profometer

PM8000

Rebar Diameter and Cover Meter

User Manual

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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.
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- 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.

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- 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.

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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.

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- ❗ 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 Profometer PM8000 family are high quality instruments used to locate rebars, measure concrete cover of rebars and estimate rebar diameters in concrete structures.

The Profometer PM8000 family offers 3 powerful versions for all application needs:

PM8000 Lite	PM8000	PM8000 Pro

The product consists of

- the PM8000 high-performance sensor
- Cart with Encoder (used for scan measurements)
- the pm iOS app
- and the Screening Eagle Workspace platform.

Figure 1: PM8000 System

1.1 Scope of this document

This document is the user manual for all products of the PM8000 Product family. Therefore, some pictures or functional descriptions may differ from your model.

1.2 Product versions

To be able to use the functionality of the pm app, a software license is required.

The following licenses are available and offer different functionality:

- Profometer License (for PM8000)
- Profometer Pro License (for PM8000 Pro)

Please refer to the table below for the supported features of the respective licenses (upgrades are possible, on request):

	PM8000 Pro	PM8000	PM8000 Lite
Measurement Modes	Spot[3] Spot data import Line Scan Area Scan	Spot[3] Spot data import Line Scan	Spot[3]
Rebar Spacing Measurements (1st layer)	Auto rebar spacing Manual rebar spacing	Manual rebar spacing	Manual rebar spacing[3]
Neighboring Rebar Correction (NRC)	1st layer NRC 2nd layer NRC	1st layer NRC 2nd layer NRC	1st layer NRC[3]
Statistics	Standard Statistics DBV[1] advanced statistics	Standard Statistics	
Line Scan	Complete view with rebar cover, diameter & signal strength view Simple view with rebar cover & diameter	Complete view with rebar cover, diameter & signal strength view Simple view with rebar cover & diameter	
Area Scan	Concrete cover & rebar diameter view Heat map AR[2] Heatmap		
Logbook	Measurements data, Instrument Information, Pictures, Geolocation, text notes, audio notes, configuration log	Measurements data, Instrument Information, Pictures, Geolocation, text notes, audio notes, configuration log	
Data Sharing	URL exchange	URL exchange	
Data Exporting	CSV HTML JPG (Snapshot) DXF	CSV HTML JPG (Snapshot)	
Data Synchronization	Screening Eagle Workspace Screening Eagle Inspect Integration	Screening Eagle Workspace Screening Eagle Inspect integration	

[1] Deutscher Beton- und Bautechnik-Verein
[2] Augmented Reality
[3] Standalone functionality only

1.3 Product applications

The PM8000 sensor can be used in various configurations:

- Standalone
  The measurement results are shown on the integrated OLED screen.
  In standalone operation the device can be used to perform spot measurements easily.

- Connected
  Via low power Bluetooth the PM8000 sensor wirelessly connects to the iPad, which runs the pm app. Given mobile data connectivity (Wi-Fi or mobile network), the pm app automatically and safely stores all measurements on the Screening Eagle Workspace.

  In connected operation the device also supports scan measurements (line and area scans). For this operation mode the device needs to be placed in the cart.

In general, two measurement types can be differentiated:

- Spot measurement (standalone)
  For cover check, diameter estimation, rebar location, finding safe spot to drill or metal detection then a spot measurement is performed.
  Spot measurements are done in standalone configuration and provide measurement values, such as concrete cover or rebar diameter. For a series of spot measurements, th   e pm app can be used to collect elementary statistics and to attach additional information such as pictures, geolocation to the measurement series.

- Scan measurement (connected, for PM8000 & PM8000 Pro)
  For durability & structural resistance assessment, quality control, mapping of concrete cover, fire resistance assessment, determination of rebar spacing & diameter values : a scan measurement is performed.
  Scan measurements are producing numerical and visual measurement data, conclusive statistics. The measurement data can be visualized in various form, e.g. in an informative heat map. Additional data such sensor information, pictures, geolocation ensure professional documentation of the measurement.

Figure 2: Application overview

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:

[profometer-pm8000-QSG.pdf (screeningeagle.com)](profometer-pm8000-QSG.pdf)

3   Measurement Principle

PM8000 uses electromagnetic pulse induction technology to detect rebars. Coils in the probe are periodically charged by current pulses and thus generate a magnetic field. On the surface of any electrically conductive material which is in the magnetic field eddy currents are induced. They produce a magnetic field in the opposite direction. The resulting change in voltage can be utilized for the measurement.
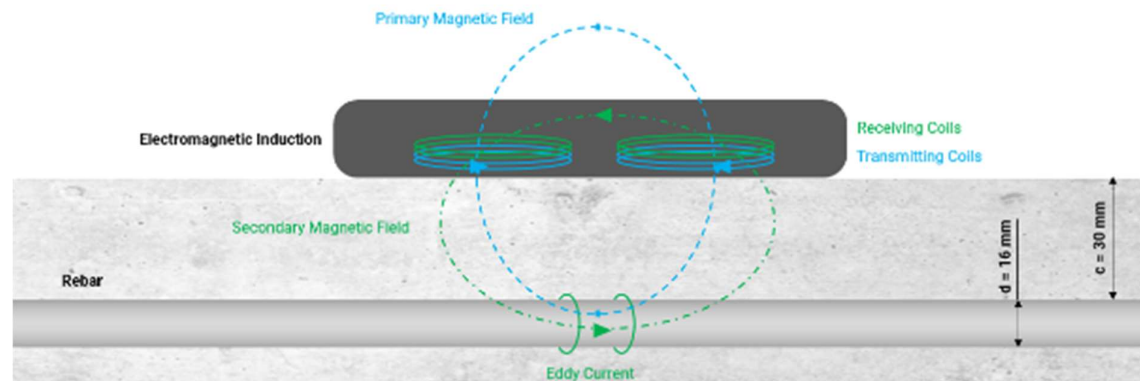
Figure 3: Measurement principle

PM8000 uses different coil arrangements to generate several magnetic fields. Advanced signal processing allows

1.   Localization of a rebar
2.   Localization of the mid-point between rebars.
3.   Determination of the cover
4.   Estimation of the bar diameter

This method is unaffected by all non-conductive materials such as concrete[3], wood, plastics, bricks etc. However, any kind of conductive materials within the magnetic field (approx. 400 mm / 16" sphere) will have an influence on the measurement.

⚠   Remove all metallic objects such as rings, watches, and all electromagnetic wave generators (smartphones, high voltage equipment etc.) from the area before you start measuring!

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[3] Some concrete types and other structural materials may have metallic content.

4 Device Overview

4.1 Switching-on and getting started

Please refer to the Quick Start Guide (included in standard delivery) for first steps with your PM8000. The Quick Start Guide is also available in the download section of the product webpage : profometer-pm8000-QSG.pdf (screeningeagle.com)

The main instructions for getting started are presented in Figure 4, Figure 5 & Figure 6

⚠️ Be careful when you get the sensor in the cart. Make sure that your fingers are not trapped in the assembling space.

Figure 4 : Inserting batteries

Figure 5 : Switching-on for standalone operation

Figure 6 : Switching-on for connected operation

4.2   Visual indicators

The visual indicators show quickly and easily the proximity of a metallic object. The exact location where the sensor measures is indicated by the measurement center mark.

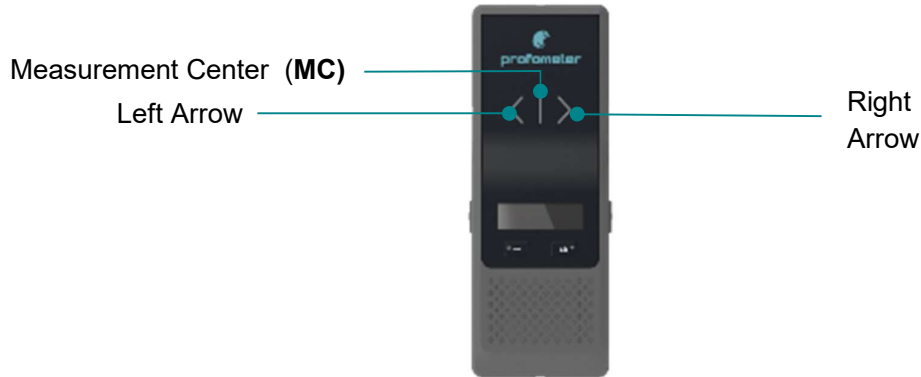The arrows right and left with LED indicate the rebar or metallic object proximity.

Figure 7: Visual indicators

4.3   Keys

4.3.1   Spot measurement

In stand-alone operation the four keys of the sensor allow the user to control the instrument and navigate the sensor menu. Figure 8 shows the function assigned to the keys.

Left Side Key

Home, Measurement Screen	
Long push (2s)	Show pre-set screen (auto-disappear after 2s)
Short push	Save cover and rebar diameters values in spot scan manual mode
Menu	
Short push	Menu Navigation: left

Right Side Key

Home, Measurement Screen	
Short push	Measure Rebar Diameter
Long push (2s)	Calibrate
Menu	
Short push	Menu Navigation: right

Left Function Key

Device ON/OFF	
Long push (2s)	Power ON
Very Long push (5s)	Power OFF
Menu	
Short push	Return to previous menu level or to measurement screen
Home, Measurement Screen	
Short push	Enter Menu

Right Function Key

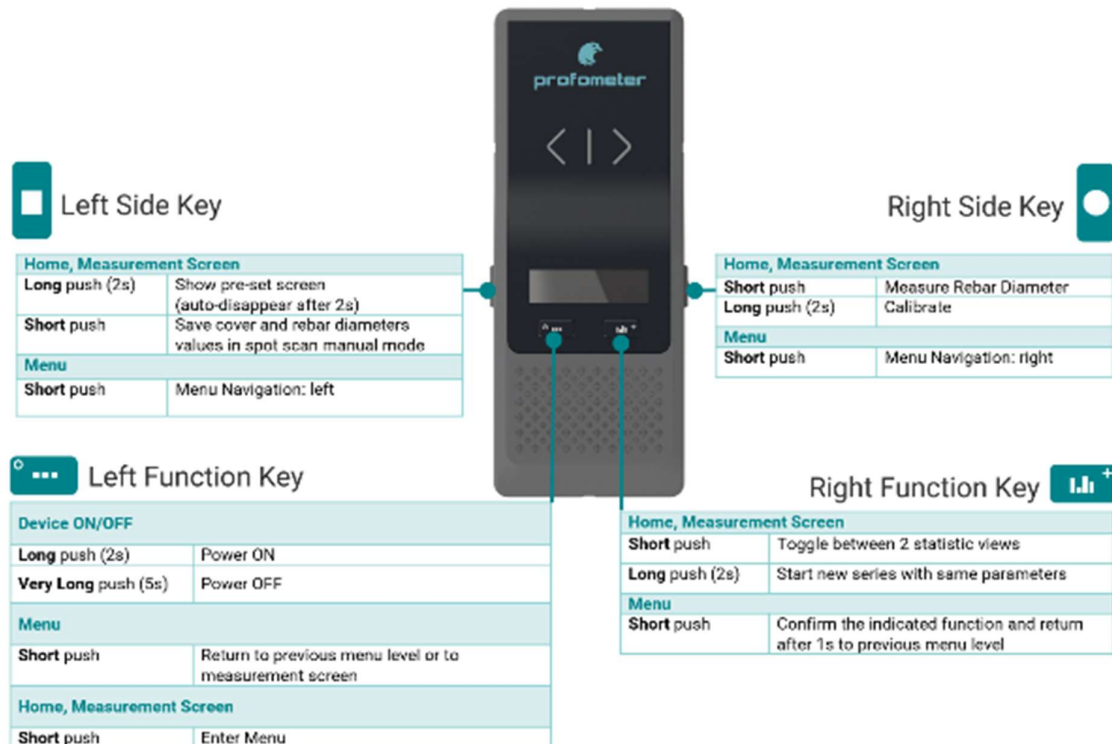| Home, Measurement Screen	
Short push	Toggle between 2 statistic views
Long push (2s)	Start new series with same parameters
Menu	
Short push	Confirm the indicated function and return after 1s to previous menu level

