings when the project was created (see **section 4.3.1**).

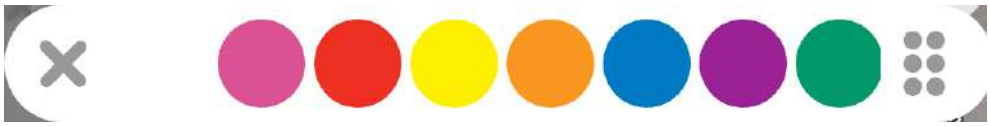


Figure 66 The marker colours (APWA). Swipe the row sideways to see all of them

Tap a colour to choose it; the marker button in the bottom bar changes to that colour. Tap **X** to close the row, or drag it by ⁝⁝ to another place on the screen. The colours of the three standards are:

	Colour	APWA	AS5488	JUPEM
	White	Proposed excavation	Communications	Unknown
	Pink	Survey markings	Unidentified	–
	Red	Electric	Fire service	Electric
	Yellow	Gas & oil	Gas	Gas & oil
	Orange	Communications	Electricity	Telecoms
	Blue	Potable water	Potable water	Water
	Purple	Reclaimed water	Recycled water	–

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	Colour	APWA	AS5488	JUPEM
	Green	Sewer & drain	Drainage	Sewerage
	Brown	–	Petroleum & fuels	–
	Cream	–	Sewer	–

APWA: American Public Works Association. AS5488: Australian Standard. JUPEM: Department of Survey and Mapping Malaysia.

7.1.2 Placing a Marker

1. Tap the **marker** button and choose the colour for the type of utility.
2. Tap the radargram on the top of the target, the apex of its hyperbola. The marker is placed where you tap, and gets a number: 5.2 means profile 5, marker 2. A marker on the apex records the exact position and depth of the target.
3. Place as many markers as you need. Tap **X** on the colour row when you are done.

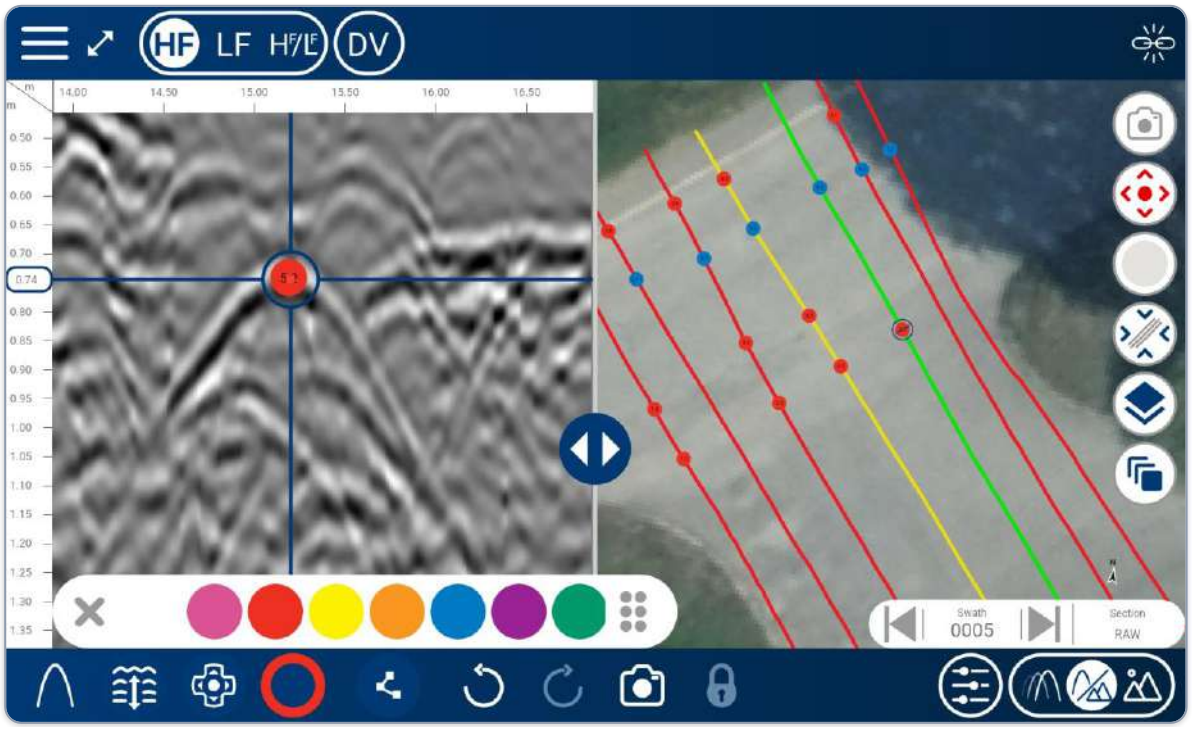


Figure 67 A red marker (5.2) on the top of a hyperbola, with the colour row still open; it also shows on the map

You can also place a marker with the **fine control** pad: move the cursor exactly onto the target with the arrows, then tap the coloured button in the middle of the pad (see **section 6.1**).

PINPOINTR AND CROSSOVER

With PinPointR and CrossOver, a marker is placed on both channels (HF and LF) at the same time.

RAPTOR-45 AND PINPOINTR 3D

With Raptor-45 and PinPointR 3D, a marker is placed on the channel shown on screen. Each channel numbers its own markers, so swath 25 can have a marker 25.3 on more than one channel. Reports

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and exports therefore add the channel: **25.3.A7** is the third marker on channel 7 of swath 25. The radargram and the map show the shorter number, 25.3.

> **TIP** If **Take automatic marker screenshot?** is switched on in Settings, ViewPoint2 saves a picture of the radargram with every marker. These pictures are used in the Field Report.

7.1.3 Checking or Deleting a Marker

Tap a marker on the radargram to see its depth. To delete it, tap the **bin** next to the depth.

You can also tap a marker on the map: it shows the marker number and depth, with a bin to delete it.

Made a mistake? Tap **Undo** in the bottom bar to take back the last marker you placed or deleted, and **Redo** to do it again. Undo works on the profile on screen; it is cleared when you move to another profile.

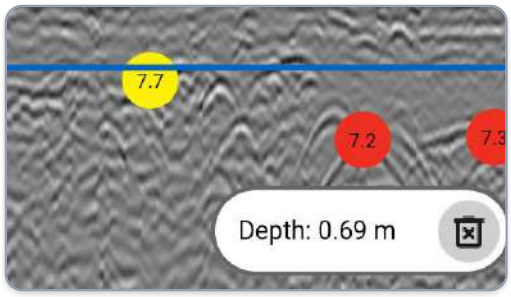


Figure 68 A marker's depth and delete button

7.2 Map Interpretation

Map interpretation lets you draw on the map: where a utility runs, the outline of an area, a measurement, or a note. Drawings are kept with the project and appear in your reports.

Tap the **interpretation** button in the bottom bar to open the **Map interpretation** panel (**Figure 69**). Choose a tool in the top row of the panel; the line beside **Finish** and **Clear** tells you what to do next. Drag the panel by ⁝⁝ if it covers the part of the map or radargram you need, and tap **X** to close it. **Double-tap** the interpretation button to hide all drawings, and again to show them.

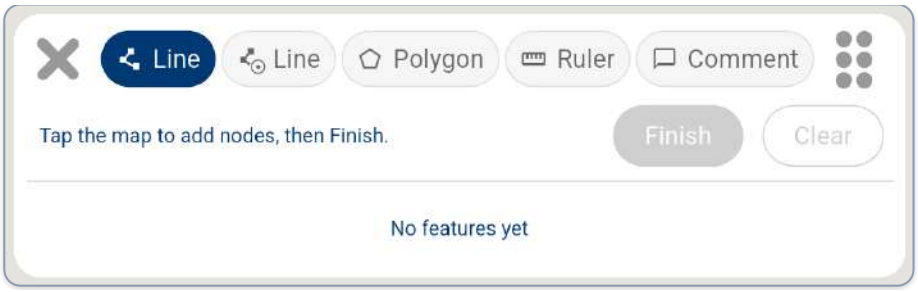


Figure 69 The Map interpretation panel

	Tool	Use it to
	Line (map)	Draw a utility by tapping points along it on the map, for example along a line in the top view.
	Line (radargram)	Draw a utility by tapping its hyperbola in the radargram of each profile that crosses it. The second Line button: the same line symbol, with a small ring and dot in its corner.
	Polygon	Outline an area, for example a zone of disturbed ground.

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	Tool	Use it to
	Ruler	Measure distances on the map.
	Comment	Leave a note, with an optional photo, at a point on the map.

All tools work the same way: tap to add points, tap **Finish** when you are done, or **Clear** to start again. Every finished drawing is listed in the panel, with an **edit** button to rename it and a **bin** to delete it.

Which tool should I use?

You want to…	Use	Why
Mark one target exactly, with its depth	A **marker** on the apex of its hyperbola (**section 7.1.2**)	A marker is a point at the exact position and depth of the target.
Record where a utility runs, with its exact position and depth	**Line (radargram)**: tap the apex of the hyperbola in each profile (**section 7.2.2**)	Every point of the line sits on the utility itself, so the line records its true position and depth all along.
Sketch where a utility runs, when the depth is less important	**Line (map)**: tap along the utility in the top view (**section 7.2.1**)	Quick to draw on the map. The depth of each point comes from the top view, so it is approximate.
Outline an area, measure a distance or leave a note	**Polygon**, **Ruler** or **Comment**	For areas, measurements and notes rather than single utilities.

7.2.1 Drawing a Utility on the Map

Use this when you can see the utility on the map, for example as a line in the top view.

Remember the difference between raw and processed data (**Figure 53**): a pipe is easiest to **recognise** on the raw radargram, as a hyperbola, and easiest to **follow** on the processed map, as a sharp line. So draw on the processed top view, and check on the raw radargram when you are unsure.

1. Open the Map interpretation panel and choose the first **Line** tool.
2. Tap the map at points along the utility. Each tap adds a point, and the points are joined by a line.
3. Tap **Finish**. A list of utility types opens.
4. Tap the type of utility. The line is drawn in its colour and named after it, for example **Electric_1**.

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The pictures below show a PinPointR 3D survey, where the utilities show as lines in the top view. With PinPointR and CrossOver, draw the line in the same way on the interpolated top view (see **section 6.4.1**).



