PI8000

Pile Integrity and Impact Echo

User Manual

Document Information

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Classification:	Technical Manual

Revision History

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0.0	Feb 18, 2026	DC

Content

Legal Notice

This document contains important information on the safety, use and maintenance of Proceq products. Read through this document carefully before the first use of the instrument. Observe the safety and warning notes in this documentation and on the product. This is a prerequisite for safe working and trouble-free operation.

Symbols used

This icon signals important information, specifications, proper working procedure and to avoid data loss, damage or destruction of the instrument.

This note signifies a warning about dangers to life and limb if the apparatus is handled improperly. Observe these notes and be particularly careful in these cases. Also inform other users on all safety notes. Besides the notes in this instruction manual the generally applicable safety instructions and regulations for prevention of accidents must be observed.

Limitation of use

The instrument is only to be used for its designated purpose as described herein.

- Replace faulty components only with original replacement parts from Proceq.
- Accessories should only be installed or connected to the instrument if they are expressly authorized by Proceq. If other accessories are installed or connected to the instrument, then Proceq will accept no liability and the product guarantee is forfeited.

Liability

Our “General Terms and Conditions of Sales and Delivery” apply in all cases. Warranty and liability claims arising from personal injury and damage to property cannot be upheld if they are due to one or more of the following causes:

- Failure to use the instrument in accordance with its designated use as described in the product documentation.
- Incorrect performance check for operation and maintenance of the instrument and its components.
- Failure to adhere to the instructions dealing with the performance check, operation and maintenance of the instrument and its components.
- Unauthorised modifications to the instrument and its components.
- Serious damage resulting from the effects of foreign bodies, accidents, vandalism and force majeure. All information contained in this documentation is presented in good faith and believed to be correct. Proceq AG makes no warranties and excludes all liability as to the completeness and/or accuracy of the information.

Safety Instructions

The equipment is not allowed to be operated by children or anyone under the influence of alcohol, drugs or pharmaceutical preparations. Anyone who is not familiar with the instrument must be supervised when using the equipment.

Reserved Rights

The content of this document is intellectual property of Proceq SA and prohibited to be copied neither in a photomechanical or electronic way, nor in excerpts, saved and/or be passed on to other persons and institutions. This document can be changed at any time and without any prenotification or announcement.

Unauthorized modifications and changes of the product are not permitted.

Damages during carriage

On receipt of the goods, check for any visible damages on the packaging. If it is undamaged you may sign the receipt of the goods. If you do suspect by visual inspection that damage has occurred, make a note of the visible damage on the delivery receipt and request the courier to countersign it. Moreover, the courier service must be held responsible for the damage in writing.

If a hidden damage is discovered while unpacking, you have to inform and hold the courier liable immediately in the following way: “When opening the parcel we had to notice that … etc.“ This superficial checking of the goods has to be done within the time limit set by the carrier, which is normally 7 days. However, the period could vary depending on the courier. Hence, it is recommended to check the exact time limit when receiving the goods.

If there are any damages also inform your authorized Proceq agent or **Proceq SA** immediately.

Shipment

Should the device be transported again, it must be packaged properly. Preferably use the original packaging for later shipments. Additionally, use filling material in the package to protect the device from any shock during carriage.

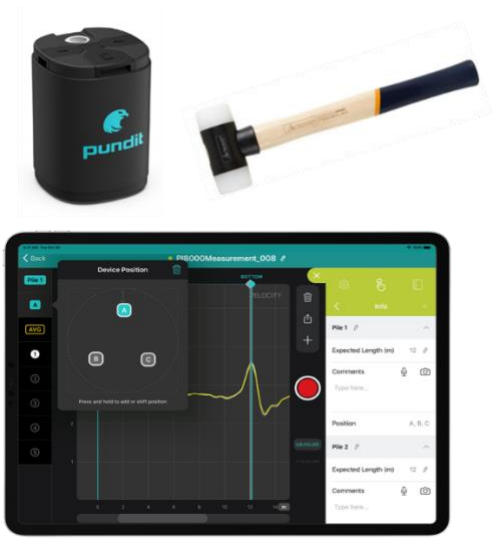
Safety notes and hints

- All maintenance and repair work which is not explicitly permitted and described in the present manual shall only be carried out by **Proceq SA** or your authorized service center, failure to comply voids warranty.
- **Proceq SA** refuses all warranty and liability claims for damages caused by usage of the product in combination with **non-original accessories**, or accessories from 3rd party suppliers.
- Never immerse the device in water or other liquids: **Danger of short circuit!**
- Never leave the product under direct sun exposure. Always store the product in its carrying case.

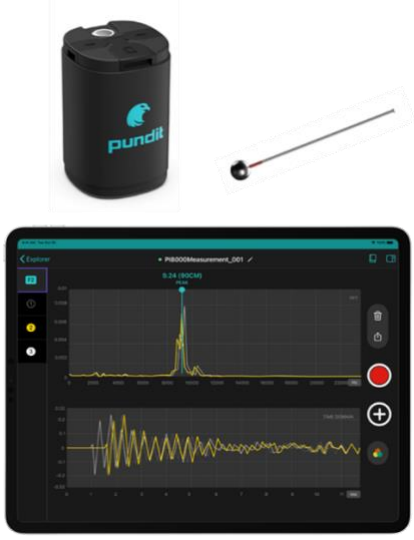
For the operation of the product all local safety regulations apply.

1 Introduction

The Pundit PI8000 instrument combines low strain impact integrity testing of deep foundations, also known as pile integrity testing, with impact echo testing for determination of the thickness of concrete elements and location of defects within concrete structures.