Figure 8: Keys functions in standalone operation

4.3.2 Scan measurement

When the sensor used connected with the pm App the key functions assignment is different.
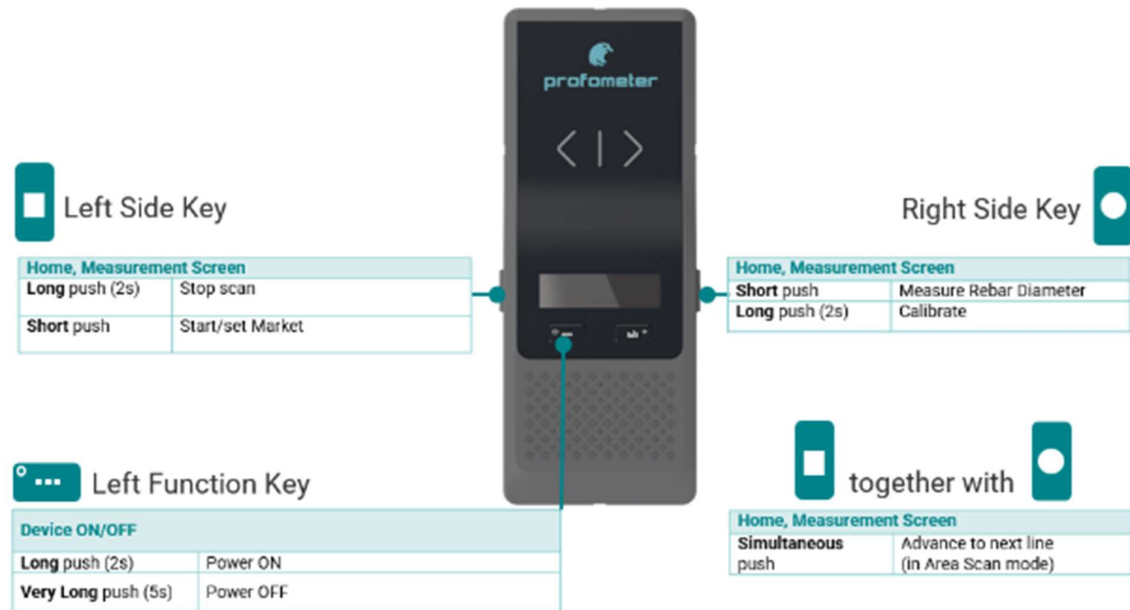

Figure 9: Key functions in connected operation

For more information, please refer to the tutorial videos of pm app (Profometer app downloadable from iOS App store).
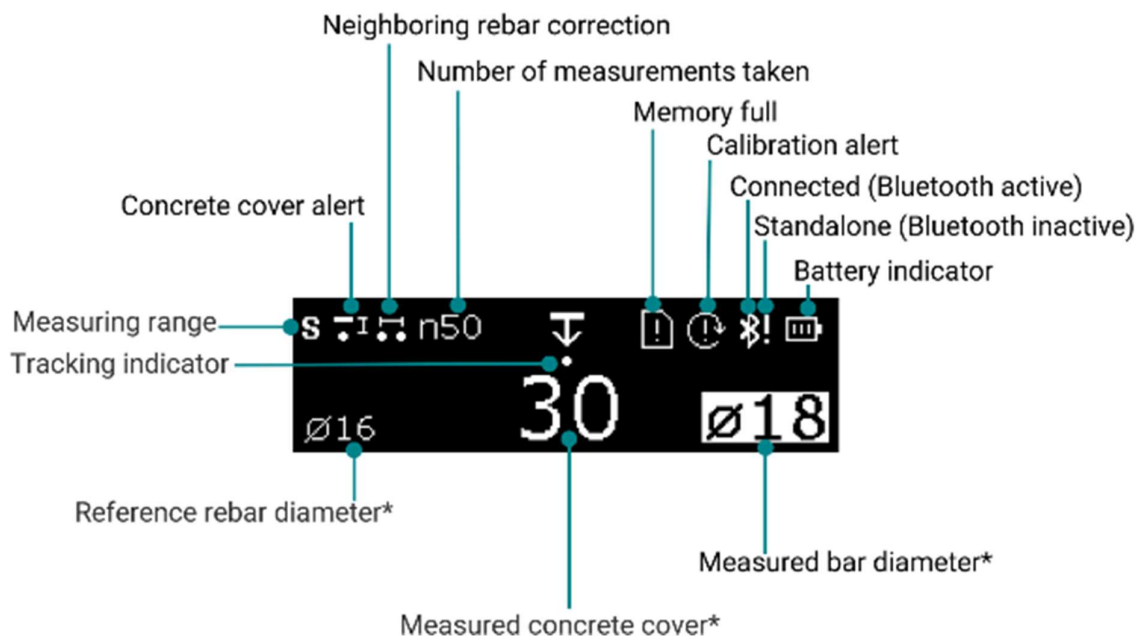
4.4 Measurement Screen for Spot measurement

Figure 10: Overview Measurement Screen in stand-alone operation

(*) Depending on the unit setting

4.5   Tracking Indicator

The tracking indicator is a moving dot on the integrated display, which visualizes the relative position of a rebar or metallic object.

The tracking indicator is installed by default on the PM8000 sensor. However, it is possible to deactivate or re-activate it following the Figure 11.

Figure 11: Activation or Deactivation of Tracking indicator

Read section 5.3 to learn how to use the tracking indicator.

4.6   Big number cover value

The cover value, when not above a rebar, is by default in small number size. However, it is possible to make the cover value bigger permanently following the Figure 12.

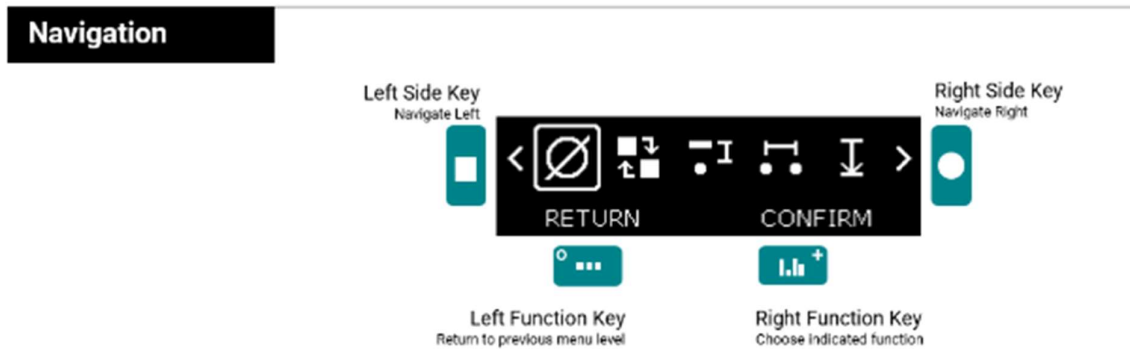*Figure 12 : Activation or Deactivation of big number cover value*

4.7 General use

In standalone operation, the PM8000 sensor can be operated and configured by the function keys. The left function key allows to enter the sensor menu:

In the menu the function keys can be used to navigate through the menu items:

4.7.1 Main Menu Items

Several menu items are available for changing the settings, configurations and access to the device information.

⌀	**Reference Rebar Diameter Settings**	Configuration of the diameter of the reference rebar
	Operation Mode Settings	Configuration of the operation mode Locate or Spot Scan (data collection)
	Concrete Cover Alert Settings	Configuration of Cover Alert value
	Neighboring Rebar Correction Settings	Configuration of spacing between rebars for neighboring rebar correction
	Measuring Range	Configuration of measuring range depending on metal object depth Standard, Deep or Auto
	Audio Settings	Configuration of all audio signalling Rebar centered, Min cover alert or Key pressed
	Units	Configuration of measurement units In Metric, ASTM or Japanese Units
	Memory	Memory used information / clear
	Information	Show Device Information

Figure 13: Menu item overview

4.7.2 Setting Reference Rebar Diameter

With the correct rebar diameter setting, the precision of cover measurement and rebar diameter estimation increases significantly.

In this menu you can set the real rebar diameter value, it's known from construction data (BIM, as-built drawings) or inspection hole.

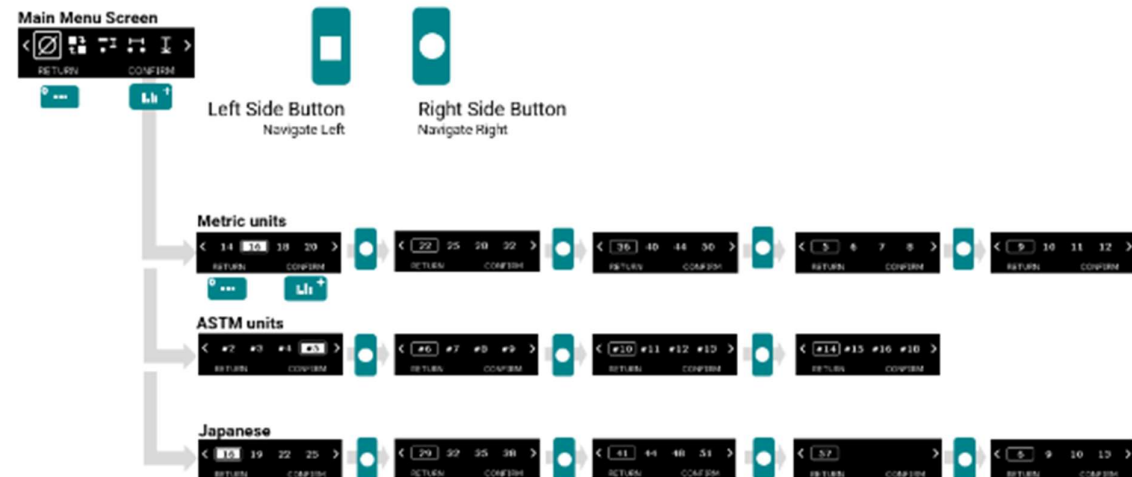❗ If the rebar diameter is unknown, then keep the default diameter of 16 mm / #5

Figure 14: Menu - Setting rebar diameters

4.7.3 Set Operation Mode

In standalone operation, it is important to select the right mode before spot measurement.

In this menu you can select on the three different modes:

- **Locate**:
  Rebar location, measurement reading, metal detection

- **Spot Scan Auto**:
  Any measurement is stored automatically (without pushing any button).

- **Spot Scan Manual**:
  Any measurement is stored manually by short pushing Left Side Key

❗ For both spot scan modes: if the rebar diameter is measured then the value is also stored along the displayed cover value stored automatically or manually.

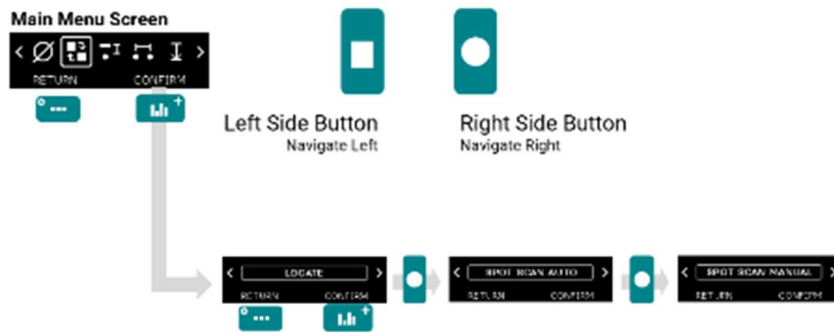❗ Create a new series or switch mode for stopping a series.

Figure 15: Menu – Operation Mode

4.7.4   Set Minimum Cover Alert limit

Having a cover alert allows the user to identify the insufficient cover areas.

In this menu you can set the minimum cover alert limit. The LED of the measurement center (MC) is lit when the cover is below this limit. If audio is on (see section 4.7.7), an audio signal is generated.