Figure 70 Points placed along a utility in the top view of a PinPointR 3D survey

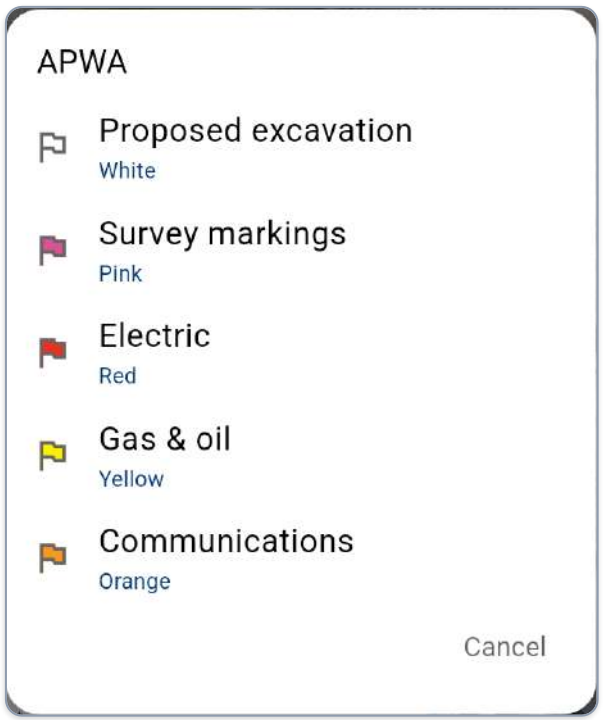


Figure 71 Choosing the type of utility

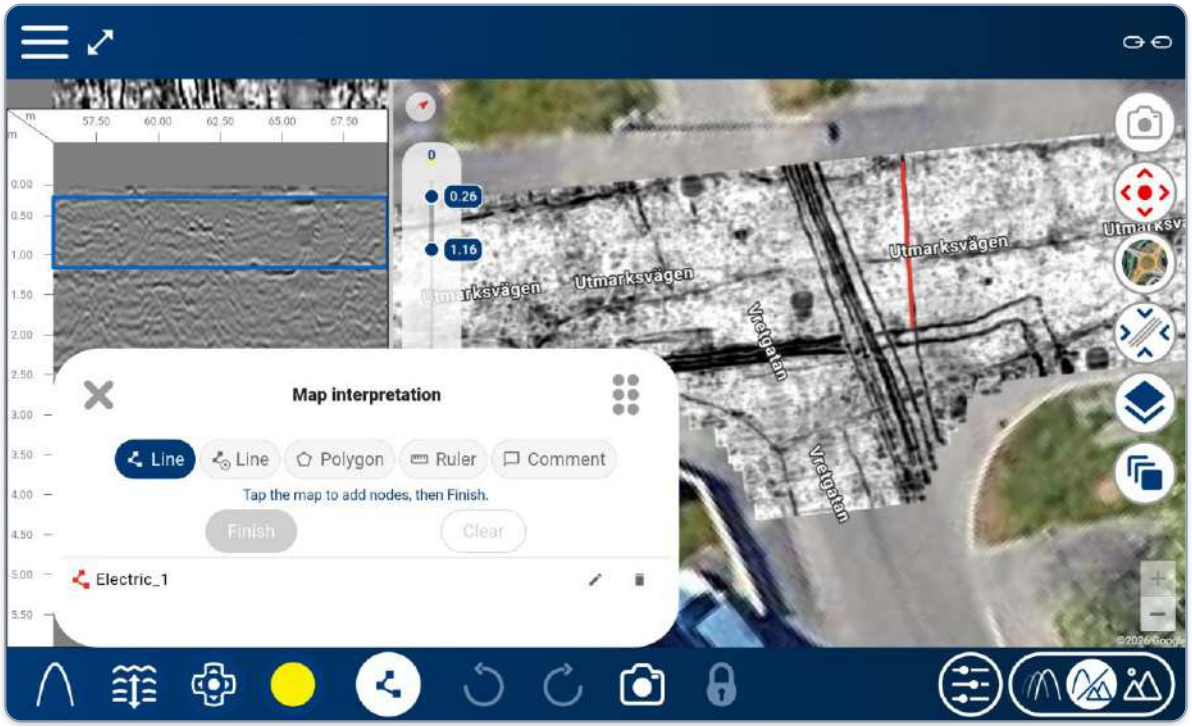


Figure 72 The finished line (Electric_1), in the colour of its utility type

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> **NOTE** The depth of each point is taken from the strongest reflection at that place in the depth window of the top view, so it is approximate. When the exact depth matters, use Line (radargram) instead.

7.2.2 Drawing a Utility from the Radargram

Use this to follow a utility exactly, from the tops of its hyperbolas. It works best on the raw radargram, where the hyperbolas are easiest to see: set the **Section** button in the swath navigator to **RAW**.

1. Open the Map interpretation panel and choose the second **Line** tool, the one with the small ring and dot in its corner.
2. On the map, tap the profile that crosses the utility. The radargram jumps to that profile.
3. In the radargram, tap the top of the utility's hyperbola. A point is added on the map.
4. Move to the next profile that crosses the utility, by tapping it on the map or with the swath navigator, and tap the top of its hyperbola. Repeat for each profile.
5. Tap **Finish** and choose the type of utility.

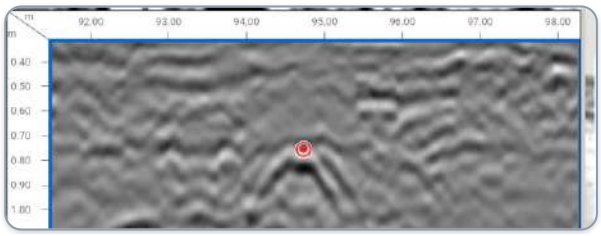


Figure 73 The first point, on the top of the hyperbola

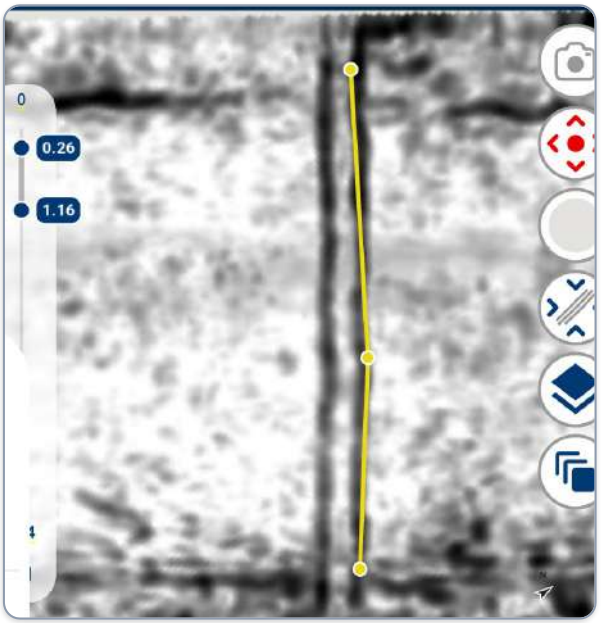


Figure 74 After three profiles the line follows the utility

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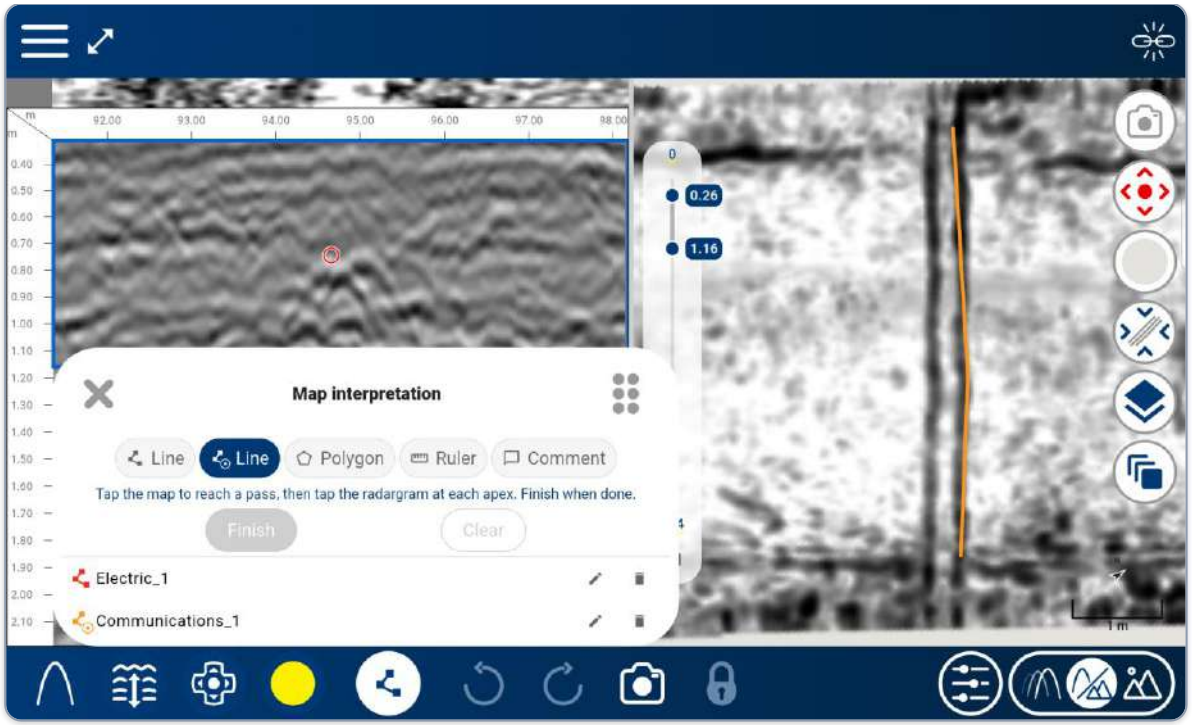


Figure 75 The finished line (Communications_1)

TIP Because each point is the apex of a hyperbola, each one is an exact position and depth on the utility, just like a marker. Use this tool when you need the true course and depth of a utility.

7.2.3 Outlining an Area

1. Choose **Polygon**.
2. Tap the map at the corners of the area, at least three.
3. Tap **Finish**. The **Feature name** window opens.
4. Enter a name, and choose an **Outline** colour and a **Fill** colour (the fill is drawn see-through).
5. Tap **OK**.

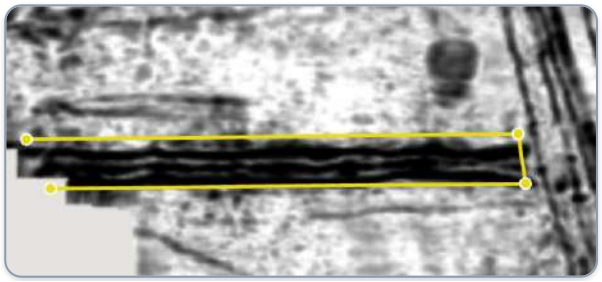


Figure 76 The corners of an area

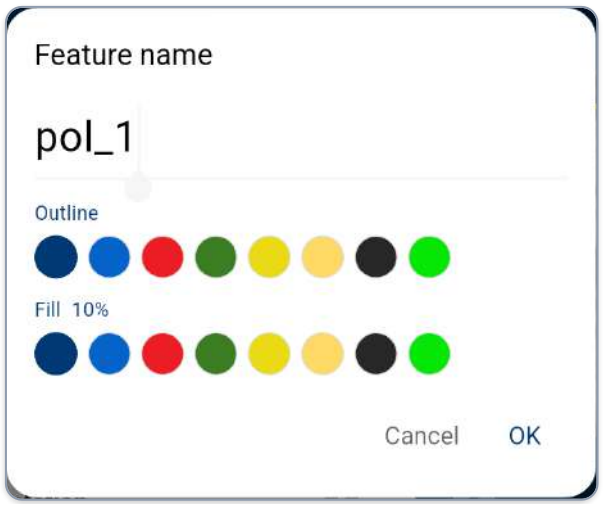


Figure 77 Naming the area and choosing its colours

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7.2.4 Measuring a Distance

1. Choose **Ruler**.
2. Tap the map at the start and at the end of what you want to measure. Add more points to measure along a bend; each segment is labelled with its own length.
3. While you measure, the panel shows the total length and the X and Y of the last point. In a total station project, these are the instrument's own metres, X and Y.
4. Tap **Finish**, enter a name and a colour, and tap **OK** to keep the measurement on the map.

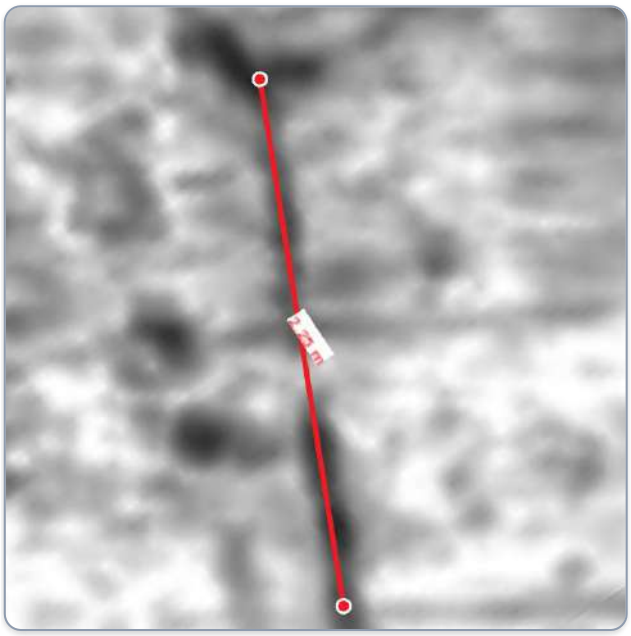


Figure 78 Measuring along a utility

7.2.5 Leaving a Comment

1. Choose **Comment**.
2. Tap the map where the comment belongs. Tap again to move it.
3. Tap **Finish**. The **Comment name** window opens.
4. Enter a name, and type your note under **Comment**, for example "Manhole cover".
5. To add a picture, tap **Photo** and take a photo with the Device's camera.
6. Tap **OK**. A pin with the name appears on the map; a comment with a photo shows a camera icon. Tap it to see the photo.