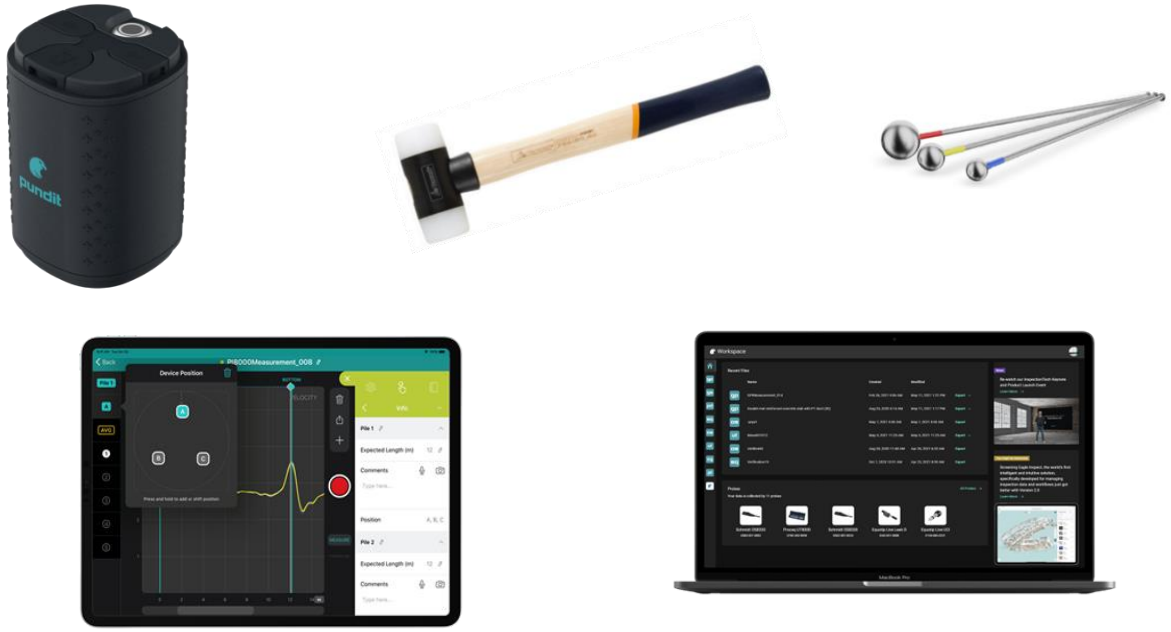
Pile Integrity Testing



Impact Echo Testing

The product consists of

- the PI8000 sensor unit
- Hammer for pile integrity testing, Impactors for impact echo testing
- the Pundit Impact iOS app
- and the Screening Eagle Workspace platform.



1.1 Product versions

To be able to use the functionalities of the pi app, a software license is required.

The following licenses are available:

- Pundit PI8000 Pro

	PI8000 Pro
Acquisition modes	• Pile integrity • Impact echo - Grid scan • Impact echo - Spot scan
View modes	• Measurement - Acceleration • Measurement – Velocity • Measurement – FFT • Pile compare • Impact echo – Acceleration / FFT • Impact echo - Grid
Data acquisition assistance	• Impact monitoring • Impact averaging • Impact exclusion
On-site annotations	• Pile status • Tagging • Photos • Notes • Voice notes • GPS positioning
Image processing	• Auto pile toe detection • Auto gain • Auto time gain compensation • Pulse velocity calibration • Frequency filters (apply to all) • Auto FFT peak detection • Auto thickness measurement
Data options	• Cloud storage and sharing • HTML export • Raw data export

1.2 Product applications

The PI8000 sensor can be used for two major applications configurations:

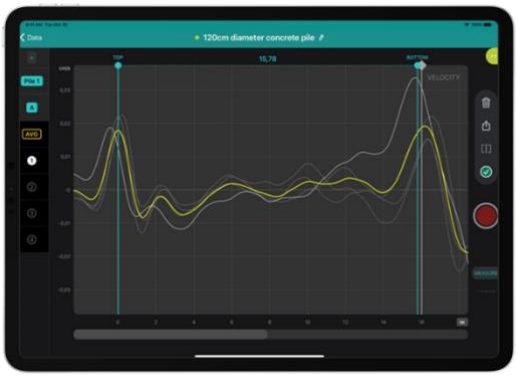
- Pile integrity testing – Low strain impact testing to quickly assess the length of piles and identify major defects. Quick comparison of all piles on the site.
- Impact echo testing – Determination of variations in the thickness of concrete elements. Location of defects such as voids and delaminations.

1.2.1 Pile integrity test

Deep Foundations:

- Cast in place piles.
- Driven piles.

Detection:



- Piles with free end.
- Piles with toe in bedrock.
- Short piles.
- Necking.
- Bulging.
- Cracks and voids.

1.2.2 Impact echo test

Concrete elements:

- Slabs, walls, tunnel linings

Detection

- Thickness
- Delaminations and voids
- Honeycombs
- Bonding failures
- PT duct voids

2 Scope of Delivery

Please refer to the Quick start Guide provided in the standard delivery and available in download section of the product webpage:

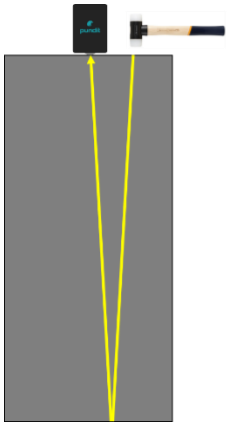
pundit-pi8000-quick-start-guide.pdf

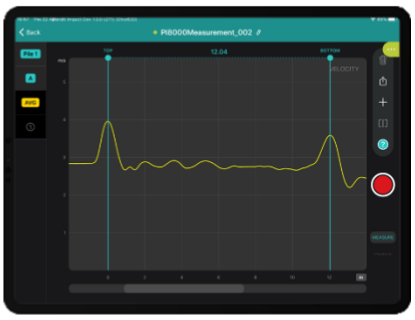
3 Measurement Principle

3.1 Low strain pile integrity test

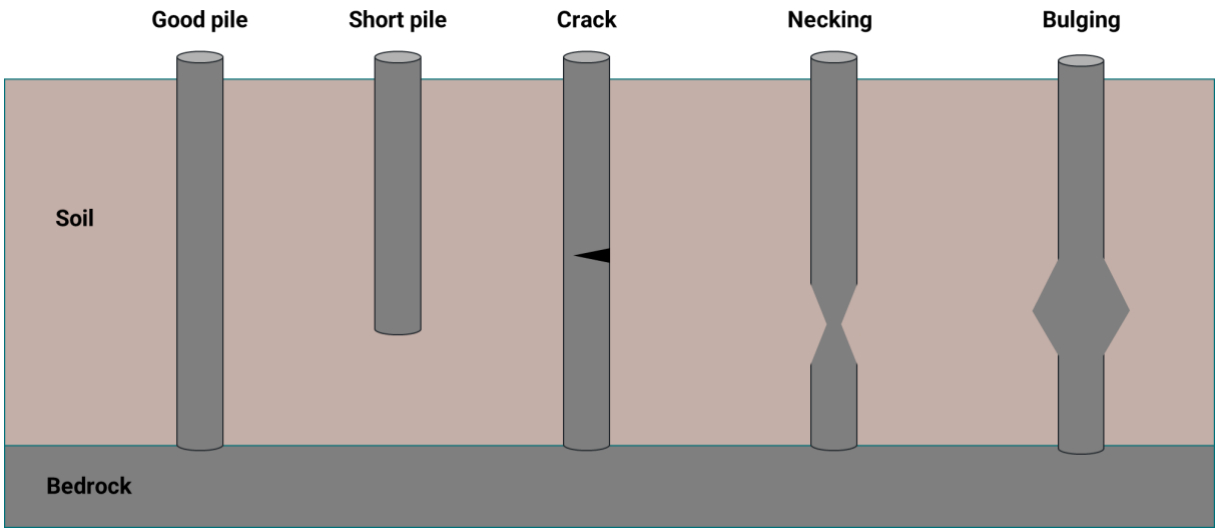
PI8000 uses the pulse echo method for pile integrity testing. A hammer is used to tap on the head of the pile. This generates a compression wave which travels along the length of the pile. Whenever there is a change in impedance, either at the toe of the pile or due to a defect, the signal is reflected.