Having a cover alert allows the user to identify the insufficient cover areas.
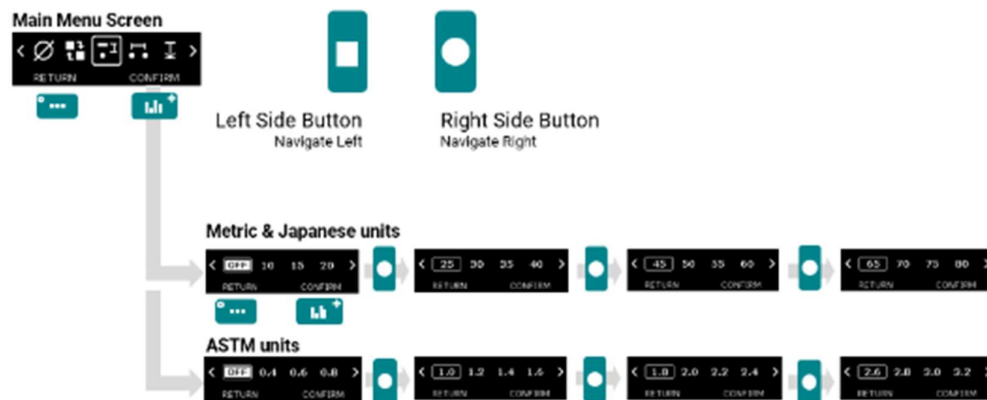

Figure 16: Menu - Minimum cover alert limit

4.7.5   Neighboring rebar correction

Cover and rebar diameter measurements are influenced by neighboring rebars. This can be compensated by using the Neighboring Rebar Correction (NRC).

In this menu, you can activate the neighboring rebar correction by setting the known rebar spacing.

❗   Please note, that this only works correctly, if the rebar spacing of first rebar layer(=mat) is under 130mm / 5.2 inch.

❗   If you do not know the rebar spacing, you can measure it manually by locating several 1st layer rebars, or get it from the construction data (BIM, as-built drawings) or inspection hole.
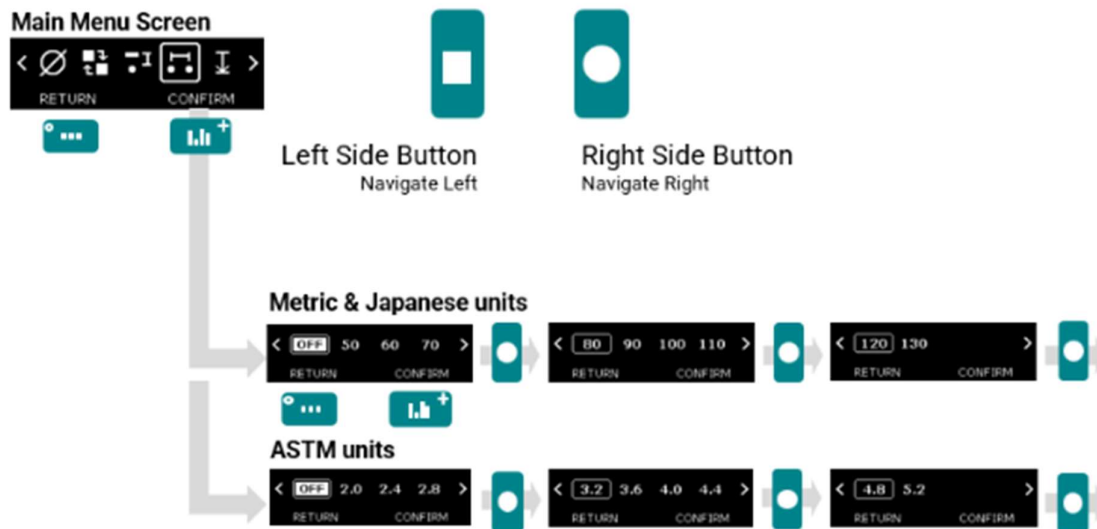
Figure 17: Menu - Neighboring Rebar Correction

4.7.6 Measuring Range

The pulse induction principle used by PM8000 has defined operating ranges and accuracies. The measuring range is dependent on the rebar size. The expected accuracy of the cover measurement is indicated in section 4.9 .

In this menu you can select the right measuring range depending on the rebar or metallic object depth:

- Standard : <80mm / 3.15 inch (Default)
- Deep : from 80mm to 180mm / 3.15 inch to 7.10 inch
- Auto : Switches automatically from Standard to Deep

🛈   Rebar diameter estimation can be performed only in Standard measuring range because of depth limitation, it cannot be performed in Deep measuring range!
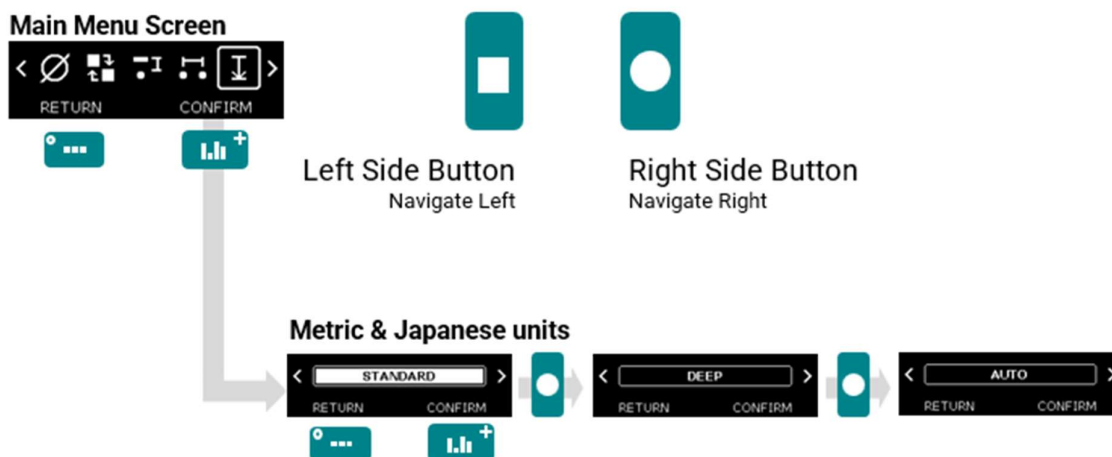
Figure 18: Menu - Measuring Range Setting

4.7.7   Audio

The device can give an audible tone to assist in location or to give useful alarms.

In this menu you can select/deselect the sound settings for the following alerts (Default: all off) :

- Rebar center detected
- Minimum Cover alert
- Key pressed

Figure 19 : Menu - Audio

4.7.8   Units

In this menu you can select your regional unit setting:

- Metric
- ASTM inch
- ASTM mm
- Japanese

The units settings affect all other displays and should be done prior to making other selections.

Figure 20 : Menu - Units

4.7.9 Memory

The PM8000 sensor has a memory capacity of 50 measurement files; each file can contain a maximum of 50 cover and/or diameter values. When the memory capacity is full, a warning icon is visible (as described in section 4.4).
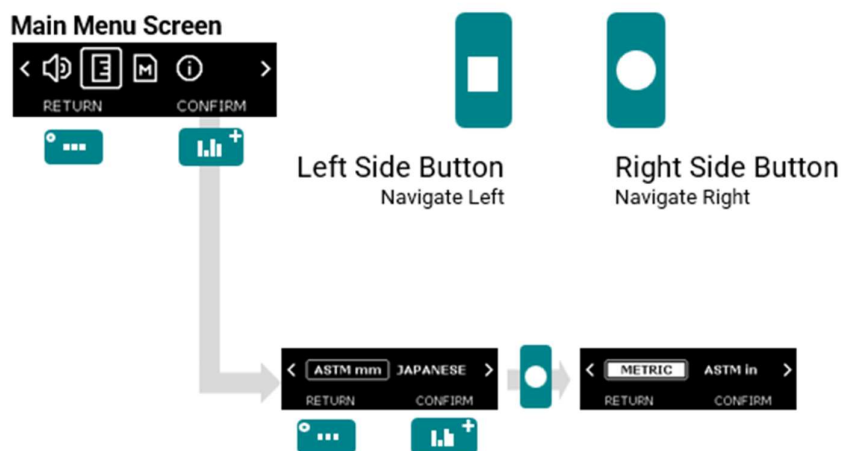
❗ PM8000 Lite does not allow spot measurement series import to the pm app software, as notified in section 1.2

The user has then 3 choices:

1. Do nothing. Any new spot measurement series will overwrite an existing one.
2. Manually delete all spot measurements series as explained in Figure 21.
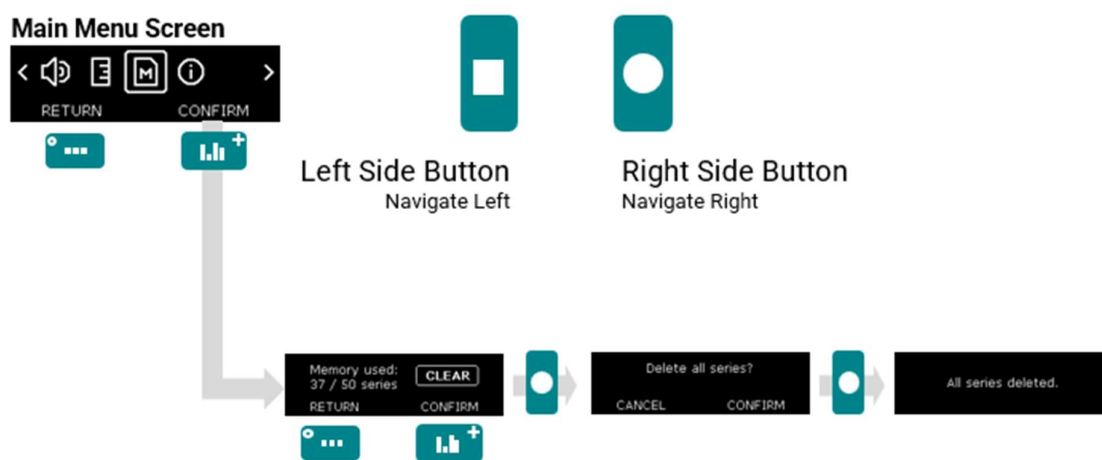
Figure 21 : Menu – Memory

3. Connect to pm app installed in an iPad to import all the spot measurement series. This automatically deletes all measurement series from the sensor memory. Given mobile data connectivity (Wifi or mobile network), the pm app automatically and safely stores all spot measurement series on the Screening Eagle Workspace by synchronizing with the iPad.
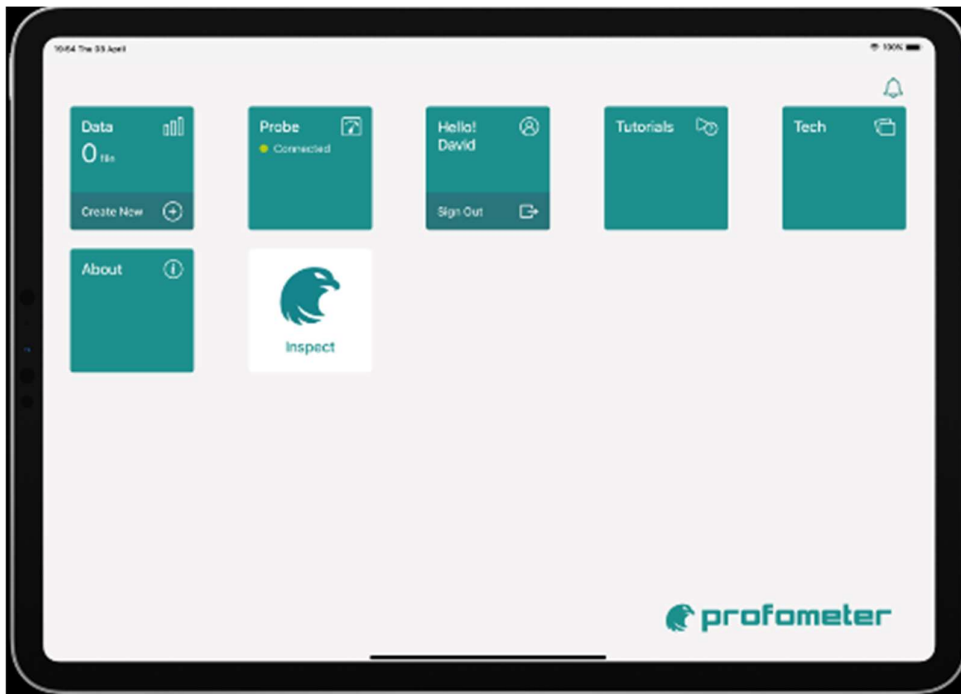
Figure 22 : pm app – sensor connected to iPad
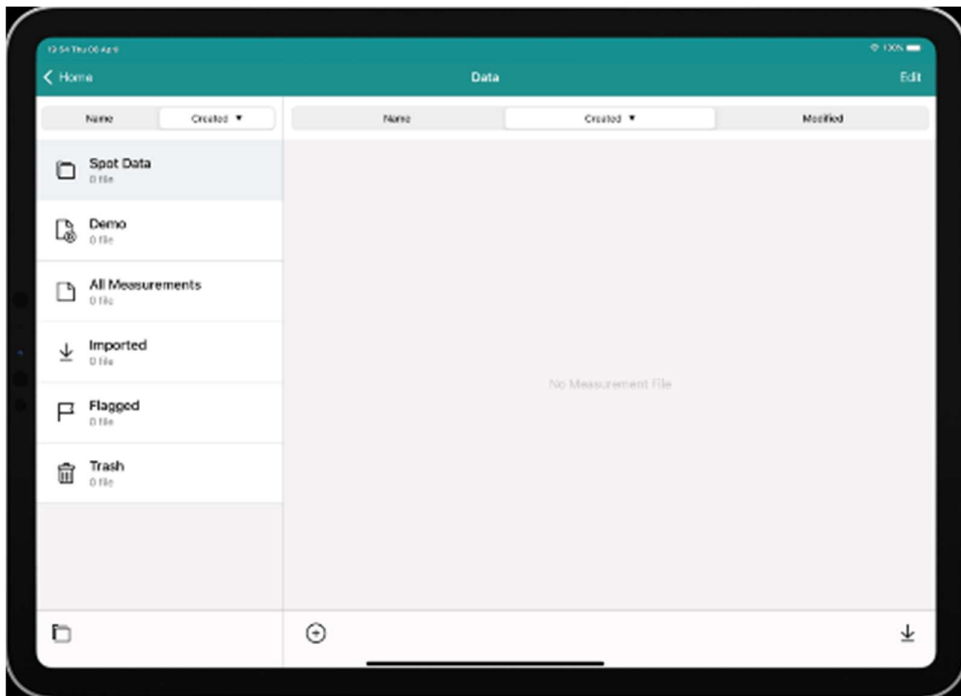
Figure 23 : pm app – import spot data