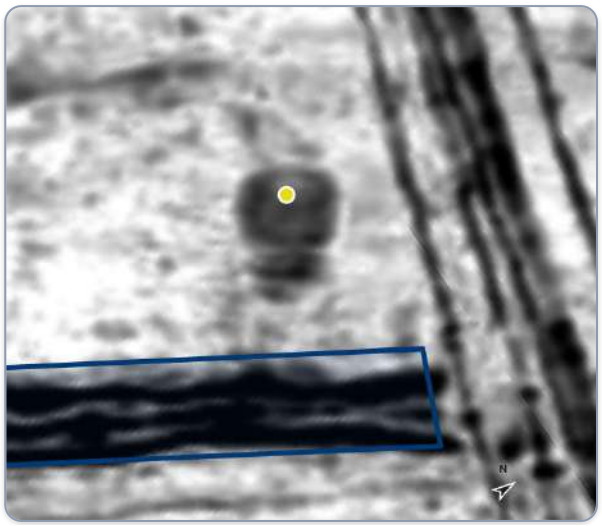


Figure 79 The place of the comment



Figure 80 Writing the comment (photo optional)

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7.2.6 Changing or Deleting a Drawing

- **Rename:** tap the **edit** button next to the drawing in the panel's list.
- **Delete:** tap the **bin** next to the drawing. It is deleted straight away.
- **Move a point:** tap a line or comment on the map to select it, then drag its points, or drag the comment, to a new place.

> **CAUTION** Undo only takes back points you are still placing. A finished drawing that you delete, rename or move cannot be undone.

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8 Reference Line Projects

A reference line project lets you map an area without GPS, for example indoors, under trees or wherever GPS is not accurate enough. You walk straight, parallel profiles across a straight line on the ground, the **reference line**. Each time you cross it, you tell ViewPoint2. From these crossings and the distance between the profiles, ViewPoint2 places all the profiles side by side, so that they line up on the map and in your reports, just like a survey with GPS.

> **NOTE** There is no separate project type for this. Any project becomes a reference line project when you create it with the positioning source set to **Reference Line**.

8.1 How It Works

The layout of a reference line survey is shown in **Figure 81**.

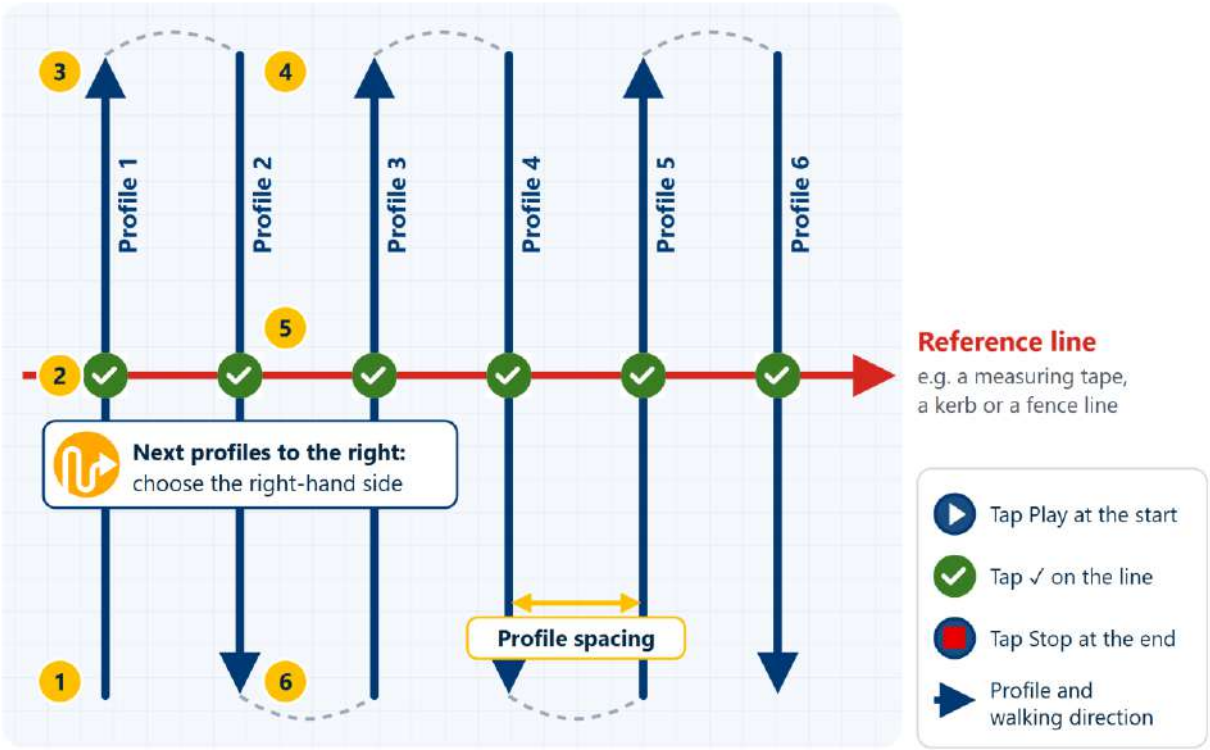


Figure 81 Layout of a reference line survey

- **The reference line** can be any straight line you can see on the ground: a measuring tape, a kerb, a wall or a fence line. Mark the start of each profile along it, one profile spacing apart.
- **The profiles** cross the reference line at right angles, one profile spacing apart, and are walked in alternate directions: the first one away from you, the next one back, and so on.
- **The crossing:** when the cart is exactly on the reference line, you tap ✓. This fixes where the profile lies.

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8.2 Setting Up the Project

1. On the **Settings** page, under **Positioning**, set **Source** to **Reference Line**.
2. Set **Profile spacing [m]** to the distance between your profiles, for example 0.5 m (0.1–10 m).
3. Create a new project as usual (see **section 5.1**).
4. Check that the **Positioning** column of the New Project window shows **Reference Line** and the spacing you chose, then tap the green tick.

> **TIP** Prepare the site before you start: lay out the reference line, and mark the start point of every profile on the ground at the chosen spacing. Equal spacing is what lines the profiles up correctly.

8.3 Recording the Profiles

Every profile is recorded with three taps:

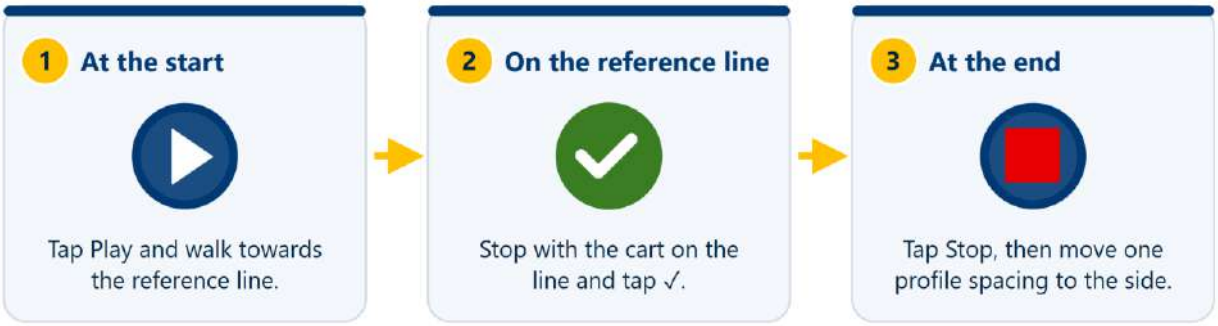


Figure 82 The three taps of every profile

While you record, the **Reference line** panel is shown on the radargram:

1 Reference line Which side of this profile the next profiles will be on: **left** or **right**. The highlighted (orange) button is selected.

2 Set for this profile **Not placed - provisional** until you tap ✓ on the reference line; **Placed** afterwards.

3 ✓ Tap when the cart is exactly on the reference line. You can tap it once per profile.

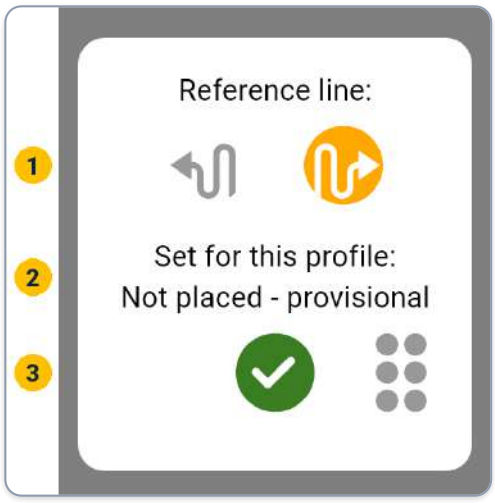


Figure 83 The Reference line panel while recording

Step by step

The numbers match **Figure 81**.

1. Place the cart at the start of profile 1, facing the reference line, and tap **Play**.

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2. Walk to the reference line and stop with the cart exactly on it. Choose the side where your next profiles will be (in the figure: **right**), then tap ✓. The status changes to **Placed**.
3. Continue to the end of the profile and tap **Stop**.
4. Move one profile spacing to the side you chose, turn the cart around, and tap **Play** to start profile 2 in the opposite direction.
5. Stop on the reference line and tap ✓. ViewPoint2 has already switched the side for you, because you are now walking the other way; check that it still points to where the next profiles will be.
6. Continue to the end and tap **Stop**. Repeat for every profile.

CAUTION Record the profiles in order, at the spacing you set, without skipping one. ViewPoint2 places each profile one spacing further along the reference line than the previous one, so a missed or extra profile shifts all the profiles after it.

Forgot to tap ✓?

ViewPoint2 will not stop a profile until its crossing is placed, and shows:



Figure 84 The message shown when you tap Stop before placing the crossing

Go back to the reference line, tap ✓ when the cart is on it, then tap Stop.

TIP Stop the cart exactly on the reference line before you tap ✓: line up the arrows on the cart hood with the line. The position of every trace in the profile is measured from this point.

8.4 Viewing the Survey

The map shows the reference line in red and your profiles side by side, on a plain background with a scale bar. As in any project, the current profile is green, the previous one yellow and older ones red.

Because a reference line survey has no GPS position, there is no background map: the map type and layers buttons and the GPS icon are not shown.

Markers, interpretations, the top view and the reports all work as in any other project.

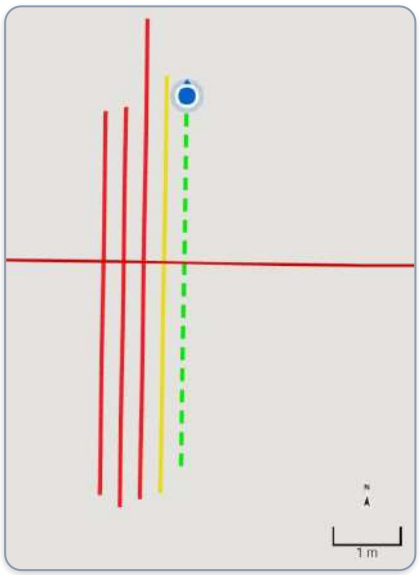


Figure 85 A reference line survey on the map

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9 Total Station Projects

A total station project places your profiles with a robotic total station. The instrument follows a prism on the GPR system and sends its position to ViewPoint2 several times a second. Use it where GPS cannot give the accuracy you need, for example indoors, beside tall buildings or under trees, or when the survey must be drawn in the coordinates of the site.

The positions are the instrument's own coordinates, in metres, in whatever the instrument is set up in: a grid of your own on the site, or a national grid. ViewPoint2 calls them **X**, **Y** and **Z**. The map, the ruler, the reports and the exports of a total station project all use them.