The reflected signal can be used to determine the length of the pile and the presence of major defects.

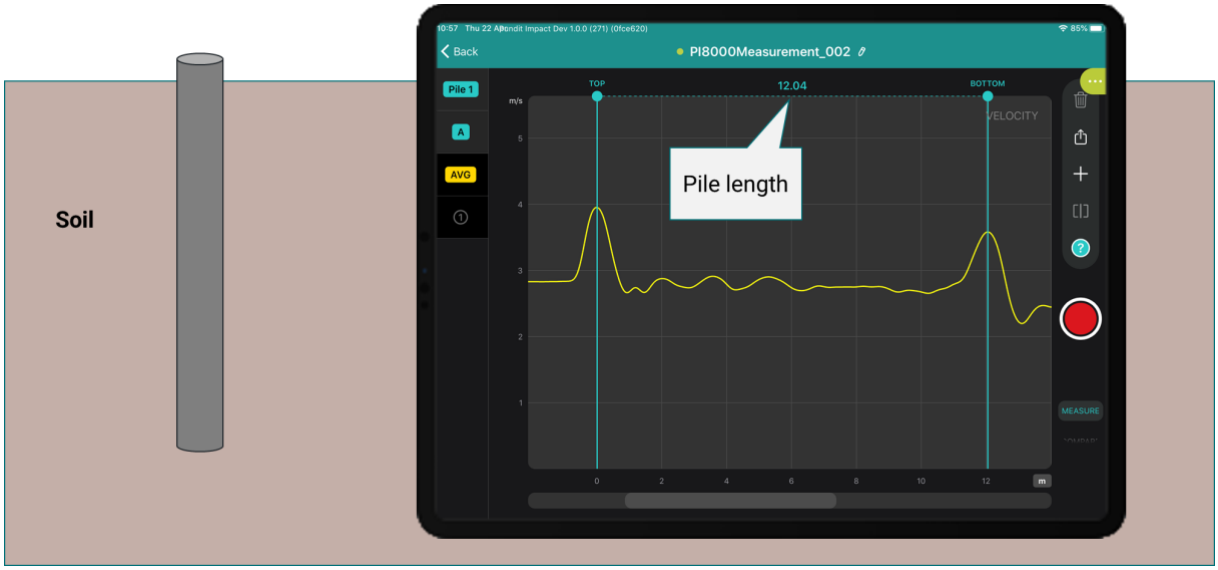




The following types of defects are detectable with the low strain pile integrity test.

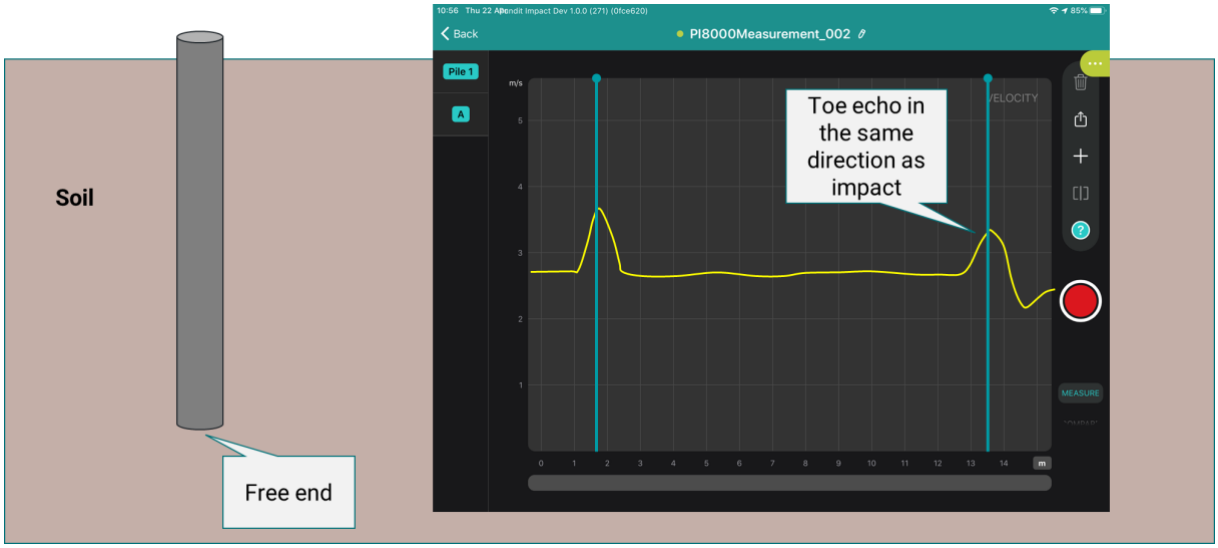


3.1.1 Basic interpretation



Markers are used to identify the top and bottom of the pile. The pile length is determined by the pulse velocity that is input. A typical (default) value for the pulse velocity is 4000 m/s (13123 ft/s).

3.1.2 Pile with a free end



If the end of the pile is free, surrounded by material with a lower acoustic impedance, then the echo from the toe will be in the same direction as the impact.

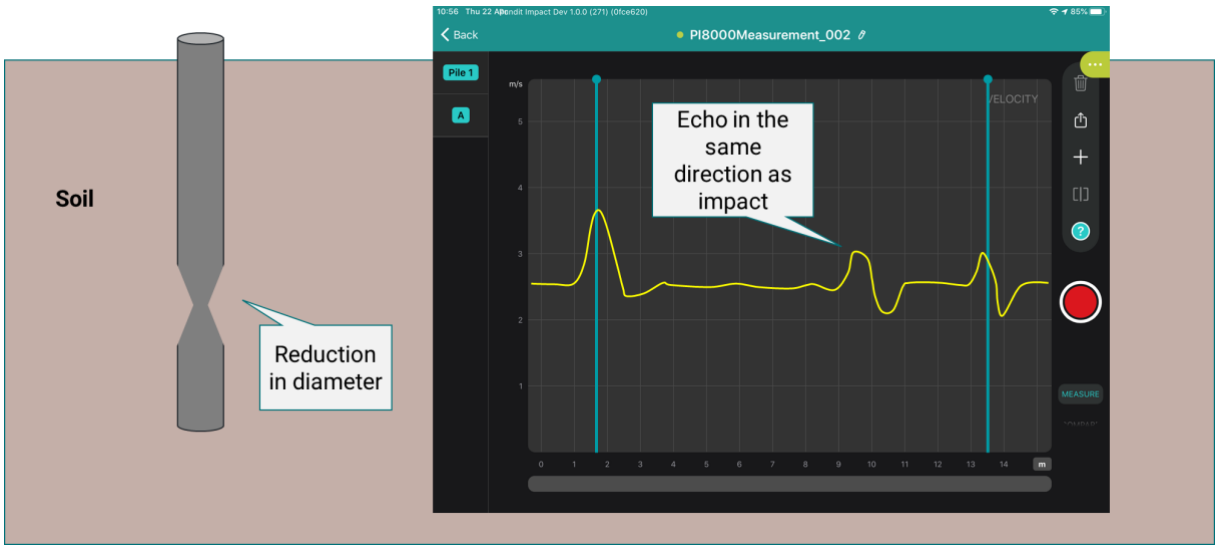
3.1.3 Toe in bedrock

If the toe of the pile is up against bedrock then the echo will be in the opposite direction to the impact.