For more information on how to import spot measurement data into pm app software, please refer to the tutorial videos of pm app or the Screening Eagle Technologies YouTube channel.
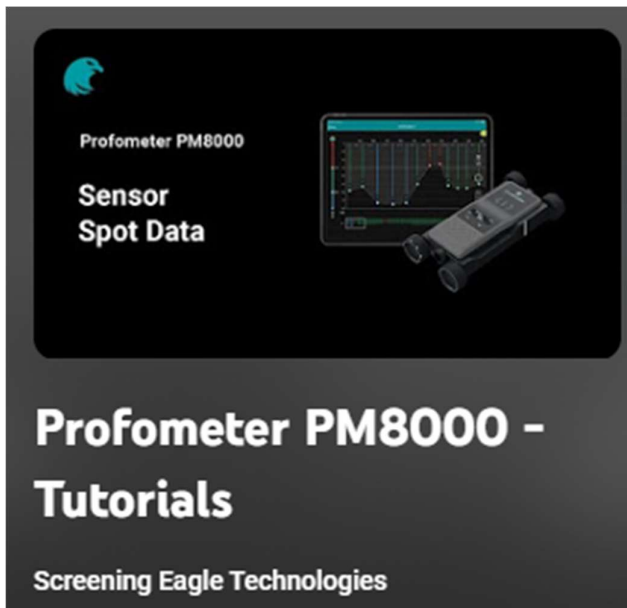
4.7.10 Device Info

The device info is useful in case of firmware update, warranty case or repair request. In this menu you can get all information about sensor serial number, firmware version and FCC ID. The device info is useful in case of firmware update, warranty case or repair request.
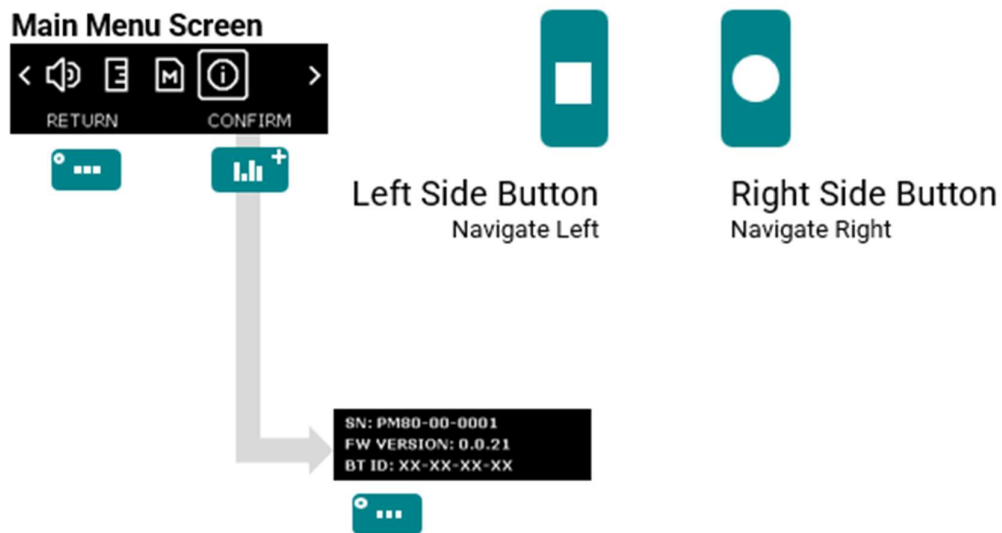
Figure 24: Menu - Device Information

❗ When a firmware update is needed, a notification in pm app will be visible. Download PqUpgrade PC software from the product webpage. Then connect the sensor to the PC with a USB-A to USB-C or USB-C to USB-C cable (not provided).

4.8   PM8000 Measuring Range

The pulse induction principle used by PM8000 has defined operating ranges and accuracies. The measuring range is dependent on the rebar diameter. The expected accuracy of the cover measurement is indicated in the graphic below, for a single rebar with sufficient spacing and known diameter (Complies with BS1881 part 204 - testing concrete recommendations on the use of electromagnetic cover meters).

4.8.1   Measuring range without the cart

*Figure 25: Configuration without cart (Spot measurement - standalone)*

🛈   When the rebar diameter is unknown, as explained in section 4.7.6, with rebar depth >80mm then the deep mode should be activated.

🛈   Be aware that the cover values will be incorrectly underestimated in deep mode if there are welded or tied meshes in the concrete!

🛈   In deep mode, 180mm is the maximum depth limit for detection. Nevertheless, if the rebar diameter is known, the Figure 26 provides more precision on the maximum depth possible of detection following the rebar diameter.

🛈   As explained in section 4.7.6, there is an Auto mode which switches automatically from Standard to Deep.

When the rebar diameter is unknown, as explained in 4.7.6, with rebar depth <80mm then the standard mode should be activated (Default mode).

However, 80mm limit is only an average depth limit. That is why if the rebar diameter is known, the Figure 26 provides more precision on the maximum depth possible following the rebar diameter.
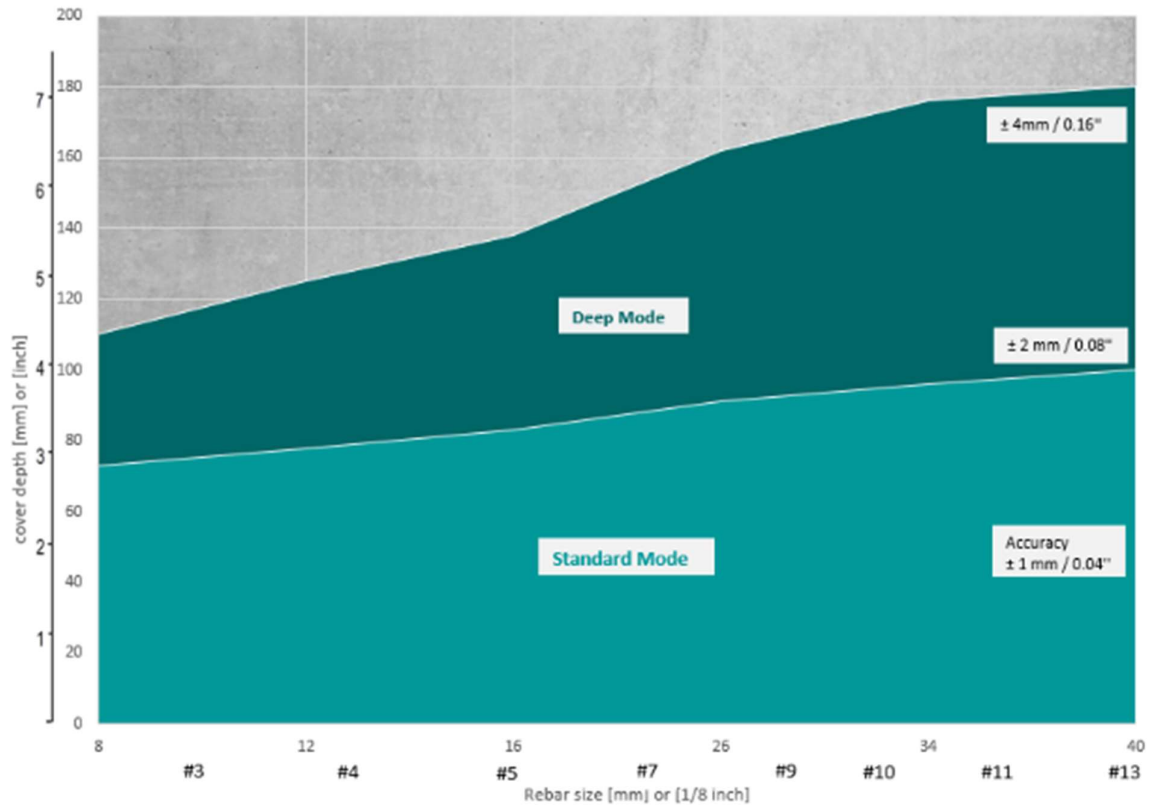
Figure 26: Measuring range without cart

4.8.2 Measuring with the cart

Figure 27: Configuration with cart (Scan measurement - connected)

🛈 Spot measurement is possible with the cart. However, we recommend not to use the cart for spot measurement to save more depth detection capacity.

🛈 Be aware that the cover values will be incorrectly underestimated in deep mode if there are welded or tied meshes in the concrete!

If the rebar diameter is unknown, and rebar depth is <70mm, then the standard mode (Default) should be activated, as recommended in the pm app software,

However, 70mm limit is only an average depth limit. That is why if the rebar diameter is known, the Figure 28 provides more precision on the maximum depth possible following the rebar diameter.

Following the recommendation on the pm app, when the rebar diameter is unknown, with rebar depth >70mm then the deep mode should be activated.

In deep mode, 180mm is the maximum depth limit for detection. Nevertheless, if the rebar diameter is known, the Figure 28 provides more precision on the maximum depth of detection possible following the rebar diameter.
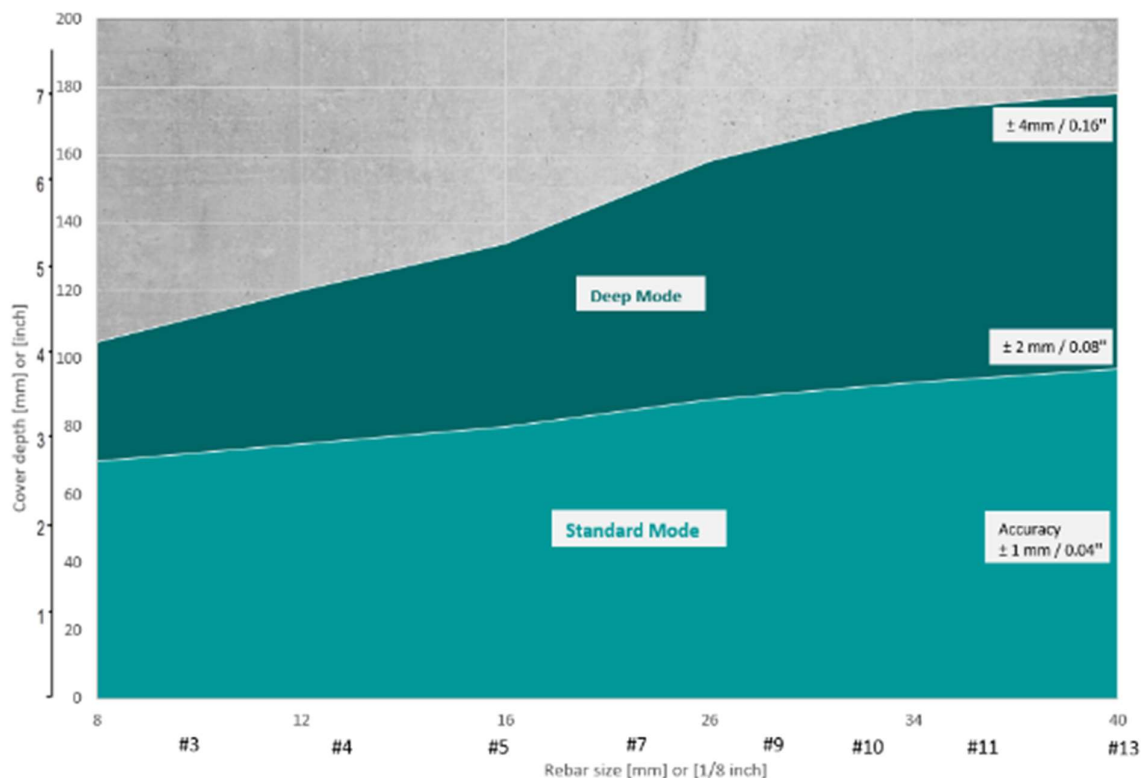
Figure 28: Measuring range with cart

4.9   Factors Affecting the Measurement

4.9.1   Errors due to Neighboring Rebars

All rebars within the sphere of influence 400mm / 16 inch diameter affect the reading.