NOTE There is no separate project type for this. Any project becomes a total station project when you create it with the positioning source set to **Total Station**.

9.1 What You Need

- **A robotic total station** that sends its position as standard NMEA GGA sentences, the same sentence a GPS receiver sends. Set the instrument to send GGA, in metres. X is the first coordinate in the sentence, Y the second, and Z is the height.
- **A prism** fixed to the GPR system, where a GPS antenna would be mounted.
- **A connection to ViewPoint2**, one of two (**Figure 86**): **Cable**, a radio from the instrument connected to the GPR unit's serial port, as for a GNSS receiver; or **Bluetooth**, the instrument, or its controller, paired with the Device.

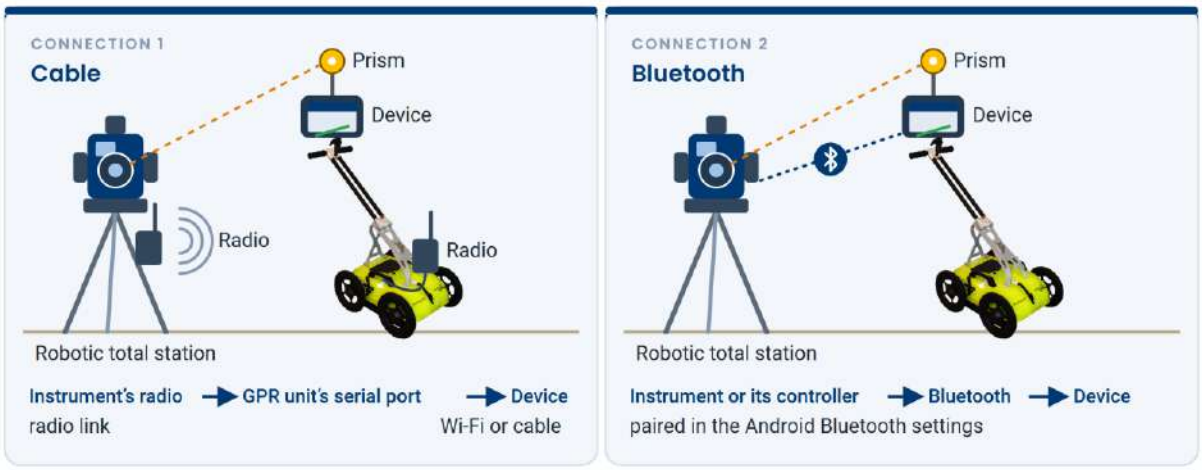


Figure 86 Two ways to connect a robotic total station: through the GPR unit's serial port, or over Bluetooth

TIP Set the target height in the instrument, so that the Z it sends is the height of the ground. ViewPoint2 records Z as the instrument sends it; there is no GPS pole height for a total station.

NOTE Keep the instrument in the same coordinate system for the whole project.

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9.2 Setting Up the Project

1. On the **Settings** page, under **Positioning**, set **Source** to **Total Station**.
2. Set **Connection** to **Cable** (the GPR unit's serial port) or **Bluetooth** (**Figure 87**).
3. On **Cable**, set **Baud rates** to the speed of the instrument's radio. Over Bluetooth, first pair the instrument, or its controller, with the Device in the Android Bluetooth settings. Then tap **Select Device** next to **Bluetooth device** and choose it from the list. If the banner 'Bluetooth not allowed' appears, allow ViewPoint2 **Nearby devices** in the Device's Android settings (see **section 2.1.3**).
4. Check that the GPS icon in the top bar is green: the instrument is sending positions (see **section 9.3**).
5. Create a new project as usual (see **section 5.1**). The **Positioning** column of the New Project window shows **Total Station**, with the baud rate or the Bluetooth device. Tap the green tick.

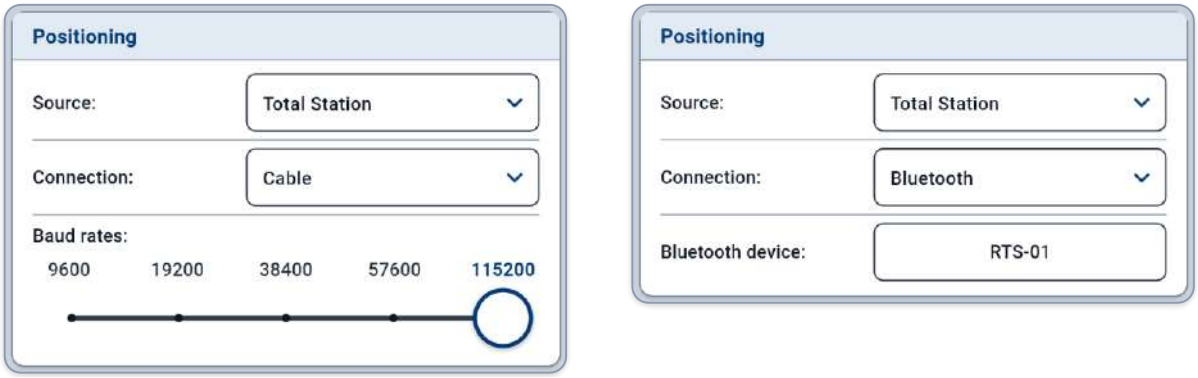


Figure 87 The Positioning card for a total station: on Cable (left) and over Bluetooth (right)

There is no **Acceptable GPS fix** and no **GPS pole height** for a total station: its positions have no GPS fix quality, and Z is recorded as the instrument sends it.

The map of a total station project is drawn on a plain background, so it needs no internet, and ViewPoint2 does not show the Map Unavailable message for it.

9.3 Checking the Positions

The GPS icon

With a total station, the GPS icon in the top bar shows whether positions are arriving. It is green while they arrive, and turns red with a cross a few seconds after they stop (about 6 seconds, or about 4 seconds while you record), for example when the instrument has lost the prism or its radio is out of range. It is never yellow, and there are no GPS fix banners, because a total station has no GPS fix quality.

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The GPS status panel

Tap the GPS icon to open the GPS status panel. With a total station it shows:

- its title, the source and its connection: **Total Station · Cable**, or **Total Station · Bluetooth:** and the device, with **Live** while positions arrive, **Waiting** before the first one and **Stopped** when they stop;
- **Last sentence**, how long ago it came, and the last sentence from the instrument, exactly as it arrived.

No GGA received yet means that nothing has arrived since you chose the source. Check that the instrument sends GGA sentences, the **Connection** setting and, on **Cable**, the baud rate.

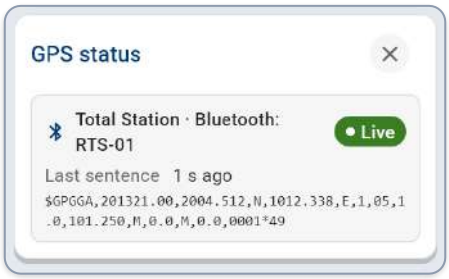


Figure 88 The GPS status panel with a total station over Bluetooth

Over Bluetooth

If the Bluetooth link to the instrument drops, ViewPoint2 tells you with a banner and reconnects by itself:

Banner	What it means
Total Station lost: Reconnecting. Check … is on and nearby. (yellow)	The Bluetooth link to the instrument has dropped, and positions have stopped. ViewPoint2 reconnects by itself. Keep the instrument switched on and nearby.
Total Station reconnected: Connected to … again. (green)	Positions are arriving again.
Could not connect to Total Station: Check the instrument is on and nearby. Try again. (yellow)	The device you chose did not answer. Check that it is switched on and nearby, and choose it again.

9.4 Recording the Profiles

Record as in any project, with **Play**, **Pause**, **Resume** and **Stop** (see **section 5.3**).

- **Before you start.** The map shows an arrow where the instrument sees the prism, also before you tap Play. With the X and Y grid on the map, you can walk to the start of a line (see **section 9.5**).
- **While you record,** every position the instrument sends is saved with the profile, and the line grows on the map as the positions arrive.
- **If the instrument loses the prism** for a moment, the line is drawn straight across the gap when it finds the prism again. When you tap Play, Resume or Stop after the instrument has lost the prism, ViewPoint2 does not use its last old position, so the line does not jump back to where the prism was lost.
- **If positions stop** while you record, the yellow banner ‘No positions’ appears, and the profile goes on recording without positions. Check the instrument and its connection.

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TIP Tap **Pause** before you lift or carry the GPR system, for example over a kerb, and **Resume** when it is back on the ground. Positions measured while the wheel stands still do not move the line: it goes straight on from where the wheel stopped to where it turns again.

Each profile's positions are saved in its own .tspraw and .tsp files, and the first positions recorded in a project fix its X and Y grid on the map (see **Appendix B**).

NOTE A total station project can be continued only with **Source** set to **Total Station**. With any other source, **Play** is greyed out; tap it to see why.

9.5 Viewing the Survey

A total station project opens on the radargram. To see the map, choose split view or map with the view switcher (see **section 5.2.1**).



Figure 89 A total station survey on the map, in the instrument's own X and Y

	Item	What it shows
1	**Grid**	Lines in the instrument's metres, labelled with their X along the bottom and their Y up the side, for example X 2005 and Y 1010. The spacing follows the zoom.
2	**Profiles**	As in any project, the current profile is green, the previous one yellow and older ones red.
3	**Arrow**	Where the instrument sees the prism, before you tap Play and while you record. It turns grey when positions stop arriving.

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	Item	What it shows
4	**Scale bar and north arrow**	North is the grid north of the instrument's coordinates.
5	**Map buttons**	Map screenshot, follow position, zoom to survey, layers (survey grid only) and depth slider (see **section 5.5**).

- The map is a plain background in the instrument's own metres: X across and Y up. There is no background map and no map type button; the Layers button offers only the survey grid.
- Grid north is always up: the map does not turn with the direction you walk. You can still turn it with two fingers.
- The map opens centred on your profiles, never on the Device's own location. Follow position keeps the instrument's position in view.
- In a new project, the grid appears as soon as the instrument sends its first position, so you can walk to a start coordinate before you tap Play.
- Markers, map interpretation and the top view work as in any other project. With PinPointR and CrossOver, switch on **Interpolate** to fill the space between the lines; with Raptor-45 and PinPointR 3D, tap **PROCESS** (see **chapter 6**).
- The ruler measures in the instrument's metres, and while you measure, the panel shows the X and Y of the last point (see **section 7.2.4**).

9.6 Reports and Exports

The reports and exports of a total station project use the instrument's own coordinates:

File	In a total station project
Field Report	Markers are listed with their X, Y and Z, and drawings with their X and Y. Lengths and areas are in the instrument's metres, and the map picture has an X and Y grid round it.
CSV	The X, Y and Z of every marker, and the X and Y of every drawing point, in the instrument's metres, in the columns ts_x, ts_y and ts_z. For a marker, feature_z gives the Z of the utility itself: its Z less its depth.
DXF, Shapefile	Drawn in X and Y, X across and Y up, in the instrument's metres.
KMZ, GeoTiff, PNG + world	Not available for a total station project: they place the survey on a map of the earth, and the instrument's own coordinates have no place on it. If you choose them, the window says 'Total Station X and Y are not places on the earth. Use DXF, Shapefile or CSV instead.'

Make them as in any project (see **chapter 10**).

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10 Reports and Exports

When your survey is finished, ViewPoint2 turns your markers, drawings and map into a report for your client, and into files for other programs such as Google Earth, CAD and GIS. You can make them in two places:

- **Inside the project:** all the files you choose, in one go (see **section 10.2**).
- **In the Project Library:** one file at a time, for any project, without opening it. This is also where you view a report (see **section 10.3**).