3.1.4 Short pile

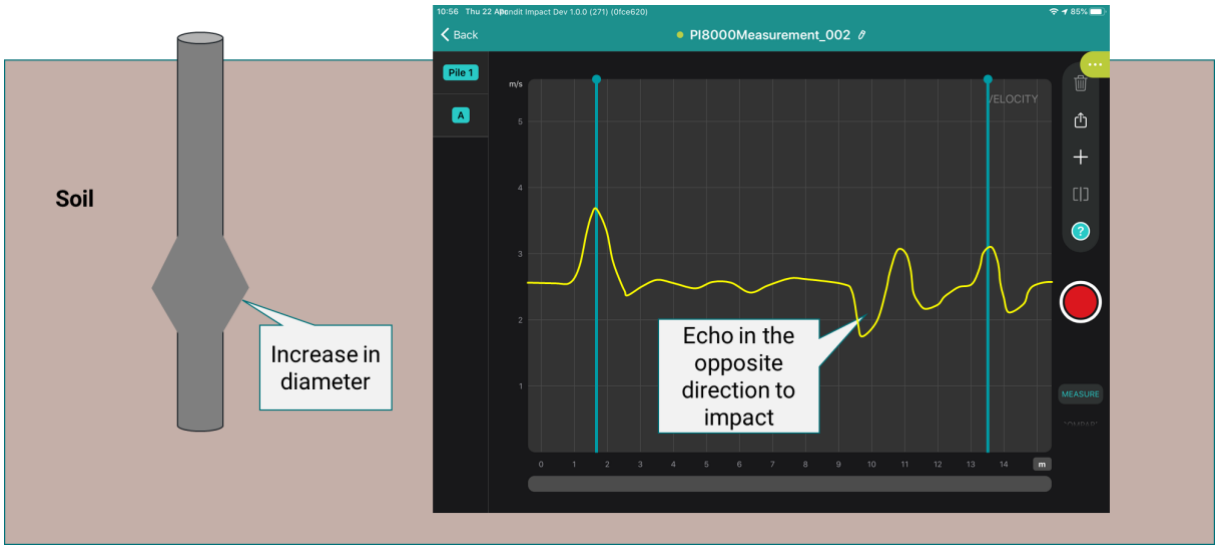
The expected length of the pile is a required input for the test, so that the site measurements can be easily compared for compliance.

3.1.5 Necking



Necking is a significant decrease in the diameter at a location along the length of the pile. This generates an echo in the same direction to the impact. The toe of the pile should still be detectable in this case.

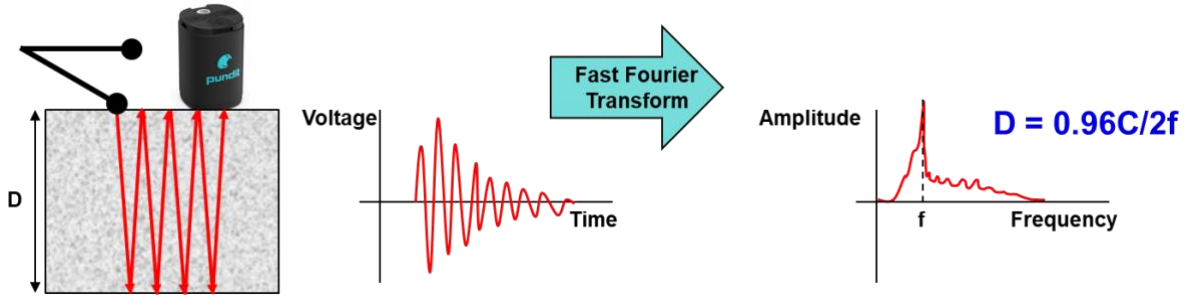
3.1.6 Bulging



Bulging is a significant increase in the diameter at a location along the length of the pile. This generates an echo in the opposite direction to the impact. The toe of the pile should still be detectable in this case.

3.2 Impact echo test

A second application supported by the PI8000 is the impact echo test.



A spherical metallic impactor is used to generate low frequency stress waves in the material under test. The frequencies generated by the impact are determined by the diameter of the impactor. Typically, the frequencies are less than 80 kHz.

The impact creates different types of stress waves, P-wave, S-waves and surface waves. If the sensor is placed close to the point of impact then the received signal is dominated by the P-waves. So for the impact echo test we consider the P-wave velocity.

The sensor detects a series of repeating P-wave echoes. The P-wave produced by the impact undergoes multiple reflections as the signal is reflected backwards and forwards from each surface of the object. So the frequency of the repeated P-wave echoes depends on the velocity ‘C’ of the signal and the distance it has to cover from surface to surface ‘D’.

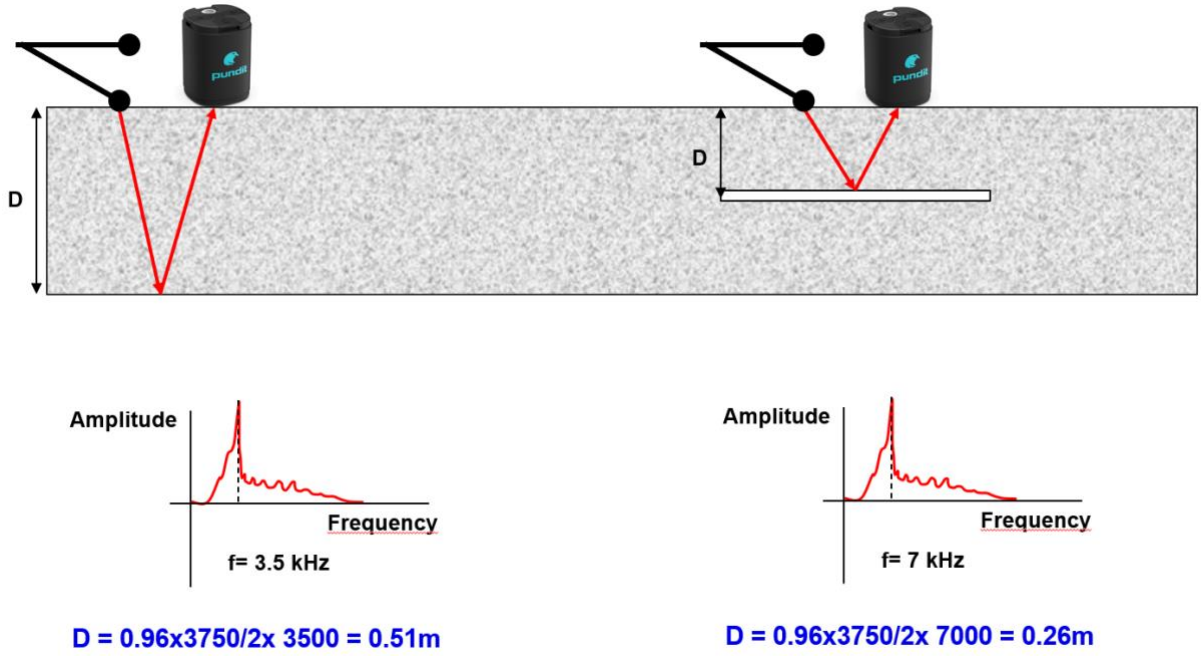
This frequency can be analyzed by using a Fast Fourier Transform to convert the signal into the frequency domain.