Any ferromagnetic material within the sphere may have an influence on the signal value (e.g. during a calibration). The center of the sphere is the Measurement Center (MC).
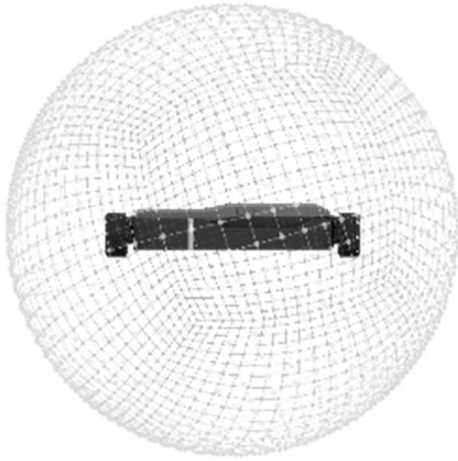
Figure 29: PM8000 sphere of influence

❶ This effect can be reduced by the neighbouring rebar correction implemented in the PM8000 for spot measurement (see 4.7.5 and scan measurements in the pm app software).

4.9.2 Resolution

❶ There is a limit to the minimum spacing of rebars, which can be differentiated. This value is depending on the cover depth and rebar diameter.
It is impossible to distinguish between individual rebars above these limits following the rebar diameters as presented in Figure 30.
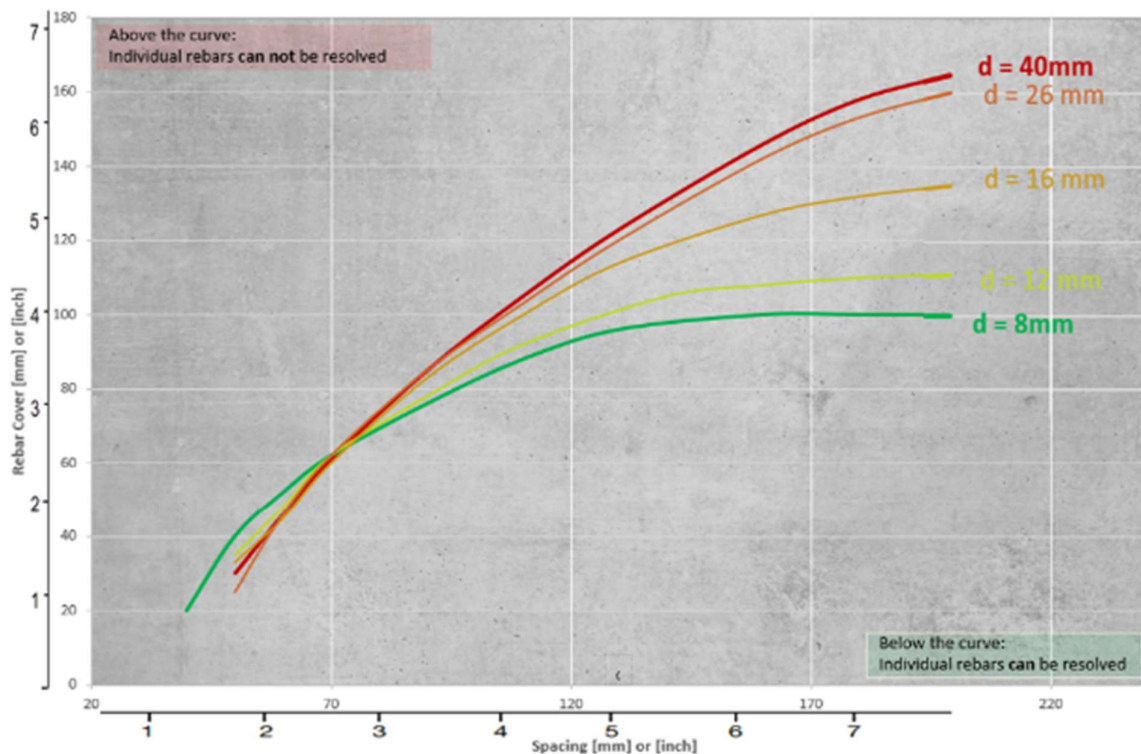
Figure 30: PM8000 Resolution Chart

4.9.3 Effect of Setting Incorrect Rebar Diameter

The accuracy of the cover measurement is also dependent on setting the correct rebar diameter for the first layer (mat). The Figure 31 provides an estimation of the error of the cover reading for different rebar sizes if a default size of 16 mm / #5 is set. The user can set the right rebar diameter for both configurations: Spot measurement (see section 4.7.2) & scan measurements (see pm app software).

In case the diameter of first layer (mat) is not known in absence of as-built drawings or cannot be measured properly because of limited conditions (see section 4.9.4), it is recommended that the rebars should be exposed in one area to set the correct diameter in the PM8000 sensor for spot measurement (standalone) or in the pm app software for scan measurement (connected). With the correct diameter set, the cover over a single rebar can be measured without the error of cover shown in Figure 31.
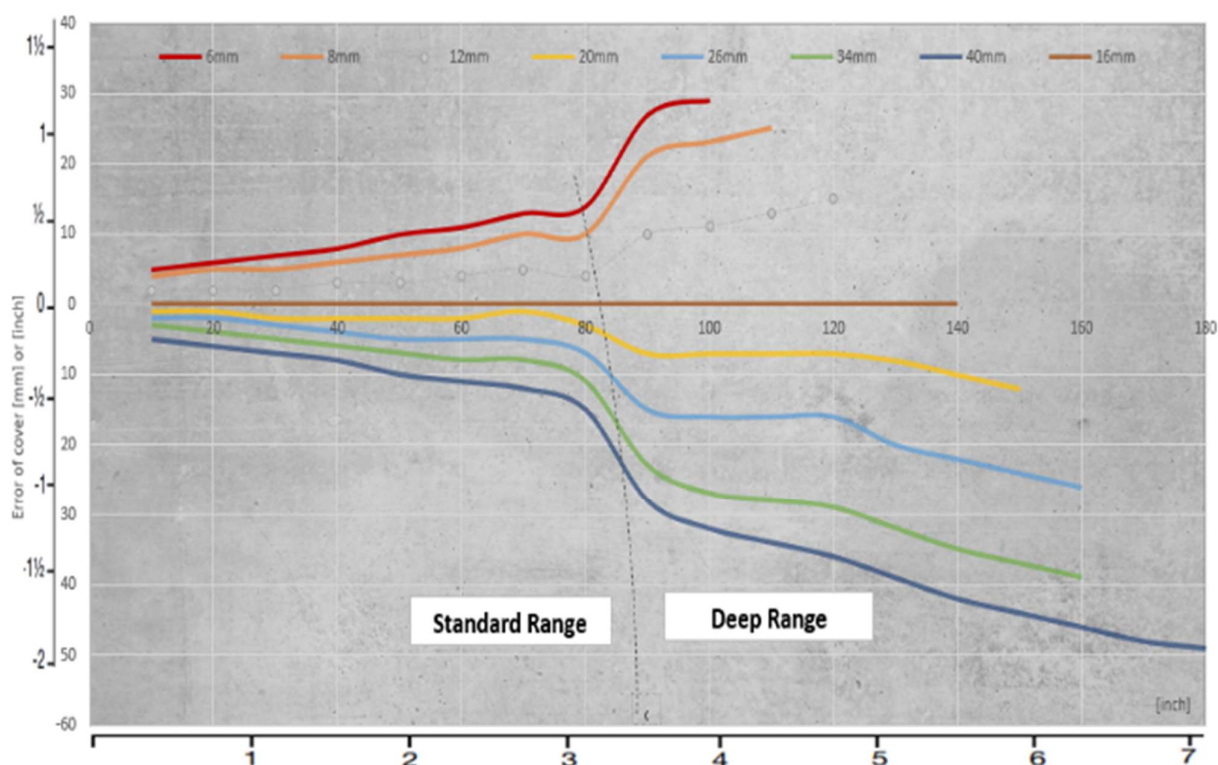
Figure 31: PM8000 Error of Cover with fixed 16mm rebar diameter setting

4.9.4 Factors Affecting Diameter Determination

🛈 Rebar diameter estimation is a challenging task with several factors affecting the estimation. It is recommended to measure in several locations to find the best conditions where there is a clean mesh without the presence of overlapping rebars, metallic object or wires/wire connecting first and second rebar layers.

❗ If one or several factors, listed in this section, affects the measurement then it is highly recommended to consider an inspection hole for determining the correct rebar diameter.

Three factors hugely affect the determination of the rebar diameter.

1. Cover depth: diameter can be determined for rebars with cover not exceeding 80% of the Standard range. 63 mm / 2.5". For more information on the standard range capacity depending on the rebar diameter correctness, see sections 4.8.1 & 4.8.2.

2. Spacing between neighbouring bars: for accurate determination of the diameter, the spacing between the rebars must be greater than the limits shown in the drawing below from the measurement center (MC) of the probe.
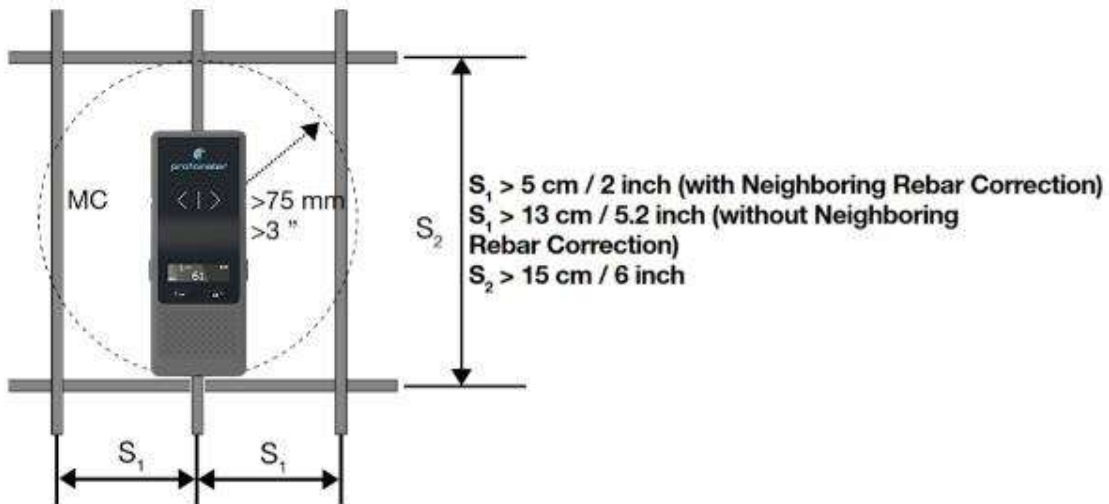
Figure 32: Minimum space for rebar diameter measurement

3. Closed welded reinforcement meshes or meshes with binding wires: This produces an additional signal which increases the displayed diameter value on PM8000 sensor or pm app software.
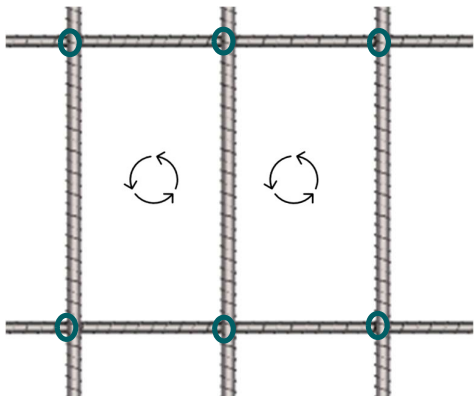
Figure 33: Welded or wired rebars

4.9.5   Orientation

The strongest signal results are obtained when the vertical axis is parallel to the rebar being measured and the measurement center is directly over the rebar. Also, the sensor must be positioned along the midpoint line.