10.1 Which File Is for What

File	What it is for
Field Report	A PDF report for your client: a summary of the project, the map, a table of everything you found, your comments and screenshots.
KMZ	Your markers and drawings, to open in Google Earth.
GeoTiff	A picture of the map with the top view of your survey, placed at its real position, for GIS programs such as QGIS or ArcGIS.
PNG + world	The same picture as a PNG image with its position files, packed in a ZIP file, for programs that do not read GeoTIFF.
DXF	Your markers and the lines, points and areas you drew on the map, for CAD programs such as AutoCAD. Each marker is drawn as its number, at its position and depth, on a layer for its type of utility.
Shapefile	Your markers and drawings as GIS layers, packed in a ZIP file.
CSV	A table of all your markers and drawings with their positions and depths, for example for Excel. ViewPoint2 keeps it up to date while you work. It is the project's record of your interpretation: the KMZ, DXF, Shapefile and Field Report are made from it whenever you ask for them.

Your logo, name and company on the Field Report come from the Settings page (see **section 4.3.3**). All the files are saved in the project folder, under Export › *project name*_interps (see **section 11.6**).

> **NOTE** The files show the project as it is when you make them. If you add, change or delete markers or drawings afterwards, make the files again.

Total station projects

The files of a total station project are in the instrument's own X, Y and Z, and KMZ, GeoTiff and PNG + world are not available for it (see **section 9.6**).

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10.2 Making Reports Inside the Project

1. Open the project. Reports cannot be made while you are recording.
2. Open the side menu and tap **Reports**. The 'Make project reports?' window opens.
3. Switch on the files you want, then tap the green tick. ViewPoint2 shows a message while it makes them.
4. The 'Reports made' window lists the files, each with a green tick. Tap **Share** to send them all at once, for example by email or to Google Drive, or tap the cross to close the window.



Figure 90 Choosing the files

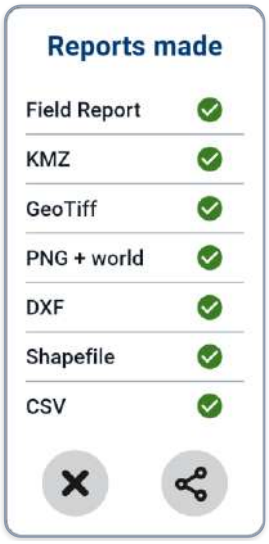


Figure 91 The files are made

If a file cannot be made, the window is called 'Some reports could not be made', or 'No reports could be made' when none could, the file is marked with a red sign, and the reason is shown under it. Follow the advice in the message, then make the reports again.

TIP GeoTiff and PNG + world are pictures of the map as it is drawn on the screen. Before you make them, show the map with the top view of your survey at the depth you want. For PinPointR and CrossOver, switch on Interpolate first (see **section 6.4.1**).

TIP For large or long surveys, choose **PNG + world** rather than GeoTiff. Both hold the same picture, but the GeoTiff is saved uncompressed: it is always a large file, up to about 50 MB, even when much of it is empty space around a long or diagonal survey, so it takes longer to save, copy and send. The PNG + world is compressed, so it is much smaller and quicker to copy and to email.

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10.3 Reports in the Project Library

In the Project Library (see **chapter 11**), you can make, view, share and delete the files of any project, without opening it. This is the only place where you can view a report in ViewPoint2.

Select the project in the list, then choose the file in the list of the **Export** panel.

If the file has not been made yet, the panel shows **+**. Tap it to make the file.

Once the file exists, the panel shows three buttons instead, to open, share or delete it.





Figure 92 Choosing a file in the Export panel

	Button	What it does
+	**Make**	Makes the chosen file for this project.
	Open	Opens the file. The Field Report opens in ViewPoint2; other files open in an app on the Device that can show them.
	Share	Sends the file with another app, for example by email or to Google Drive.
	Delete	Deletes the file. It is not shown for the CSV, which ViewPoint2 keeps up to date.

Tap **Open** next to the Field Report to read it in ViewPoint2, and **Close** to return (**Figure 93**).

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Figure 93 A Field Report opened from the Project Library

TIP To update a file that already exists, make the reports again from inside the project (see **section 10.2**), or delete the file here and make it again. Make GeoTiff and PNG + world from inside the project, as they are pictures of the map on the screen.

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11 The Project Library

The Project Library lists all the projects on the Device. Here you can see the details of a project, open it, rename it, zip and share it, and delete projects, profiles or processed data you no longer need. Open it with the folder button on the start screen, or with **Library** in the side menu.

11.1 The Library Screen

The parts of the Project Library are shown in **Figure 94**.



Figure 94 The Project Library, with a PinPointR 3D project selected

	Item	What it shows
1	**Project list**	All your projects, the most recently recorded first. Tap a project to select it. PinPointR and CrossOver projects are shown in blue, Raptor-45 and PinPointR 3D projects in black.
2	**Project name**	The name of the selected project. Tap the pencil to rename the project (see **section 11.3**).
3	**Project Details**	The settings the project was recorded with: GPR unit, trigger and interval, samples, data mode, soil velocity, GPS pole height, wheel, and the firmware of the GPR unit. Reference line projects also show the profile spacing.
4	**Project buttons**	Delete, delete processed data, zip, share and open (see the table below).

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	Item	What it shows
5	**Export**	Makes, opens, shares and deletes the reports and other files of the project (see **section 10.3**).
6	**Profiles**	The profiles of the project, with the number of traces and the length of each.
7	**Profile buttons**	Shown for the selected profile: delete the profile, or open the project at this profile.

The buttons

	Button	What it does
	**Open**	Opens the project at its last profile.
	**Zip**	Packs the whole project into one ZIP file, ready to send. For a large project (over 1 GB), ViewPoint2 asks first, as zipping takes a while.
	**Share**	Sends the project's ZIP file with another app on the Device, for example by email, to Google Drive or to Teams. If the project has not been zipped yet, ViewPoint2 offers to zip it first.
	**Delete processed data**	Frees storage space by deleting the results of PROCESS. Shown only when the project has been processed.
	**Delete project**	Deletes the whole project, after you confirm.
	**Open at profile**	Opens the project at the selected profile.
	**Delete profile**	Deletes the selected profile.
	**Rename**	Renames the project.

> **TIP** After you have recorded more profiles or made new reports, tap **Zip** again before you tap **Share**, so that the ZIP file contains them. The ZIP file leaves out the results of PROCESS to keep it small; PROCESS can make them again.

11.2 Opening a Project

Select the project and tap the green **Open** button. The project opens at its last profile. To open it at another profile, tap the profile in the **Profiles** list, then its green button. **Last project** on the start screen opens the project you worked on most recently.

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To record more profiles in a project, connect the same type of GPR system that the project was recorded with, set **Positioning** to the project's kind of positioning (GPS, Total Station or Reference Line), open the project and tap **Play**. ViewPoint2 puts the project's own settings on the GPR unit, so the new profiles match the ones already recorded. If Play is greyed out, tap it to see why. Any project can still be viewed, processed and reported on.

> **NOTE** If the Device has no internet and the map of the area is not stored on it, ViewPoint2 shows **Map Unavailable** before it opens a GPS project. Tap **Open anyway** to open the project without a background map, or **Go Back**.

11.3 Renaming a Project

1. Select the project and tap the pencil next to its name. You can also touch and hold the project in the list.
2. Type the new name and tap **YES**.



Figure 95 Renaming a project

If the project is open, it is closed and opened again under the new name. Reports you have already made still show the old name, so ViewPoint2 removes them once the project is renamed. Make them again afterwards (see **section 10.2**). If the project cannot be renamed, the window says why, and the project and its reports stay as they were.

11.4 Deleting Projects, Profiles and Processed Data

Deleting a project

Select the project and tap the red bin. Tap **YES** to delete the project and all its data, or **NO** to keep it. If it is the open project, ViewPoint2 closes it first; while a profile is being recorded, it is not deleted, and the banner 'Not deleted' says why.



Figure 96 Deleting a project

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Deleting a profile

Tap the profile in the **Profiles** list, then its grey bin. If it is the last profile of the project, ViewPoint2 asks whether you want to delete the whole project.

Deleting processed data

The results of PROCESS can take a lot of storage space. Tap the broom button to delete them. The window shows how much space this frees. Your recorded data is kept, and you can run PROCESS again at any time; it takes as long as it did the first time.

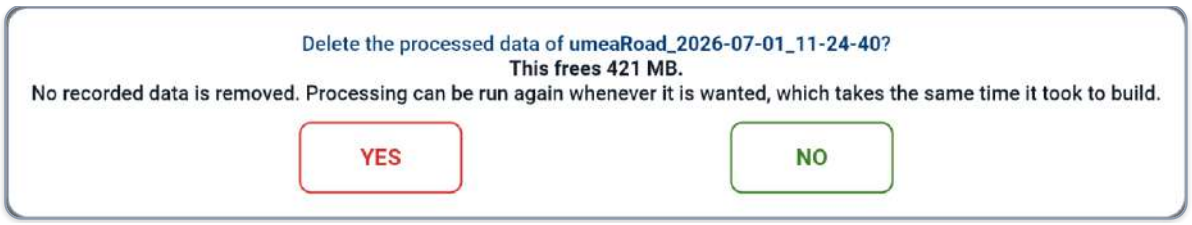


Figure 97 Deleting the processed data of a project

CAUTION Deleting a project or a profile cannot be undone. If you may need the data later, zip and share the project first.

11.5 Your Projects on the Map

Tap **Map** on the start screen or in the side menu to see where your projects were recorded (**Figure 98**).

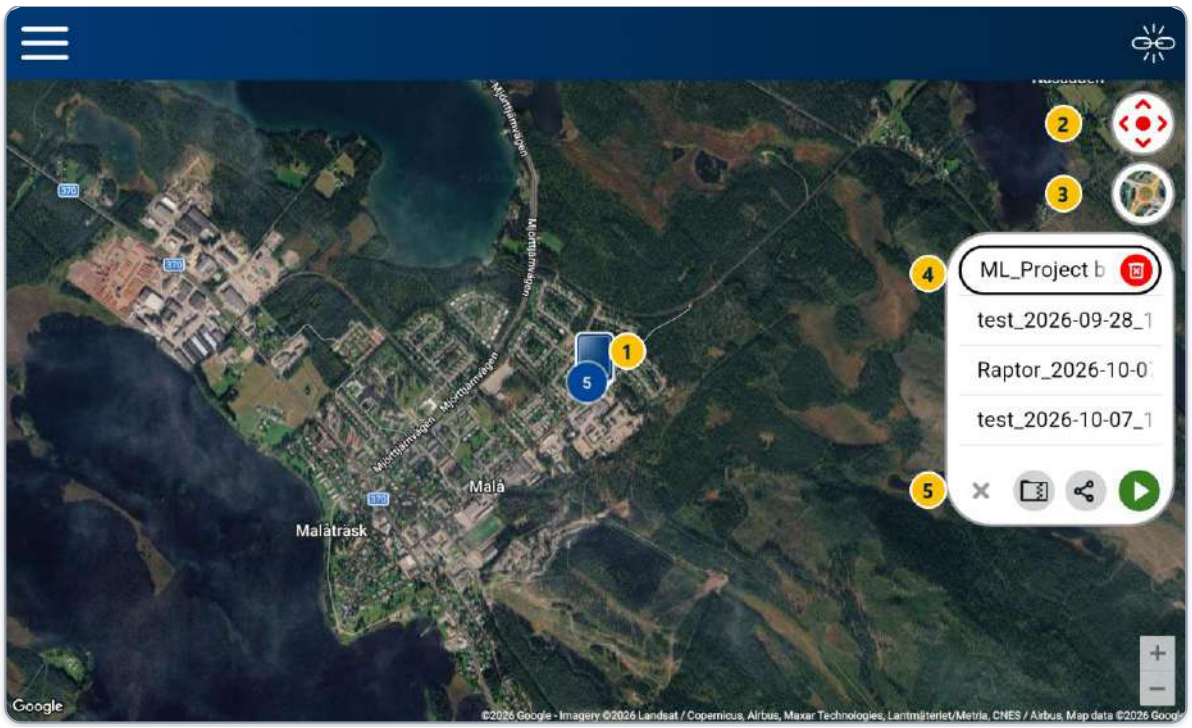


Figure 98 All your projects on the map, with the project list open

	Item	What it does
1	**Projects**	Each project is shown where its survey starts. Projects close together are grouped in a circle with their number; zoom in to separate them. Projects without GPS positions, such as Reference Line and Total Station projects, are not shown.
2	**Centre map**	Moves the map to the GPR unit's last GPS position, or else to your own location.
3	**Map type**	Switches between the map types, for example satellite or road map.
4	**Project list**	The folder button shows how many projects are in view. Tap it to list them, then tap a project to select it. The red bin next to the selected project deletes it.
5	**List buttons**	Close the list, zip or share the selected project, or open it.