The receiver is placed close to the impactor so that the round trip distance is assumed to be 2x D. The frequency is wave speed divided by the round trip distance.

A factor of 0.96 is applied to the P-wave velocity. This is called the apparent wave speed. This factor was determined by empirical studies in the early days of impact echo.

Usually we know the speed from calibration at a known thickness and the frequency can be determined from the frequency domain analysis. This allows us to calculate the thickness ‘D’ of the object under test using the equation shown.

3.2.1 Flaw detection



An echo from a defect such as a delamination or void within the object, shortens the path that the signal has to travel and increases the frequency which means the peak in the frequency domain shifts to a higher frequency.

3.2.2 Impactors

The kit contains three impactors with varying diameters.

The table below shows the typical frequencies generated by these impactors and the minimum measurable thickness.

7.5mm, 10mm and 15mm

Diameter	Max frequency kHz	Min measurable depth, mm
7.5	31	65
10	23	86
15	16	129

The maximum measurable depth is generally determined by the quality of the concrete.

3.2.3 Limits of impact echo technology

The following recommendations are rules of thumb which can typically be applied to this technique.

- ASTM
- Thickness measurements can typically be achieved up to maximum thickness of 80 cm.
- Near surface defect detection is unreliable. See the table above for the minimum measurable depths.
- Voids or defects can be detected if the width to depth is greater than 1.
- Test surface should be dry, clean and smooth.

4 PI8000 Operation

4.1 Preliminary operations

4.1.1 Pile integrity testing

The surface should be dry and free of debris. If necessary an angle grinder can be used to smooth the top of the pile.

If the pulse velocity is not known a default value of 4000 m/s (13123 ft/s) is often used. As this test is a comparison method, this is not so critical.

4.1.2 Impact echo testing

Ensure that the surface is clean and smooth. If the surface is rough it may be necessary to grind it smooth.

Ideally the pulse velocity should be calibrated at a location of known thickness.

If this is not possible, a default pulse velocity of 4000 m/s (13123 ft/s) can be selected. For locating internal defects this is acceptable. For accurate thickness measurements it is necessary to calibrate the pulse velocity.

4.2 Device Overview

4.2.1 Switching-on and getting started

Please refer to the Quick Start Guide (included in standard delivery) for first steps with your PI8000. The Quick Start Guide is also available in the download section of the product webpage : pundit-pi8000-quick-start-guide.pdf.

Insert an AA battery into the battery compartment as directed in the quick start guide.

⚠ Be sure to read the warnings on handling and charging batteries in the quick start guide. Turn on the device by pressing the ON/OFF button for 2s. The device will turn on and the pushbutton LED will turn green, indicating that it is ready to pair with the app.

An overview of the pushbutton operations can be seen below

Device ON/OFF	
Medium push (2s)	Power ON / OFF
Very Long push (8s)	Reboot device
During measurement	
Short push	Arming the probe – start / resume measurement
Short push	Disarming the probe – stop measurement

The pushbutton LED provides useful information about the device's status. This is summarized in the table below.

LED behaviour	
Battery Status (when turning on the device)	Green: single quick blink: >20%
	Red: single quick blink: <20%
Turn on, awaiting Bluetooth connection	Green pulsing
Connected, awaiting arming (disarmed) • Paused • Stopped	Blue pulsing
Armed • Resumed	Blue Solid
While measuring (rod/wheels)	Blue Solid
Errors	
Error	Red pulsing
Device in boot loader mode	Red-Green alternate pulsing
Battery Charging	
While Charging	Green pulsing 0.5Hz
Charged done	Green solid
Error • batteries not charging / not inserted • Overvoltage / overheated	Red solid

4.2.2 Download the Pundit Impact App and Create Eagle Account

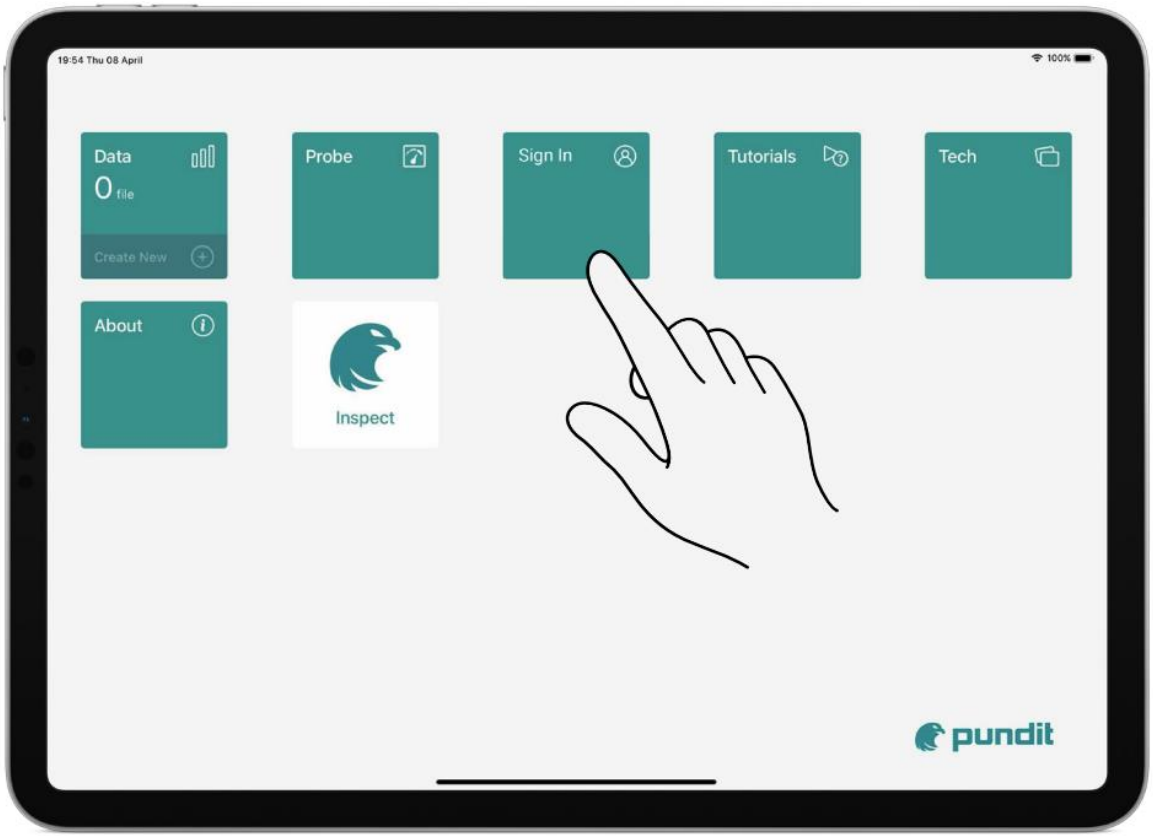
The app can be downloaded free of charge from the Apple Store. To do so, you need to have a compatible iPad with a minimum version of iOS installed. (See the most recent information for compatible iPads at Screening Eagle website).