❗ The rebar cover measurement & rebar diameter estimations will not be precise if the sensor is not positioned along the midpoint line!
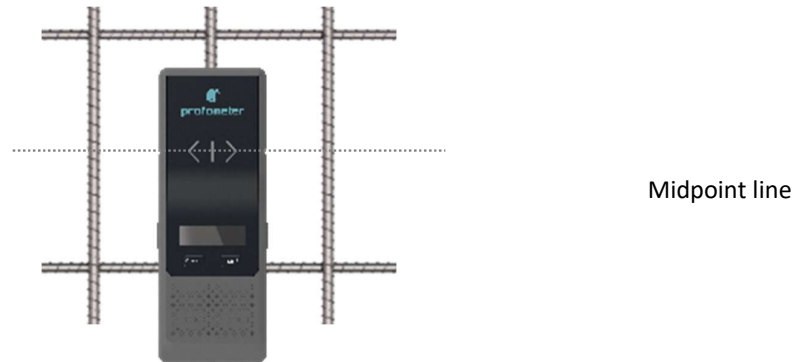
Midpoint line

Figure 34: Sensor positioned at the midpoint line

There are 3 methods to find the midpoint lines in both directions:

1.   Use PM8000 sensor in spot measurement (locate mode) for locating horizontal and vertical rebars. Then, manually draw the midpoint lines in both directions. The sensor can also locate midpoint lines as described in section 5.3.1.

2.   Use pm app in scan measurement, the sensor can be positioned along the midpoint line thanks to the coil balance indicator at the bottom right of iPad screen. The coil balance should remain in green colour (to get more information watch tutorial video about line scan measurement).

❗ PM8000 Lite does not allow scan measurement, as described in section 1.2

Figure 35: pm app - Coil balance indicator

3. Use Proceq GPR for locating all rebars in both directions. Then manually draw the midpoint lines in both directions. For more information visit the following webpage : Ground Penetrating Radar | Ground Radar | Concrete Radar (screeningeagle.com)

4.9.6   Welded or tied meshes in deep mode

🛈 The presence of welded or tied meshes in concrete may affect the cover measurement in deep mode measuring range. The loops created by meshes produce an additional signal which makes rebar appear shallower (which means lower cover values).

In this case, we recommend either to remain in standard mode if rebar depth allows this measuring range (see section 4.8) or to use Proceq GPR if rebar depth is too important; For more information visit the following webpage : Ground Penetrating Radar | Ground Radar | Concrete Radar (screeningeagle.com).

5 Operation and handling

A Quick Start Guide is provided in the packaging (case) to help you to start the device and to set your Eagle ID which is necessary for using the pm app software.

❗ Carefully read the Quick Start Guide.

⚠️ Be careful when you get the sensor in the cart. Make sure that your fingers are not trapped in the assembling space.

5.1 Initial setup

A start-up test kit (one 16 mm / #5 diameter rebar) is provided within the packaging (case) to help you familiarize yourself with the instrument.

Carefully read this user manual. Watch all the tutorial videos provided in pm app software or see a demo by a qualified Screening Eagle representative.

❗ The test kit is a functional test only. It cannot be used for any quantitative test since the tolerance of the case is too high.

1. Flip the case to give better access to the rebar and lay the case on a flat surface.
2. Verify that there are no metal items on hands, fingers, or in the vicinity of the test area, (e. g. steel frame of the table, metal trolleys etc.).
3. Take the PM8000 sensor without the cart.
4. Power on the PM8000 sensor
5. Reset the PM8000 sensor (as explained in section 1)
6. Position the PM8000 sensor with the right orientation (as explained in section 4.9.5)
7. Measure the rebar cover
   a. The location and orientation of the rebars •
   b. The position between two rebars
   c. Cover depths approximately 15 mm / 0.59 and 60 mm / 2.36”
   d. Diameter 16 mm / #5, see 3.4.1

Congratulations! Your new PM8000 is fully operational, and you can now continue with your measurements.

5.2 Performing a Calibration

The pulse induction measuring principle is prone to drift with temperature and other external influences. Performing a calibration corrects for any drift and ensures accurate measurements. We recommend a calibration every 5 minutes or so. At power on, in stand-alone operation the PM8000 reminds the user to perform a calibration. In connected operation, the pm app software reminds also to perform a calibration.

Hold PM8000 in free space (no metal within a 400 mm / 16” sphere) and press right side Key.

A circular arrow rotates on the display for approximately 2.5 seconds while the calibration is carried out.

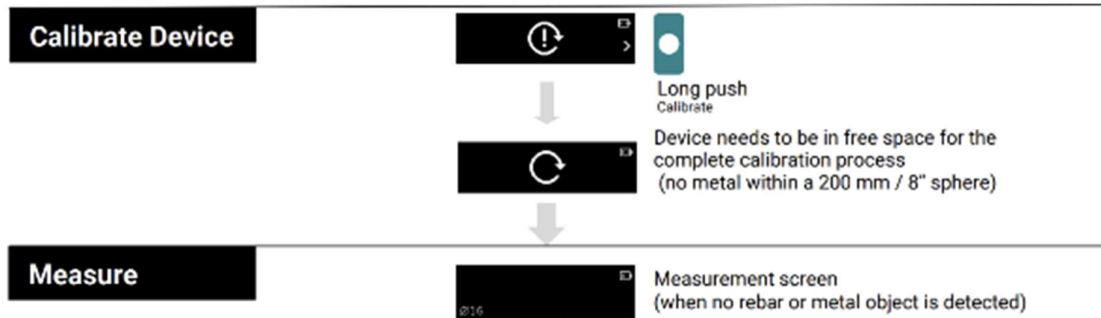*Figure 36: Calibration procedure*

5.3 Measurement process

Generally, a measurement follows the procedure in Figure 37.
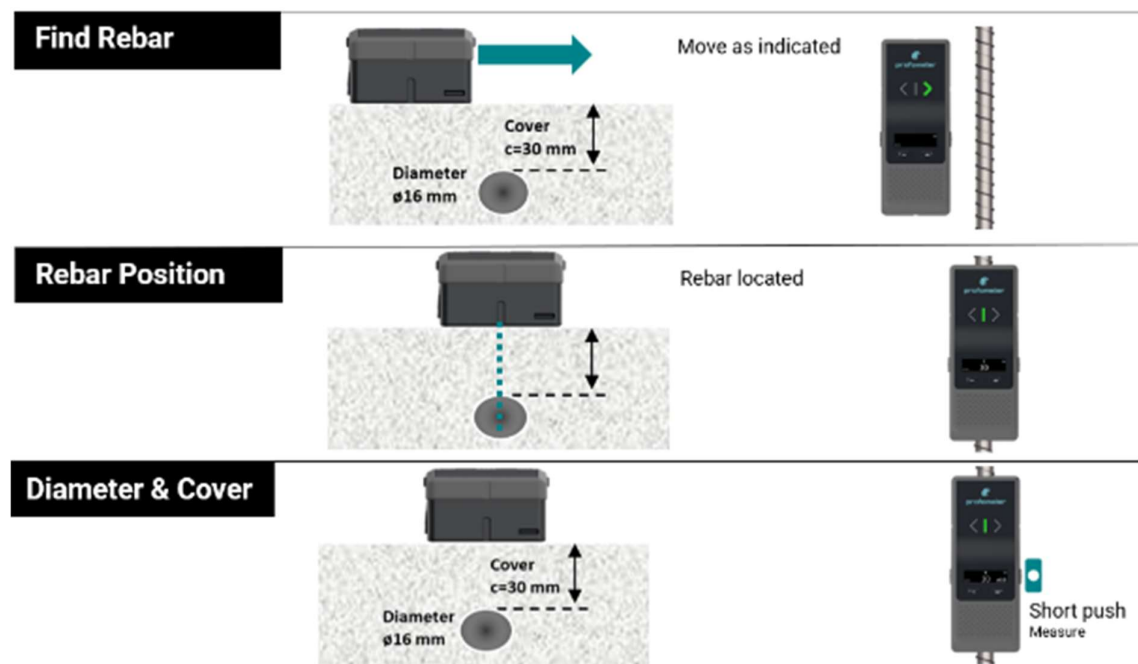

Figure 37: Measurement process

5.3.1 Finding a Rebar, midpoint (="safe spot" to drill) or rebar orientation

Place the PM8000 on the test surface and move it slowly in a chosen direction. The PM8000 reacts differently depending on its orientation relative to the rebars.

There are three scenarios.

Scenario A: *Sweeping Perpendicular to the Rebars*

The Center Line is in parallel to the rebars This is the correct scenario to detect the rebars. Try it out on the rebar provided in the case, as explained in section 4.9.5.

Approaching a Rebar
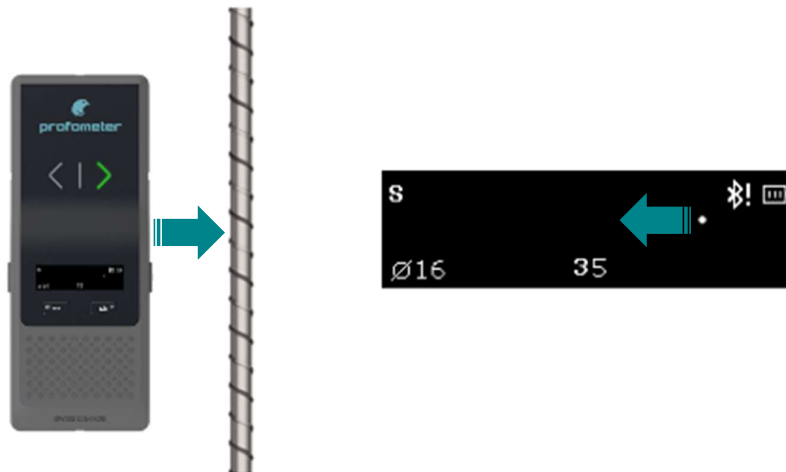
Figure 38: Approaching a Rebar

- Tracking indicator moves in opposite direction to the PM8000.
- The cover value is decreasing as the tracking indicator moves towards the Center Line.

Continue sweeping until the tracking indicator is exactly at the Center Line.

- The cover value reaches the minimum value corresponding to rebar cover.
- The LED Indicator will light. (If the acoustic signal is activated it will sound as long as the LED is lit).
- The rebar is directly beneath the measurement center (MC).

🛈 When the rebar is too deep and/or small, it may happen that the tracking indicator indicates the presence of an object without LED indicator lighting.