> **NOTE** The map needs an internet connection, or map images of the area that were stored on the Device earlier.

11.6 Where Your Data Is Stored

ViewPoint2 keeps all projects in its own folder on the Device:

Internal storage › Android › data › com.impulseradar.viewpoint2 › files › Viewpoint II › Projects

Each project has its own folder, named after the project:

In the project folder	What it holds
Recordings	The recorded profiles, with their GPS positions and markers. Leave these files as they are.
Export › project name_interps	The reports and other files from **chapter 10**.
Export › OperatorScreenShots	The pictures you take with the screenshot buttons on the radargram and on the map.
Export › AutoScreenShots	The pictures ViewPoint2 takes for the Field Report, such as the automatic marker screenshots and the map.
layers	The map layers you have imported into the project.
processed	The results of PROCESS. They are deleted with the broom button in the Project Library.
project name.zip	The ZIP file made with the Zip button.

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Copying projects to a PC

The simplest way is **Zip** and **Share** in the Project Library: send the ZIP file to yourself by email, or to cloud storage such as Google Drive or OneDrive.

You can also connect the Device to the PC with a USB cable. On the Device, allow file transfer when asked. Then open the Device in File Explorer on the PC, go to the folder above, and copy the project folder.

> **NOTE** Some Devices do not show the Android › data folder on a PC. In that case, use Zip and Share.

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Appendix A Specifications

ImpulseRadar products are under continuous development, and we reserve the right to change specifications at any time without prior notice. For the latest specifications, see the product data sheets on our website, or contact us at support@impulseradar.com.

A.1 PinPointR and CrossOver

	PinPointR	CrossOver CO1760	CrossOver CO730
GPR unit			
Technology	ImpulseRadar real-time sampling	ImpulseRadar real-time sampling	ImpulseRadar real-time sampling
Centre frequency	CH-1: 400 MHz (LF) CH-2: 800 MHz (HF)	CH-1: 170 MHz (LF) CH-2: 600 MHz (HF)	CH-1: 70 MHz (LF) CH-2: 300 MHz (HF)
Channels	CH-1 and CH-2 (LF and HF)	Dual-channel, or CH-1 or CH-2 only	Dual-channel, or CH-1 or CH-2 only
Signal to noise ratio (SNR)	> 100 dB	> 100 dB	> 100 dB
Significant/useful number of bits	> 16 bit	> 16 bit	> 16 bit
Scans per second	> 800	> 800	> 800
Survey speed	> 130 km/h at 5 cm point interval	> 130 km/h at 5 cm point interval	> 130 km/h at 5 cm point interval
Time window	388 ns (LF), 194 ns (HF)	1050 ns (LF), 263 ns (HF)	2500 ns (LF), 625 ns (HF)
Bandwidth	> 120 % (fractional, −10 dB)	> 120 % (fractional, −10 dB)	> 120 % (fractional, −10 dB)
Acquisition mode	Wheel, time or manual	Wheel, time or manual	Wheel, time or manual
Positioning	Wheel encoder, internal DGPS, external GPS (NMEA 0183)	Wheel encoder, internal DGPS, external GPS (NMEA 0183)	Wheel encoder, internal DGPS, external GPS (NMEA 0183)
Power supply	12 V Li-Ion rechargeable battery, or external 12 V DC source (optional)	12 V Li-Ion rechargeable battery, or external 12 V DC source (optional)	12 V Li-Ion rechargeable battery, or external 12 V DC source (optional)

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	PinPointR	CrossOver CO1760	CrossOver CO730
Power consumption	1.3 A	1.3 A (dual), 1.0 A (single)	1.5 A (dual), 1.2 A (single)
Operating time	7 hours	7 hours (dual), 9 hours (single)	6 hours (dual), 8 hours (single)
Dimensions	444 × 355 × 194 mm	695 × 445 × 205 mm	960 × 760 × 270 mm
Weight (including battery)	6.35 kg	9.5 kg	20.2 kg
Operating temperature	−20 to +50 °C	−20 to +50 °C	−20 to +50 °C
Environmental	IP65	IP65	IP65
Regulatory certification	CE, FCC and IC approved	CE, FCC and IC approved	CE, FCC and IC approved
Cart			
Dimensions, folded for transport	870 × 540 × 370 mm	920 × 640 × 390 mm	–
Dimensions, in use	1010 × 540 × 1030 mm	1100 × 640 × 1030 mm	–
Wheels	4 × Ø 315 mm	4 × Ø 315 mm	–
Weight (cart only)	12.8 kg	15.3 kg	–

A.2 Raptor-45 and PinPointR 3D

	Raptor-45	PinPointR 3D
GPR unit		
Technology	ImpulseRadar real-time sampling	ImpulseRadar real-time sampling
Centre frequency	450 MHz	450 MHz
Channels	8 (push cart), up to 18 (vehicle mount)	8
Signal to noise ratio (SNR)	> 100 dB	> 100 dB
Significant/useful number of bits	> 16 bit	> 16 bit
Scans per second	> 800	> 800

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	Raptor-45	PinPointR 3D
Survey speed	> 130 km/h at 5 cm point interval	> 130 km/h at 5 cm point interval
Data acquisition rate	160 MHz	160 MHz
Time window	166 ns	166 ns
Bandwidth	> 120 % (fractional, −10 dB)	> 120 % (fractional, −10 dB)
Acquisition mode	Wheel, time or manual	Wheel, time or manual
Positioning	Wheel encoder, external GPS and total station	Wheel encoder, external GPS and total station
GPS support	Internal and external GPS, NMEA 0183 protocol	Internal and external GPS, NMEA 0183 protocol
Data time-tagging	To 1 ms of GPS time	To 1 ms of GPS time
Swath	67.5 cm (push cart)	59 cm (centre to centre, channel 1 to 8)
Power supply	12 V Li-Ion rechargeable battery, or external 12 V DC source	12 V Li-Ion rechargeable battery, or external 12 V DC source
Power consumption	0.5 A per channel	3.2 A
Operating time	10 hours (8 channels, 50 Ah battery)	5.4 hours (8 channels, two hot-swappable 8.7 Ah batteries)
Dimensions	230 × 165 × 160 mm (one antenna)	880 × 600 × 190 mm (antenna)
Weight	1.85 kg (one antenna)	13.2 kg (antenna)
Operating temperature	−20 to +50 °C	−20 to +50 °C
Environmental	IP65	IP65
Regulatory certification	CE, FCC and IC approved	CE, FCC and IC approved
Cart		
Dimensions	4-wheel cart: 920 × 1020 × 450 mm 3-wheel cart: 920 × 900 × 450 mm	Folded: 990 × 870 × 370 mm In use: 990 × 870 × 1050 mm
Weight	56 kg (cart with antennas)	12.2 kg (cart only)

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A.3 The Android Device

These are the requirements for the Device that runs ViewPoint2, for all GPR systems:

	ViewPoint2
Operating system	Android 10 or later
Screen	720 × 1280 pixels or better. A tablet is recommended for all systems, and strongly recommended for Raptor-45 and PinPointR 3D.
Connection to the GPR unit	PinPointR and CrossOver: Wi-Fi. A CrossOver can also use an Ethernet cable, and so can a PinPointR with ImpulseRadar's Ethernet kit. Raptor-45 and PinPointR 3D: Ethernet cable through a USB-C-to-Ethernet adapter. The Device needs a USB-C port that supports such an adapter.
Network settings (arrays)	Static IP address 10.10.255.252, netmask 255.255.0.0
Bluetooth	Needed only for a GNSS receiver or a total station connected over Bluetooth
Recommended Device	Samsung Galaxy Tab Active5 Pro, or equivalent (see below)

Our recommended Device is the Samsung Galaxy Tab Active5 Pro, a rugged tablet made for field work:

	Samsung Galaxy Tab Active5 Pro
Screen	10.1 inches, 1920 × 1200 pixels, 120 Hz
Processor	Qualcomm Snapdragon 7s Gen 3
Memory and storage	6 GB with 128 GB, or 8 GB with 256 GB, and a microSD card slot
Battery	10,100 mAh
Ruggedness	IP68 dust and water protection, and MIL-STD-810H
Operating system	Android 15 at launch
Models	SM-X350 (Wi-Fi) and SM-X356B (5G). With the 5G model, the map can use mobile data while an array is connected by cable.

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Appendix B File Formats

This appendix describes the files ViewPoint2 stores, for when you open your data in desktop software such as CrossPoint, Condor or GIS programs, or send it to ImpulseRadar support.

B.1 Where ViewPoint2 Keeps Its Files

All files are kept under Internal storage › Android › data › com.impulseradar.viewpoint2 › files › Viewpoint II (see **section 11.6**).

Folder	What it holds
Projects	One folder for each project (see **section B.2**).
Firmware	Firmware files for the GPR unit, supplied by ImpulseRadar support and offered by **Update unit firmware** on the Settings page.
Corporate Logo	Your logo images for the Field Report (.png or .jpg).
Logs	ViewPoint2's log files, one for each day, for the last 14 days. **Send logs to support** on the About page sends them to ImpulseRadar.

B.2 Files in a Project Folder

The files of each profile are named after the project, the profile and the channel:

- **PinPointR and CrossOver:** project name, a 4-digit profile number and the channel, where 0 is channel 1 (LF) and 1 is channel 2 (HF). Example: Site_A_0001_0.iprb.
- **Raptor-45 and PinPointR 3D:** project name, a 3-digit pass number and the channel, from A01 upwards. Example: Site_B_001_A01.iprb.

File	One for each	What it holds
.iprb	Profile and channel	The radar data: a binary file with the traces stored one after another. Each sample is a signed 16-bit or 32-bit integer (see DATA VERSION in the header).
.iprh	Profile and channel	The header: the settings the profile was recorded with, as text (see **section B.3**).
.mrk	Profile and channel	The markers of the profile (see **section B.4**).
.cor	Profile	The GPS position of every trace (see **section B.4**).
.time	Profile	The time each trace was recorded.
.gps	Profile	Every GPS position received during the profile, as received.

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File	One for each	What it holds
.tsp	Profile	Total station positions, in the layout Talon writes, each at the trace where ViewPoint2 places it. A total station profile has this file and the .tspraw in place of the .cor, .time and .gps files.
.tspraw	Profile	Total station positions as they were recorded: every position the instrument sent, with the time it reached the Device. ViewPoint2 makes the .tsp from it. Keep it with the project.
.ord	Pass (arrays)	The position of each channel across the array.
.mlproj	Project (reference line)	The list of profiles of a reference line project and the profile spacing.
.tsgrid	Project (total station)	The origin of the project's X and Y grid on the map, written once from the first positions recorded. Keep it with the project.
viewstate.json	Project	How the project was last displayed, so that it opens the same way again.
layers	Project (folder)	The map layers imported into the project.
Export	Project (folder)	Reports and exports, and the screenshots (see **section 11.6**).
processed	Project (folder)	The results of PROCESS. They can be deleted and made again at any time.
project name.zip	Project	The ZIP file made with Zip. It holds everything except the processed folder and the display settings.

> **NOTE** Times in the .time, .cor and .gps files are in UTC. The START TIME and STOP TIME in the header are the Device's local time.

B.3 The Header File (.iprh)

The header is a text file with one setting on each line, written as NAME: VALUE, for example SAMPLES: 512.