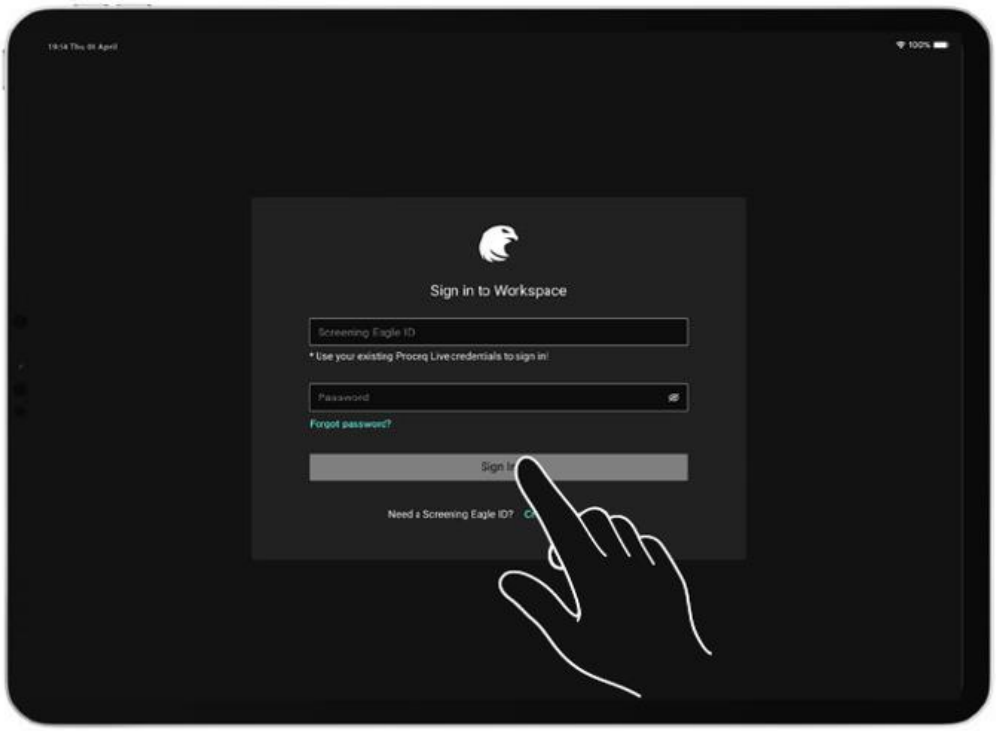
For more information on the product use of the product,
please refer to the Product Name PI8000 documentation

It is available for download on

https://www.screeningeagle.com/en/products/pundit-pi8000

Click on Sign In to either log into your existing account or to create a new account.





4.2.3 Turning the device on and off

Press the button for 2 seconds until the LED turns solid green. To turn it off, press it also for 2 seconds until the LED turns off as described previously.

4.2.4 Connect the sensor unit to the Pundit Impact App

The PI8000 sensor unit uses Bluetooth wireless connectivity to be paired with the iPad.

Just select the “Probe” icon, and then click “Connect” when you find your sensor unit.