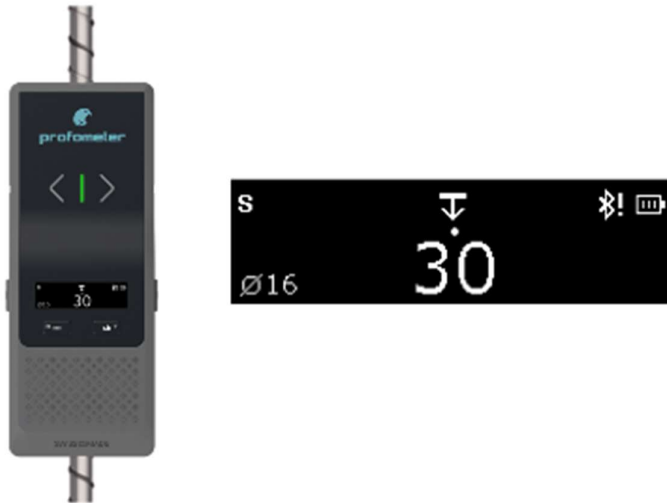*Figure 39: Indication of a rebar*

Approaching a Midpoint
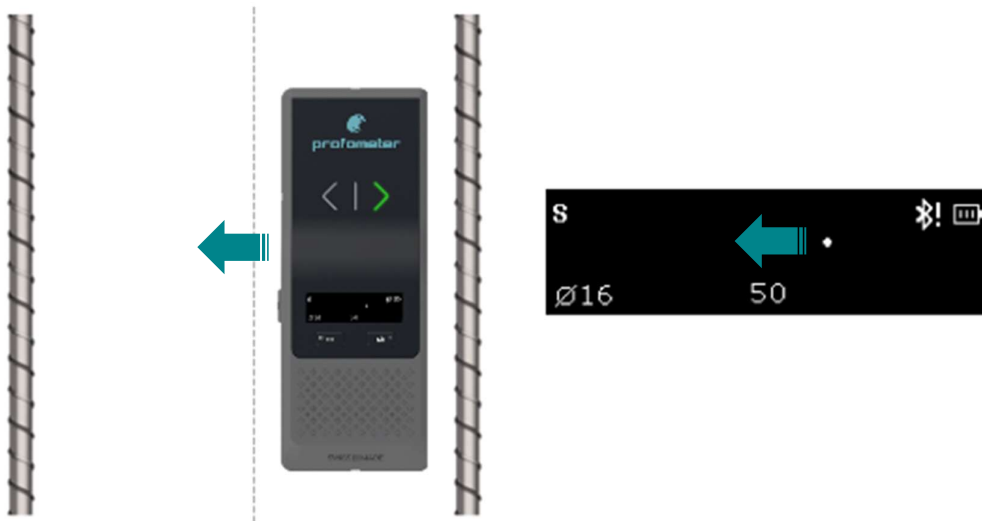
Figure 40 : Approaching a midpoint

- The tracking indicator moves in the same direction as the PM8000.
- The cover value keeps increasing until a maximum value.

Continue sweeping until the tracking indicator is exactly at the midpoint Line.

- The *midpoint* is directly beneath the Measurement Center (MC).
- The LED Indicator will *not* light.
- The LED arrows will not light or will light rapidly from one direction to the opposite one.
- The cover value reaches the maximum value.
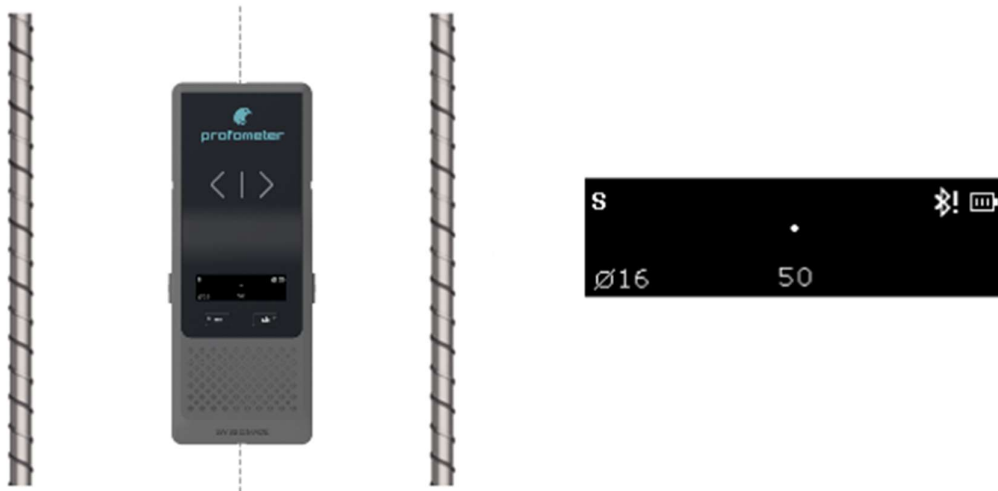
Figure 41 : indication of a midpoint

Distinguishing between a Rebar and a midpoint

The midpoint is typically **the safe spot to drill**, located in the middle of two rebars (when not so far apart from each other). By moving the PM8000 sensor, it is possible to locate each rebar and the midpoint.
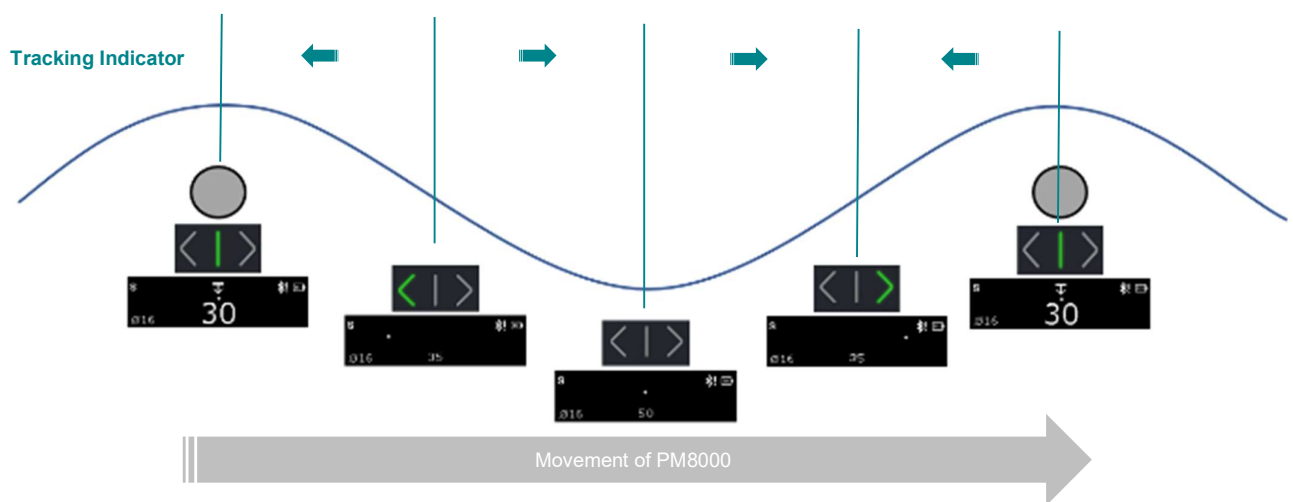
Figure 42: Distinguishing between a Rebar and a Midpoint

Scenario B: *Sweeping Parallel to the Rebars*

The Center Line (9) is perpendicular to the rebars.
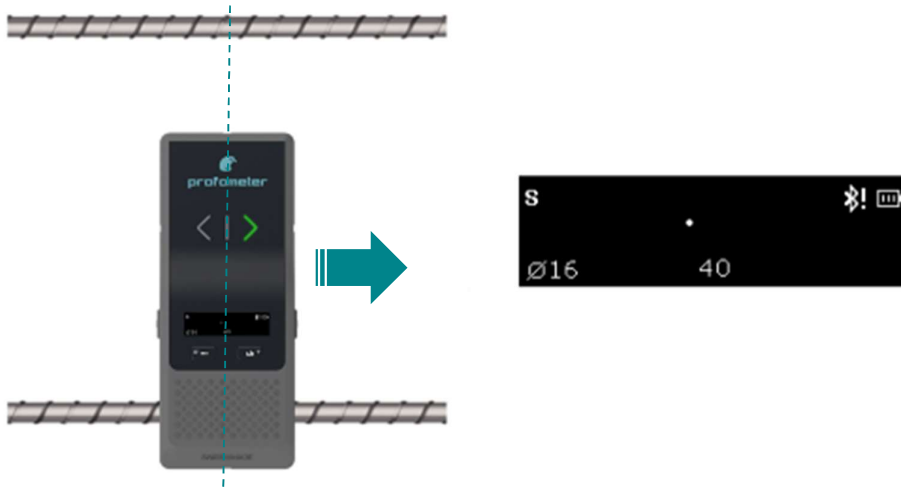
Figure 43: Sweeping parallel

Little or no movement of the tracking Indicator. In this case turn the PM8000 by 90° and continue sweeping as described under Scenario A.

Scenario C: *Sweeping at an Angle to the Rebars*

The response on the screen will be like the case when you are sweeping perpendicular (Scenario A), but the movement of the tracking indicator will be slower. Move the PM8000 until the LED lights. The Measurement Center (MC) is precisely above a rebar which you do not know the orientation. Mark the position of the MC.
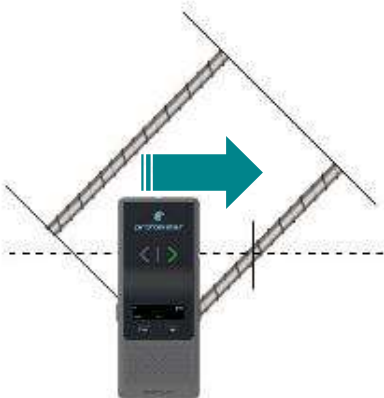
Figure 44: Sweeping at an angle

How to find the check the rebar orientation? Rotate the PM8000 sensor around the measurement center as described in Figure 45.

When the PM8000 rotates toward the rebar orientation, the cover value will reduce until a minimum value corresponding to the real rebar cover and real orientation.
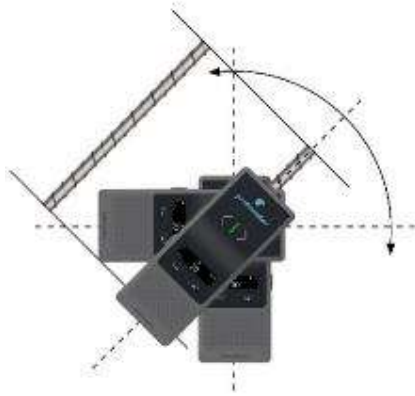
Figure 45: Rotating to find the rebar orientation

5.3.2   Map out the rebar grid

There are two ways to map out the rebar grid of the reinforced concrete element:

1. Use Area scan measurements with the PM8000 sensor and pm app software (see tutorial videos, only available with PM8000 Pro).
2. Detect and mark rebars with PM8000 sensor in standalone by starting with the first rebar layer and then second rebar layer. It is very important to always position the sensor at the midpoint line.

❗   First rebar layer is usually set horizontally for columns or walls, vertically for beams.

❗   Rebar diameter measurement for columns is a very delicate task considering the limitations described in section 4.9.4.
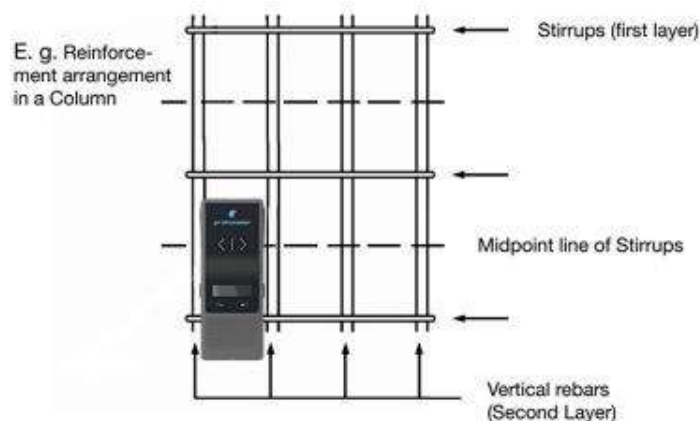
Figure 46 : Mapping rebar grid for column

5.4 Measurement files visualization & storage

Depending on the product license (see section 1.2), the pm app software enables the visualization of spot and scan measurements such as line scan & area scan views, statistics & advanced statistics, heat maps. In addition, there is a logbook providing traceability of each measurement: time, operator, position and instrument information, pictures (with iPad camera) and written or oral notes.

Given mobile data connectivity (Wifi or mobile network), the pm app automatically and safely stores all measurements on the Screening Eagle Workspace by synchronizing with the iPad. Reporting is done from the Screening Eagle Workspace.

❗ Swipe vertically up or down with 2 fingers for navigating between line scan view, area scan view & statistics. Menu is always accessible on the right.

❗ The threshold slider defining cover limits is always accessible on the left for any view. Add colours by pushing "+" or more colours by pushing the palette on top.

5.4.1 Spot scan measurements

Available only with Profometer PM8000 and PM8000 Pro licenses, the spot measurements collected with the PM8000 sensor in standalone mode can be transferred to the iPad (as described in section 4.7.9); pm app software provide statistics of spot data & logbook for adding additional information.

Figure 47 : Spot data statistics & logbook

5.4.2 Line scan measurements

Available only with Profometer PM8000 and PM8000 Pro licenses, there are 2 views for line scan measurements:

- The complete view with rebar cover, diameter & signal strength view by default during measurement and after-measurement
- The simple view with rebar cover & diameter line scan view, useful for reporting

❗ The signal strength view allows a deeper understanding of metallic objects size, depth, and locations. It can be used for identifying very close rebars at different depth.