Name	Meaning
HEADER VERSION	Version of the header format
DATA VERSION	Data format of the .iprb file: 16 or 32 bit
DATE	Date of the measurement (YYYY-MM-DD)

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Name	Meaning
START TIME, STOP TIME	Start and end of the profile (hh:mm:ss, local time)
ANTENNA	Antenna frequency
ANTENNA SEPARATION	Distance between transmitter and receiver, in metres
SAMPLES	Number of samples in each trace
SIGNAL POSITION	Signal position
CLIPPED SAMPLES	Not in use
RUNS, MAX STACKS, AUTOSTACKS	Number of runs, maximum number of stacks, and automatic stacking (1 = on)
FREQUENCY	Sampling frequency
TIMEWINDOW	Time window, in nanoseconds
LAST TRACE	Number of traces in the profile
TRIG SOURCE	What triggers a trace: wheel, time or manual
TIME INTERVAL	Interval between traces with the time trigger, in seconds
DISTANCE INTERVAL	Interval between traces with the wheel trigger, in metres, as set in the GPR unit
USER DISTANCE INTERVAL	The interval you chose, in metres
STOP POSITION	Length of the profile, in metres
WHEEL NAME, WHEEL CALIBRATION	The wheel used, and its calibration in ticks per metre
ZERO LEVEL	Zero level, in samples
SOIL VELOCITY	Soil velocity, in m/µs
GPS POLE HEIGHT	Height of the GPS antenna above the ground, in metres
PREPROCESSING	Pre-processing information
OPERATOR COMMENT	Android version and the Device model
ANTENNA F/W, ANTENNA H/W, ANTENNA FPGA	Firmware, hardware and FPGA versions of the receiver
ANTENNA SERIAL, ANTENNA NAME	Serial number and name of the receiver
SOFTWARE VERSION	The ViewPoint2 version used

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Name	Meaning
POSITIONING	Positioning: 0 = none or reference line, 1 = total station, 2 = GPS
CHANNELS, CHANNEL CONFIGURATION	Number of channels, and this channel's configuration
CH_X_OFFSET, CH_Y_OFFSET	Position of this channel relative to the positioning, in metres (across and along)
MEASUREMENT DIRECTION	Forward = 1, backward = −1
RELATIVE DIRECTION, RELATIVE DISTANCE, RELATIVE START	Reference line projects: direction to the start of the reference line, distance from its start to this profile, and distance from the start of the profile to the reference line
START TEMPERATURE, STOP TEMPERATURE	Temperature of the GPR unit at the start and end of the profile, in °C

B.4 Positions, Markers and Interpretations

GPS positions (.cor)

A text file with one row for every trace. The values are separated by tabs:

Trace number · date · time (UTC) · latitude · N/S · longitude · E/W · altitude above mean sea level · M · GPS fix quality

The GPS fix quality is: 0 = invalid, 1 = GPS fix, 2 = DGPS fix, 3 = PPS fix, 4 = RTK fixed, 5 = RTK float, 6 = estimated (dead reckoning), 7 = manual input, 8 = simulation.

Markers (.mrk)

A text file with a header line, then one row for each marker. The values are separated by tabs:

Trace · sample · marker standard · colour (#RRGGBB) · marker type number · (empty) · latitude · N/S · longitude · E/W · altitude · M · GPS fix quality · (empty) · marker ID

A marker placed without a GPS position has empty position fields and fix quality 0.

Markers and interpretations (CSV)

The file project name_interps.csv in Export › project name_interps holds all markers and map interpretations of the project, with their positions and depths. It has two tables. In a total station project, the GPS columns, latitude to northing, are replaced by the instrument's X, Y and Z in ts_x, ts_y and ts_z, and by feature_z, the Z of the utility (Z less its depth):

Table	Columns
Markers	uuid, swath, channel, trace, sample, standard, code_index, code_name, color, latitude, longitude, surface_altitude_m, gps_fix, depth_m, feature_altitude_m, easting, northing, label
Interpretations	feature_id, name, type, point, color, fill_color, comment, latitude, longitude, easting, northing, depth_m, channel, sample, segment_length_m, swath, trace, photo

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Table	Columns
Markers (total station)	uuid, swath, channel, trace, sample, standard, code_index, code_name, color, ts_x, ts_y, ts_z, depth_m, feature_z, label
Interpretations (total station)	feature_id, name, type, point, color, fill_color, comment, ts_x, ts_y, ts_z, feature_z, depth_m, channel, sample, segment_length_m, swath, trace, photo

Total station positions (.tsp, .tspraw) A text file as Talon writes it: five header lines that start with $, then one row, separated by tabs, for each position kept: trace number, X, Y and Z in metres, the instrument's time (hh:mm:ss:mmm) and its status. The trace number is the trace at which ViewPoint2 places the position, from the time the instrument measured it. X is the first coordinate in the instrument's sentence, Y the second. The .tspraw beside it holds every position as it was recorded, with a seventh column, Arrival: the time it reached the Device.

B.5 Project Names

Spaces in a new project name are replaced with underscores. A project name can have up to 50 characters (fewer with letters such as å, ä or ö) and needs at least one letter or number. It cannot contain any of the characters \ / : * ? " < > |, cannot start or end with a full stop, and cannot be the same as another project on the Device, even with different capitals.

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Appendix C Troubleshooting

ViewPoint2 tells you what is happening with coloured banners below the top bar (see **section 3.3**), with windows that ask you to confirm or choose, and with short lines in its panels. Red banners stay until the problem is solved. Yellow and green banners close by themselves after 5 seconds, or when you tap their cross. Blue banners show the progress of a longer task.

C.1 Common Problems

Problem	What to do
ViewPoint2 cannot find the GPR unit	PinPointR and CrossOver: check that the GPR unit is switched on and that the Device is on the unit's Wi-Fi network. Switch off 'Auto reconnect' for other saved Wi-Fi networks. Raptor-45 and PinPointR 3D: check the Ethernet cable and the adapter, and that the Device has the static IP address 10.10.255.252 with netmask 255.255.0.0.
The connection is lost	ViewPoint2 decides the connection is lost after 12 seconds without an answer from the GPR unit when not recording, or, with a Raptor-45 or PinPointR 3D, 6 seconds while recording, and reconnects by itself as soon as the unit answers. A PinPointR or CrossOver recording goes on; the red banner 'Off the unit's Wi-Fi' shows while the Device is off the unit's network. Check the Wi-Fi or the cable, and keep the Device near the unit (see **section 2.4**).
The map is empty	In a GPS project, the Device has no internet, or a GPR unit connected by cable is using the Device's network. Use a Device with a SIM card and mobile data, or open the map of the survey area once while the Device has internet, so that it is stored. The top view, markers and interpretations work without a background map.
The GPS icon is red	No GPS has been chosen yet, or no satellites can be seen, for example indoors. Choose the internal or external GPS on the Settings page, and go outdoors with a clear view of the sky.
The GPS icon is yellow, not green	Your GPS positions do not meet the acceptable GPS fix set on the Settings page. Positions are still recorded. Check the receiver, or change the acceptable GPS fix.
The GPS icon blinks green and yellow	The position is good, but the GPR unit's own GPS is not giving the radar its time yet (Raptor-45 and PinPointR 3D, with External GPS). Stay under open sky and wait until the icon is solid green, usually a few minutes. Until then, a Raptor-45 keeps New project, Discovery mode, Last project and Play greyed out (see 'GPS time sync' in **section 4.2.3**).

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Problem	What to do
The GPS time sync line never turns green	Raptor-45 with External GPS. After about 10 minutes under open sky, switch the radar off and on and wait again. If it still does not turn green and the receiver is on Cable, switch off Time sync from radar GPS under Positioning, with Advanced configuration on (see 'GPS time sync' in **section 4.2.3**).
Play is greyed out in an open project	Tap Play to see why. The project was recorded with another kind of positioning or another GPR system, or a Raptor-45 with External GPS is still waiting for GPS time sync. Set Positioning as the message says, or connect the system it names. The project can still be viewed, processed and reported on (see **section 5.3**).
The GPS icon stays red with a total station	Open the GPS status panel. 'No GGA received yet': check that the instrument sends GGA sentences, and check the Connection setting and the baud rate or Bluetooth device. A last sentence many seconds old: the instrument has stopped sending, for example because it has lost the prism (see **section 9.3**).
Total station lines are far too long or too short	Set the instrument to send its coordinates in metres.
The start screen shows 'Missing required permissions'	Tap the button and allow Location (Precise, While using the app) and Photos and videos (Allow all) (see **section 2.1.3**).
Traces are missed while recording	Survey more slowly, keep the Device close to the GPR unit, and use 16-bit data, a suitable time window and a longer trace interval (see **section 5.3.1**).
A report or export cannot be made	Read the reason under the file in the 'Some reports could not be made' window, follow its advice and make the reports again (see **section 10.2**).
A project cannot be renamed	Stop recording, and wait until any reports, zip, share or PROCESS have finished.
The Device is running out of storage	Delete processed data or old projects in the Project Library, after zipping and sharing anything you want to keep.
A firmware update does not finish	Keep the GPR unit switched on and close to the Device; the restart can take a few minutes. If the window says Not connected again, wait another minute, then switch the unit off and on and connect to it: the Unit information panel shows the firmware it runs. If it says Not updated, Not confirmed or Partly updated, do what the window says, or contact ImpulseRadar support.

C.2 Common Messages

These are the messages you are most likely to see, grouped by subject, with what each one means and what to do. Other messages are rare; if you see one you do not understand, send the logs to support from the About page. The message is written as it appears on the screen; "…" stands for a

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name or a number that changes. Where a message appears only with some GPR systems, this is said under it.

Start and permissions

Message	Where	What it means and what to do
Missing required permissions	Window	A permission ViewPoint2 needs, such as location, was refused. Tap **Allow required permissions** and accept. If the button says **Open settings to update permissions**, tap it and allow them there. The window closes by itself as soon as they are allowed.

Connection

Message	Where	What it means and what to do
Connection lost: Not recording. Reconnecting to the unit.	Red banner	ViewPoint2 has stopped hearing from the GPR unit. A Raptor-45 or PinPointR 3D recording, or the Trace View, has stopped; a PinPointR or CrossOver recording goes on (see Off the unit's Wi-Fi). Check the unit is on and charged, and the Device is on its Wi-Fi or cable. ViewPoint2 reconnects by itself. You can close the banner with its cross.
Connected again: The unit is connected again.	Green banner	ViewPoint2 is talking to the GPR unit again. A Raptor-45 or PinPointR 3D recording that was running when the connection dropped was stopped, so start a new one if you need it. The banner closes by itself.
Off the unit's Wi-Fi: Since …. Stop only when back on it: off it, a Stop does not reach the unit. The unit records on unless switched off.	Red banner	The Device left the GPR unit's Wi-Fi during a profile, at the time shown, and the unit records on. Get the Device back on the unit's network; the banner closes by itself. Then push on for a few metres and tap **Stop**. While the profile is paused, the banner reads Resume or **Stop** only when back on it. The run is paused. *PinPointR and CrossOver only*
Not on the unit's Wi-Fi: Tap Pause or Resume again once back on it: off it, neither reaches the unit, nor does a Stop.	Yellow banner	You tapped **Pause** or **Resume** while the Device is off the GPR unit's Wi-Fi, so nothing was sent. Get the Device back on the unit's network, wait until the red banner has closed, and tap again. *PinPointR and CrossOver only*
The Gpr Unit is connected to another user. Do you want to force the connection?	Window	Another Device holds the GPR unit but is not recording. Tap **YES** to take it over, or **NO** to leave it; ViewPoint2 then keeps trying and connects once the unit is free.

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Settings and the GPR unit

Message	Where	What it means and what to do
Wheel not saved	Yellow banner	The wheel was not saved. Check that the GPR unit is still connected, give the wheel a name (not 'New Wheel') and a calibration above 0, and tap the green tick again.
Traces may be missed: Go slower. The receivers will not adapt to speed.	Yellow banner	The receivers did not accept automatic stacking, usually because of older receiver firmware. Recording still works; survey more slowly, and ask ImpulseRadar support about a firmware update. *Raptor-45 only*
Sending the firmware to the unit, Updating the unit	Window	The firmware update is under way. Keep the GPR unit switched on and close to the Device. ViewPoint2 connects to the unit again by itself, which can take a few minutes, and then says how the update ended: Firmware updated, or Not updated with the reason. Tap Close. If the unit does not come back, contact ImpulseRadar support.