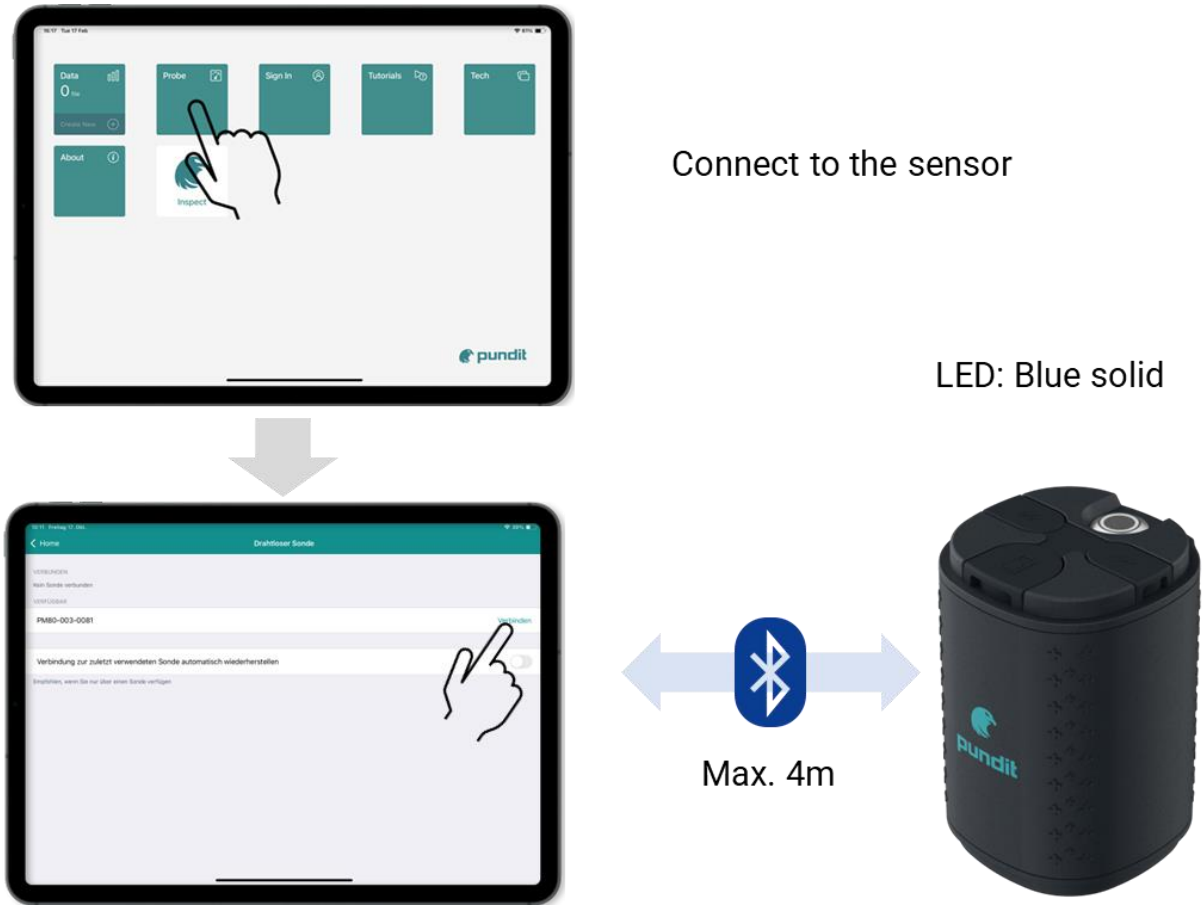
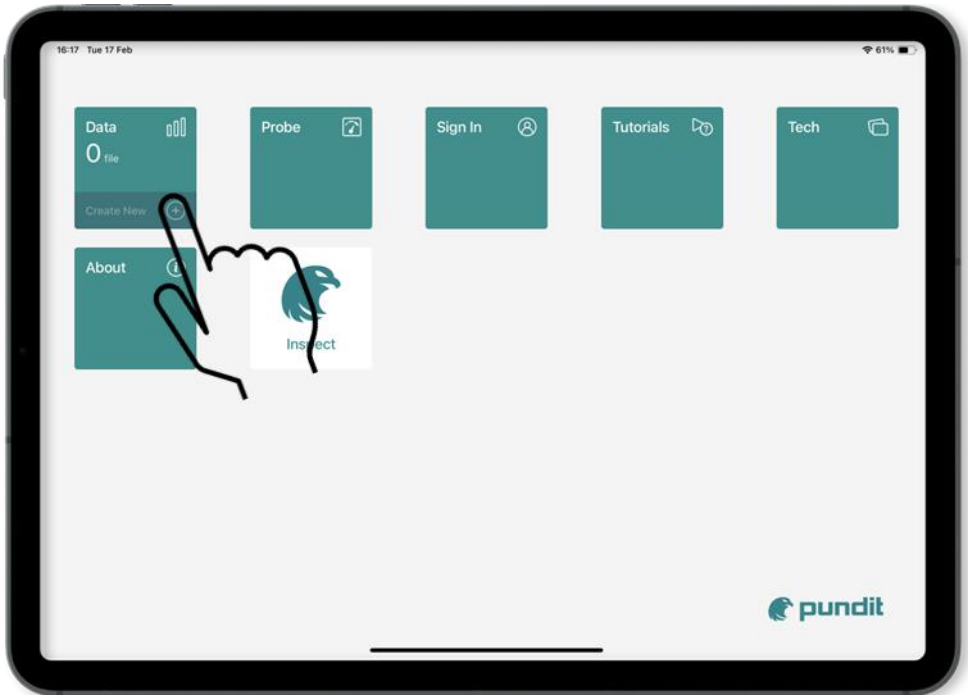


Figure 1 : PM8500 Profometer App: connecting the probe

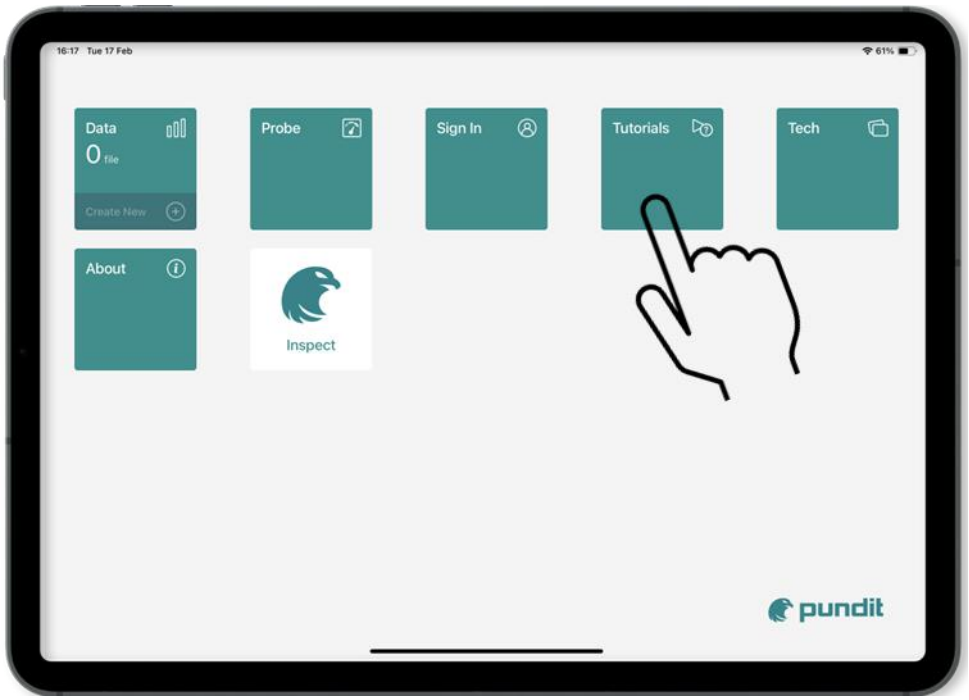
4.2.5 Create a new file and start your first measurement

Click “Create New” to start a new measurement:



4.3 Pundit Impact App

A full description of how to work with the Pundit Impact app to perform both pile integrity and impact echo measurements is covered in the tutorial videos which can be accessed directly from the app.



4.3.1 Tutorial Videos

1. **Getting started** -Turning the probe on. Connecting to the probe. Creating a new measurement. Creating a measurement folder. Starting a measurement for pile integrity test.
2. **Performing a firmware upgrade**.
3. **Sensor features** – Button operations. Status LED indications.
4. **Impact echo spot mode set up** – Setting up the app correctly for an impact spot measurement.
5. **Impact echo spot measurement** – How to perform measurements and calibrate the pulse velocity.
6. **Impact echo spot review** – How to view the results and detect concrete thickness and defects. Using filters. Using auto FFT peak detection. Adding comments, notes to spots.
7. **Impact echo grid set up** – Setting up the app correctly for impact echo grid measurements. Define the grid size. Define the cell size. Select data collection directions. Set colour ranges. Using smart disarming function.
8. **Impact echo grid review** – How to view results detect concrete thickness and defects in grid mode.
9. **Pile integrity**: **Setting the test position** – Add and select piles. Add and select test locations.
10. **Pile integrity**: **Data acquisition** – How to acquire data. Placing the sensor on the head of the pile. Pile preparation. How to perform an impact. Selecting and deleting impacts.
11. **Pile integrity**: **Data processing** – Waveform optimization (auto gain, time gain compensation, velocity adjustment, using filters.)
12. **Pile integrity status tagging** – Assign a status to a pile and mark possible defects.
13. **Pile integrity comparison mode** – How to view all selected piles to compare for outliers and defects.