GPS and positioning

Message	Where	What it means and what to do
GPS fix not acceptable: Now …. Settings asks for …	Yellow banner	Your GPS fix has been below the **Acceptable GPS fix** set in **Settings** for 5 seconds. Positions are still recorded. Wait for it to improve before relying on positions, or lower that setting if the job allows.
GPS fix acceptable again: Now …	Green banner	The fix has been back at your **Acceptable GPS fix** for 5 seconds.
No positions: This profile is being recorded without positions.	Yellow banner	Positions stopped arriving while you record, from the GPS receiver or the total station. It repeats every 20 seconds until they return. Check the receiver or instrument and its cable or Bluetooth link. The GPR unit keeps recording.
Bluetooth GPS lost: Reconnecting. Check … is on and nearby.	Yellow banner	The Bluetooth link to the receiver dropped and positions have stopped. ViewPoint2 reconnects by itself, so you do not need to choose it again. With a total station, the banner reads Total Station lost.
Bluetooth GPS reconnected: Connected to … again.	Green banner	The Bluetooth link is back, and positions arrive again. With a total station, the banner reads Total Station reconnected.
Could not connect to GPS: Check the receiver is on and nearby. Try again.	Yellow banner	The receiver you chose did not answer. Check it is switched on, charged and nearby, and choose it again. With a total station, the banner reads Could not connect to Total Station.

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Message	Where	What it means and what to do
Bluetooth not allowed: Allow Nearby devices (or Location) in Android settings.	Yellow banner	ViewPoint2 may not use Bluetooth, so the source or connection stays as it was. In the Device's Android settings, allow ViewPoint2 **Nearby devices** (Location on older Android), then choose Bluetooth again.
Positioning not changed: A profile is being recorded. Stop it first.	Yellow banner	You chose another kind of positioning (GPS, Total Station or Reference Line) while a profile is being recorded, or, with a PinPointR or CrossOver, another GPS source or connection while a profile is being recorded or paused. **Stop** the profile, then change Source. With a PinPointR or CrossOver, a baud rate or GNSS change is refused in the same way, under the title Baud rate not changed or GNSS settings not applied: make it again after **Stop**.
No GGA received yet	GPS status panel	With a total station: nothing has arrived from the instrument since you chose it. Check that the instrument sends GGA sentences, the Connection setting and, on Cable, the baud rate.
Time sync: Inactive	GPS status panel	The GPR unit is getting no GPS time pulse yet, so traces are timed by the Device's clock. You can still record, except with a Raptor-45 on External GPS, which waits for GPS time sync. For the most accurate positions, wait until it reads Active.
Waiting	GPS status panel	On the receiver's card: no position has arrived yet. On the **GPS time sync** card: the GPR unit's own GPS is not giving the radar its time yet (No fix yet while it has no fix). Wait under open sky until it reads **Live**, then record.
Waiting for GPS time sync	Window	You tapped **New project**, **Discovery mode**, **Last project** or **Play** before the radar has **GPS time sync**: its own GPS has not locked onto satellites yet. Tap **OK** and wait under open sky, usually a few minutes, until the **GPS time sync** card in the GPS status panel shows 'GPS time sync ready. You can start a project.' If it has not come after about 10 minutes, see 'GPS time sync' in **section 4.2.3**. *Raptor-45 only*
Trace clock: Radar's counter, pulse lost … ago	GPS status panel	The GPS time pulse dropped out while you were recording. The GPR unit keeps timing traces on its own counter, so you can carry on. *Raptor-45 only*
Trace clock: Tablet - the radar's time is not usable	GPS status panel	Traces are being timed by the Device's clock (the card shows **Tablet**), so positions along the line can be slightly off. If accuracy matters, stop, wait for **Time sync: Active**, then record again. *Raptor-45 only*

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Recording

Message	Where	What it means and what to do
Recording did not start: Transmitters stayed off. Switch the unit off and on.	Red banner	**Play** could not switch on the array's transmitters, so nothing was recorded. Switch the radar off and on, wait until it has connected again, then tap **Play**. The banner closes once the radar is connected again. *Raptor-45 only*
Recording did not start: The unit did not answer Start. Tap Play again.	Yellow banner	The GPR unit did not answer when you tapped **Play**, so nothing was recorded. Tap **Play** again. If it keeps happening, check that the Device is on the unit's Wi-Fi and close to the unit. *PinPointR and CrossOver only*
Recording did not start: Could not make the profile's files. Check free space.	Yellow banner	The new profile's files could not be made, usually because the Device is full, so nothing was recorded. Free some storage, for example by deleting processed data or old projects, then tap **Play** again.
Restoring missed traces	Window	Shown after you tap **Stop** when some traces did not arrive while recording. ViewPoint2 is fetching them from the GPR unit; the window counts down what is left on HF and LF and closes by itself. **CANCEL** stops it, and traces not yet fetched stay missing. *PinPointR and CrossOver only*
Still recording: Stop not confirmed. Tap Stop again.	Red banner	The GPR unit did not confirm the stop, so ViewPoint2 is still recording. Tap **Stop** again. The banner stays until the recording has really ended. If it keeps happening, check the connection to the GPR unit. *Raptor-45 and PinPointR 3D only*
Unit did not stop: Switch the unit off and on to stop it.	Red banner	The GPR unit did not confirm that it stopped recording, after you pressed Back while a Raptor-45 or PinPointR 3D was recording, or when ViewPoint2 connected again to a unit that was still recording. Switch the GPR unit off and on. The banner closes when the unit has stopped or connects again.
Reference line not placed: Still recording. Place it, then tap Stop.	Yellow banner	In Reference Line mode, **Stop** is refused until this profile's crossing is marked, so recording carries on. Tap the green tick in the **Reference line** panel as you cross the reference line, then tap **Stop**.
Profile not continued: Only the profile just recorded can be continued.	Yellow banner	You touched and held Play on another profile than the one just recorded. Nothing was recorded. Tap Play to start a new profile.
A profile is being recorded: Look at other profiles once it has stopped.	Yellow banner	You tapped another profile, on the map or with the arrows of the swath navigator, while a profile is being recorded or paused, or while its missed traces are being restored. Tap **Stop**, wait until Restoring missed traces has closed, then look at the other profiles. *PinPointR and CrossOver only*

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Message	Where	What it means and what to do
Positioning does not match	Window	Shown when you tap a greyed-out Play: the project was recorded with another kind of positioning than **Settings** shows, for example 'This is a Total Station project. Set Positioning to Total Station to continue it.' Change Source on the **Settings** page as it says. The project can still be viewed, processed and reported on.
Another unit is connected	Window	Shown when you tap a greyed-out Play: the project was recorded with another GPR system, for example 'This is a PinPointR 3D project. A PinPointR is connected.' Connect the system it names to continue the project. The project can still be viewed, processed and reported on.

Projects and the Project Library

Message	Where	What it means and what to do
Spaces changed to _: Saved as …	Yellow banner	For information only. The spaces in the name you typed were replaced with underscores. If **Add date to project name** is on, the date and time follow it.
A project with the name "…" already exists. Do you want to replace it?	Window	Tap **YES** to delete the existing project of that name, with all its data, and start the new one. This cannot be undone. Tap **NO** to go back and choose another name.
Trace interval too small: Set a larger Interval in Settings > Trigger.	Yellow banner	The interval is shorter than one tick of the selected wheel, so the project was not created. Enter a larger interval, or check the wheel's calibration.
Discovery mode not started: Check the connection to the unit and try again.	Yellow banner	The GPR unit did not take the settings, so Discovery mode did not open. Check that the unit is switched on and connected, then tap **Discovery mode** again. If the banner gives another reason, do what it says.
A profile is being recorded: Stop it first.	Yellow banner	You tried to open or create another project, or to start Discovery mode, while a profile is being recorded or paused, or while its missed traces are being restored. Tap **Stop**, wait until Restoring missed traces has closed, then try again. *PinPointR and CrossOver only*
Not deleted: …: Stop recording first. Nothing was deleted.	Yellow banner	You tried to delete the open project, one of its profiles or all projects, or to replace it from New project, while a profile is being recorded or paused. Tap **Stop**, then try again. The banner can also say that missed traces are still being restored, or that the unit is being started or set up: wait a moment, then try again.

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Processing

Message	Where	What it means and what to do
Change the velocity? The processing already computed was built for the previous velocity and cannot be reused. Accepting this one rebuilds it for the whole project, which takes as long as the first time did.	Window	You closed the **Soil velocity** or **Known depth** slider at a new velocity while **PROCESS** is on and finished. Tap **Rebuild** to process again at the new velocity, or **Keep previous** to keep the existing processing. *PinPointR and CrossOver only*
build did not finish	Button text	The last processing run stopped before it finished, so nothing processed is shown. Tap **PROCESS** to try again. If it stops again, free storage on the Device, for example by deleting other projects' processed data. *Raptor-45 and PinPointR 3D only*

Map and map layers

Message	Where	What it means and what to do
Map Unavailable: No internet and no cached map found, so the map will be blank. A GPR unit connected by cable takes over the network on this tablet. For an aerial photograph: unplug the unit, join Wi-Fi, open the map to cache your area, then plug the unit back in. The top view, markers and interpretations work either way.	Window	Shown before you create, open or resume a GPS project, or start Discovery mode with a GPS source, when there is no internet and no saved map. Tap **Open anyway** to work without the photo, or **Go Back** to get the map first. Reference Line and Total Station projects need no background map, so it is not shown for them.
Not imported: …: this type cannot be imported. Use KML, GeoTIFF, or a ZIP of a PNG with its world file, or of a shapefile set.	Yellow banner	You picked a file that cannot be imported by itself, or is not a map file. Zip the PNG with its world file, or all the files of the shapefile, and import the ZIP instead.
Could not load a map layer: Could not read …. Check its size and projection.	Yellow banner	The picture is larger than 60 megapixels, or its coordinate system cannot be placed: a GeoTIFF must be in a projected system such as UTM, with its EPSG code. Export a smaller one, cropped to the site, in WGS 84 / UTM, ETRS89 / UTM or SWEREF 99 TM, and import it.
Could not load a map layer: Could not read …. Its shapes may not be supported.	Yellow banner	The shapefile is damaged, or holds shapes ViewPoint2 cannot draw, such as 3D or multipoint shapes. Export it again as plain 2D points, lines or polygons, zip all its files and import the ZIP.
Could not open the ZIP: Copy … again before importing.	Yellow banner	The ZIP file could not be read, often because it was not copied completely. Copy it to the Device again and import it once more.
No map in the ZIP: It needs a GeoTIFF, KML, shapefile or PNG + world.	Yellow banner	The ZIP holds no file ViewPoint2 can draw. Put the map files themselves in the ZIP, for example a PNG with its world file, or all the files of a shapefile.

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Reports, exports and sharing

Message	Where	What it means and what to do
Nothing is marked or drawn in this project yet.	Line in a window	A KMZ, DXF, Shapefile or CSV holds your markers and map drawings, and this project has none. Place markers or draw on the map first, then make it again.
No map: open the project map, make it again.	Line in a window	The Field Report was made without its map picture, which is taken from the project's map view while it is on screen. Open the project, show its map, and make the report again before sending it to a client.
The survey has no GPS positions yet.	Line in a window	GeoTiff, PNG + world, DXF and Shapefile are placed by the survey's GPS positions, and this survey has none yet. If it was recorded with GPS, show the project map, wait until the survey appears, then make the file again. A survey without GPS can still have the CSV and the Field Report.
Failed to zip the project.	Window	The project could not be zipped. The window closes by itself. Check that the Device has free storage and try again. If it keeps failing, send the logs to support from the **About** page.
The tablet is full. Free some space and try again.	Line in a window	There is no room on the Device for the file, so it was not made. Move finished projects off the Device or delete files you no longer need, then make it again.

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