4.3.2 Typical workflow - pile integrity testing

More details can be found in the video tutorials.

- The surface of the piles are cleaned and smoothed as necessary
- The transducer is fixed to the surface with the putty provided in the kit.
- The user makes multiple light impacts close to the transducer with a hammer.
- The impact echoes are averaged to produce a waveform.
- The waveform is analysed to detect primarily the length of the pile and secondly any defects before the pile
- Generally multiple piles are tested at the same location on the same day and a key part of the interpretation is a comparison of the results from all piles tested at the same location in the same soil conditions.

4.3.3 Typical workflow - impact echo testing

More details can be found in the video tutorials.

- The transducer is not fixed to the surface. The silicone tips can be used for rapid measurements, but if there is a problem with instable measurements the putty provided

in the kit can be used. Use of the putty will always provide a better contact with the surface.

- The user makes a few measurements at each location, and typically tests in a linear or grid pattern.
- The waveform is converted to the frequency domain.
- The frequency signal is analysed to detect the thickness of the object or major defects like voids.
- The test object has to be plate (much wider than it is thicker).
- Generally results are plotted as a grid.
- Pulse velocity calibration is performed at a point in the structure where the thickness is known.

4.3.4 Filter settings – pile integrity test

The low-pass filter is used to smooth out high-frequency noise. This can be caused for example, by the presence of rebars. A typical setting for low pass filter will be from 1 to 2 kHz.

High pass filter- This filter removes the low frequency effects that can be caused by soil resistance. A typical value for this will be around 100 Hz

4.3.5 Filter settings – impact echo

Generally a highpass filter is used with impact echo and this is the default setting. For very think elements, it may be helpful to use a lowpass filter also.

Below are some general recommendations for the filter settings based on the object thickness.

Lowpass – not recommended for impact echo

Concrete thickness less than 7.5 cm (3 inches) – Lowpass 50 kHz, Highpass 10 kHz

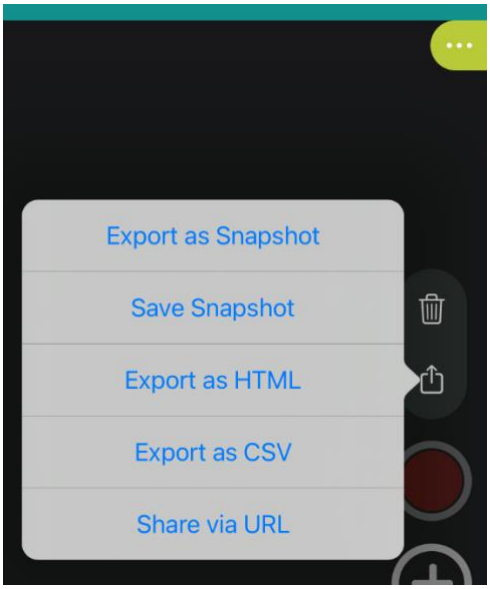
Concrete thickness between 7.5 and 15 cm (3 and 6 inches)– Highpass 6 kHz

Concrete thickness between 15 and 30 chm (6 and 12 inches) – Highpass 3 kHz

Concrete thickness greater than 30 cm (12 inches) – Highpass 1 kHz

5 Export Formats

A number of data export formats are available. .



Format	Explanation
Export snapshot	Creates a .PNG image of the current iPad display along with a CSV file containing user info, measurement settings, statistical data and measurement data that can be opened with spreadsheet software (e.g. EXCEL)
Save Snapshot	Creates a .PNG image of the current iPad display that is sent to the logbook
Export as CSV	Creates a CSV file that can be opened with spreadsheet software (e.g. EXCEL)
Export as HTML	Creates a link that enables the logbook of the scan to be viewed on the Workspace viewing portal
Share va URL	Shares a copy of the measurement file with another user who can open it and modify it with the Pundit Impact app

5.1 Workspace - Data storage, reading, sharing & reporting

Given mobile data connectivity (Wifi or mobile network), the Pundit Impact app automatically and safely stores all measurements on the Screening Eagle Workspace by synchronizing with the iPad.

Screening Eagle Workspace is a web-based online platform where all measurements are stored automatically as soon as there is data connectivity (Wifi or mobile network) allowing synchronization of the iPad.

Reading, sharing & reporting is possible.

A user guide for Workspace can be downloaded from the website.

6 Maintenance and Support

6.1 Maintenance

Under normal use, this instrument does not require calibration. However, if there is any doubt about measurement accuracy it is advisable to check the instrument on a known test object. . This type of check can be done on a yearly basis. Proceq also offer the possibility to perform a calibration check if required. The following actions are also advised to extend the service life of the instrument.

- Do not immerse the instrument in water or other fluids.
- Always keep the housing clean.
- Wipe off contamination using a moist and soft cloth.
- Do not use any cleaning agents or solvents.
- Do not open the housing of the instrument yourself.

6.2 Support Concept

Screening Eagle Technologies is committed to providing a complete support service for this instrument by means of our global service and support facilities. As soon as you download the app on the Apple Store, you will obtain the latest available updates both for the Firmware and the Software, as well as other valuable information.

6.3 Standard Warranty and Extended Warranty

The standard warranty covers the electronic portion of the instrument for 24 months and the mechanical portion of the instrument for 6 months.

6.4 Disposal

Disposal of electric appliances together with household waste is not permissible. In observance of European Directives 2002/96/EC, 2006/66/EC and 2012/19/EC on waste, electrical and electronic equipment, and its implementation, in accordance with national law, electric tools and batteries that have reached the end of their life must be collected separately and returned to an environmentally compatible recycling facility.

7 Technical Specifications

Measuring Range	Impact Echo: max thickness = 60 to 80cm depending on concrete quality and selected impactor Pile Integrity: max ratio Length/Diameter = 30 to 60 depending on the soil conditions (hard soils to soft soils)
Range	>35 kHz, +/- 50 g
Resonant frequency	> 50 kHz
Sampling rate	400 kSPS
Weight	144 g (Including battery)
Dimensions	85 x 56 x 59 mm
Connections	Low energy Bluetooth ®, USB-C for charging and updates
Battery	• 1xAA (NiMH) rechargeable or non-rechargeable • Removable • Flight-safe • 8 hours autonomy • USB-C charger
Environmental Conditions	▪ Humidity <95% RH, non-condensing ▪ Operating temperature: -10ºC to +50ºC
IP Classification	IP67 with closing caps inserted.
Standards and Guidelines	ASTM C1383, ASTM D5882, DGZfP Merkblatt B11, RI-ZFP-TU, CE certification

SWISS MADE

For safety and liability information, please check www.screeningeagle.com/en/legal

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