Figure 48: Line scan complete view with signal strength view

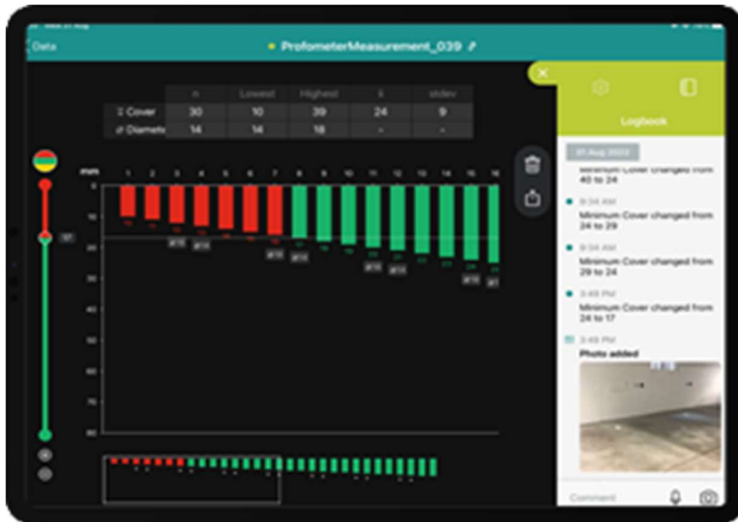*Figure 49 : Line scan simple view*

5.4.3 Area scan measurements

Available only with Profometer PM8000 Pro license, the area scan view (cover & diameter values) is created with scan measurement with connected sensor.
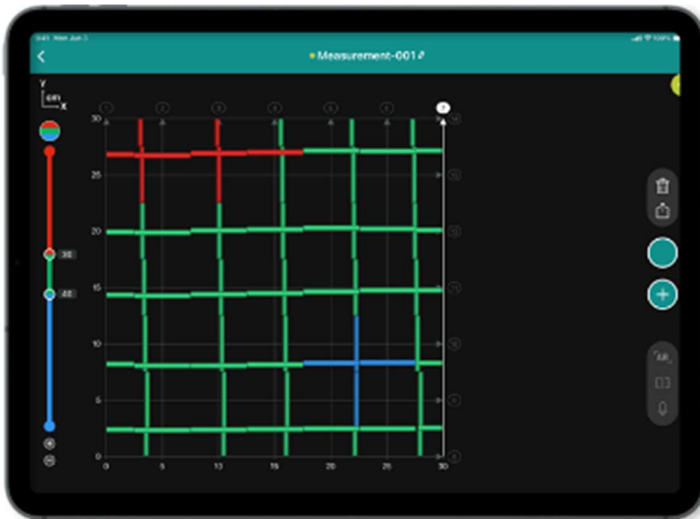

Figure 50: Area scan view

5.4.4 Image processing

To reach the optimal accuracy defined in section 4.8.2, it is important to provide additional information in the image processing menu of the software (before or any time after scanning):

5.4.4.1 Rebar diameter

- Rebar diameter of the first layer (mat)
- Rebar diameter of the second layer (mat)

When one or few rebars have specific rebar diameters different from most of the scanned rebar (=rebar diameter setting in image processing) then it is possible to change rebar diameters by selecting manually the concerned rebar (long push).

🛈 How to know rebar diameters? we recommend reliable sources such as shop drawings or inspection holes. The rebar diameter estimation with PM8000 is still possible but the values must be taken with extreme precaution considering the limitations defined in section 4.9.4.

5.4.4.2 Neighbouring rebar correction (NRC)

- Rebar spacing of the first layer (mat)
- Rebar spacing of the second layer (mat)

The rebar spacing of the first layer can be automatically measured by the sensor and processed by the software, just activate "auto rebar spacing a1" feature (only available with PM8000 Pro license).

5.4.5   Statistics & Advanced statistics

Statistics are available for spot, line & area scan measurements. In addition, advanced statistics according to DBV (Deutscher Beton- und Bautechnik-Verein) are provided for line & area scan measurement, only available for Profometer PM8000 Pro. A document explaining DBV statistics is provided in the website : [Screening_Eagle_Technologies_Intro_to_DBV guideline.pdf (screeningeagle.com)](#).

Figure 51: Advanced statistics view

5.4.6 Heat Maps

Available only with Profometer PM8000 Pro, heat maps can be created from area scan view. Augmented reality is possible by superimposing the heat map on the real structure.
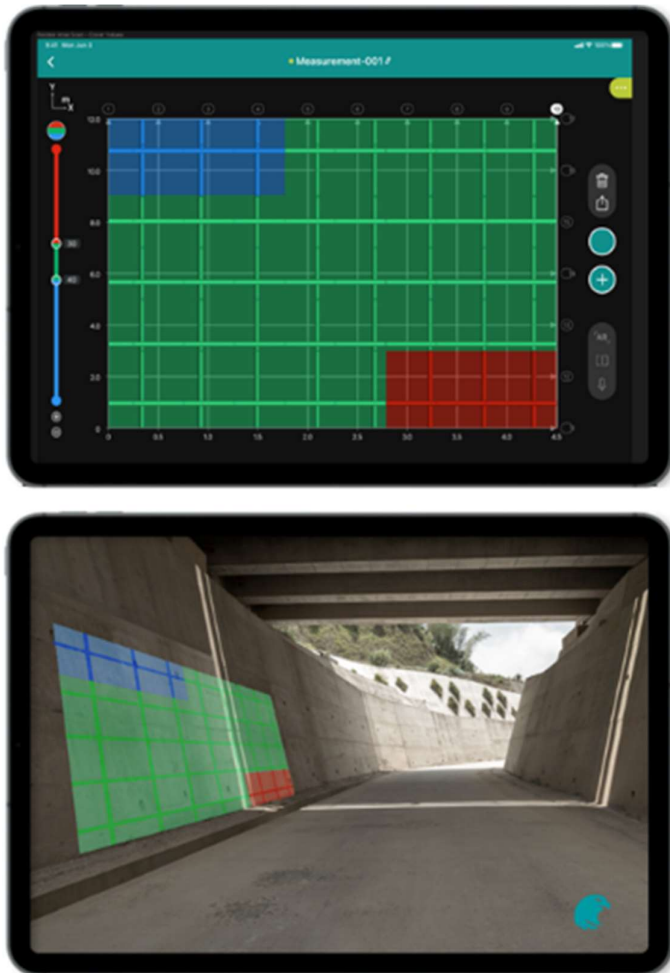
Figure 52: Heat map & Augmented reality

5.4.7 Data storage, reading, sharing & reporting

Screening Eagle Workspace is the 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 & reporting (pdf printing of tab) is possible. The tabs provide all the cover & diameters table values, screenshot views & logbook information.

Sharing from workspace is possible with different formats such as CSV or DXF.

Figure 53: Screening Eagle Workspace

6   Application hints

6.1   Measurement process

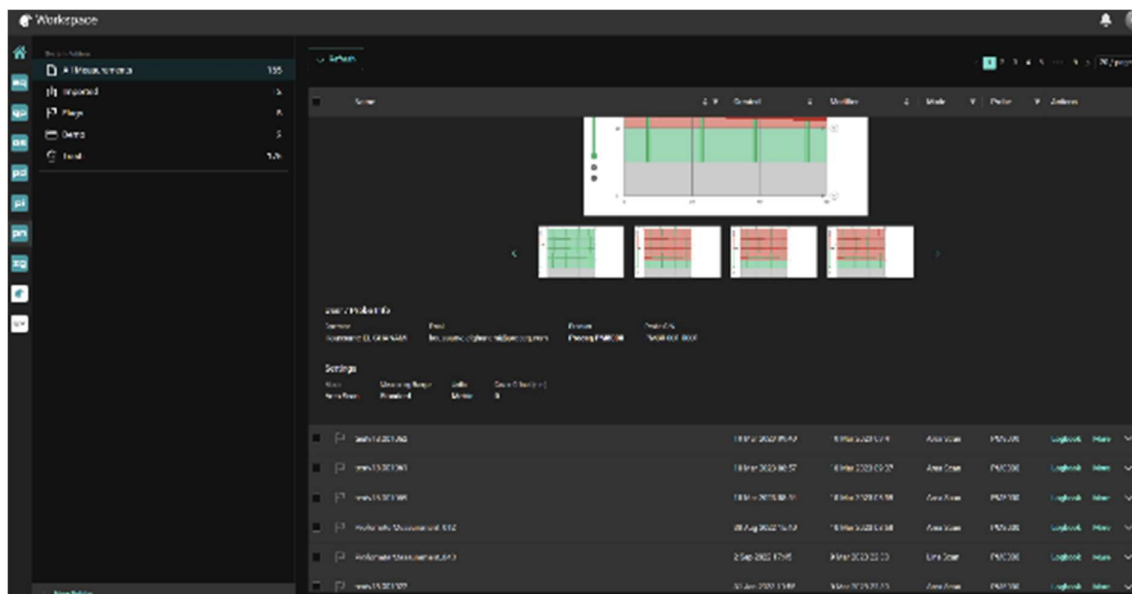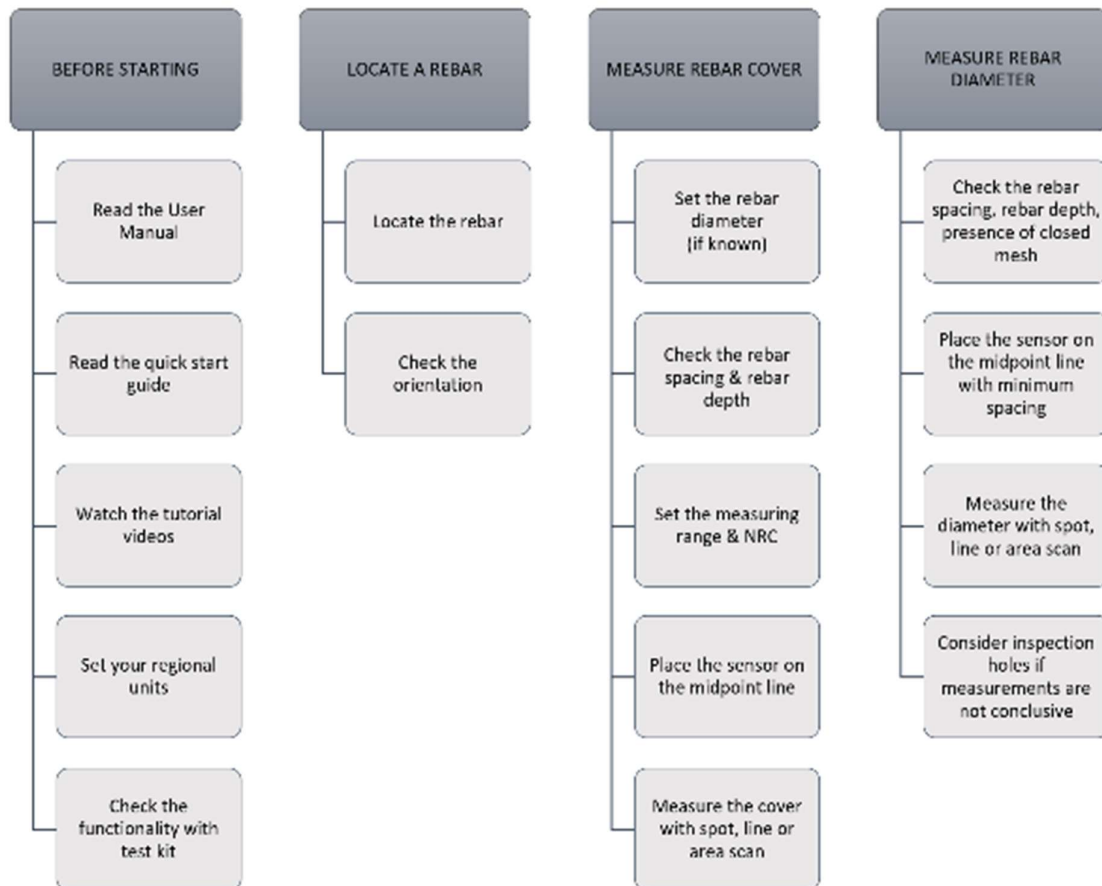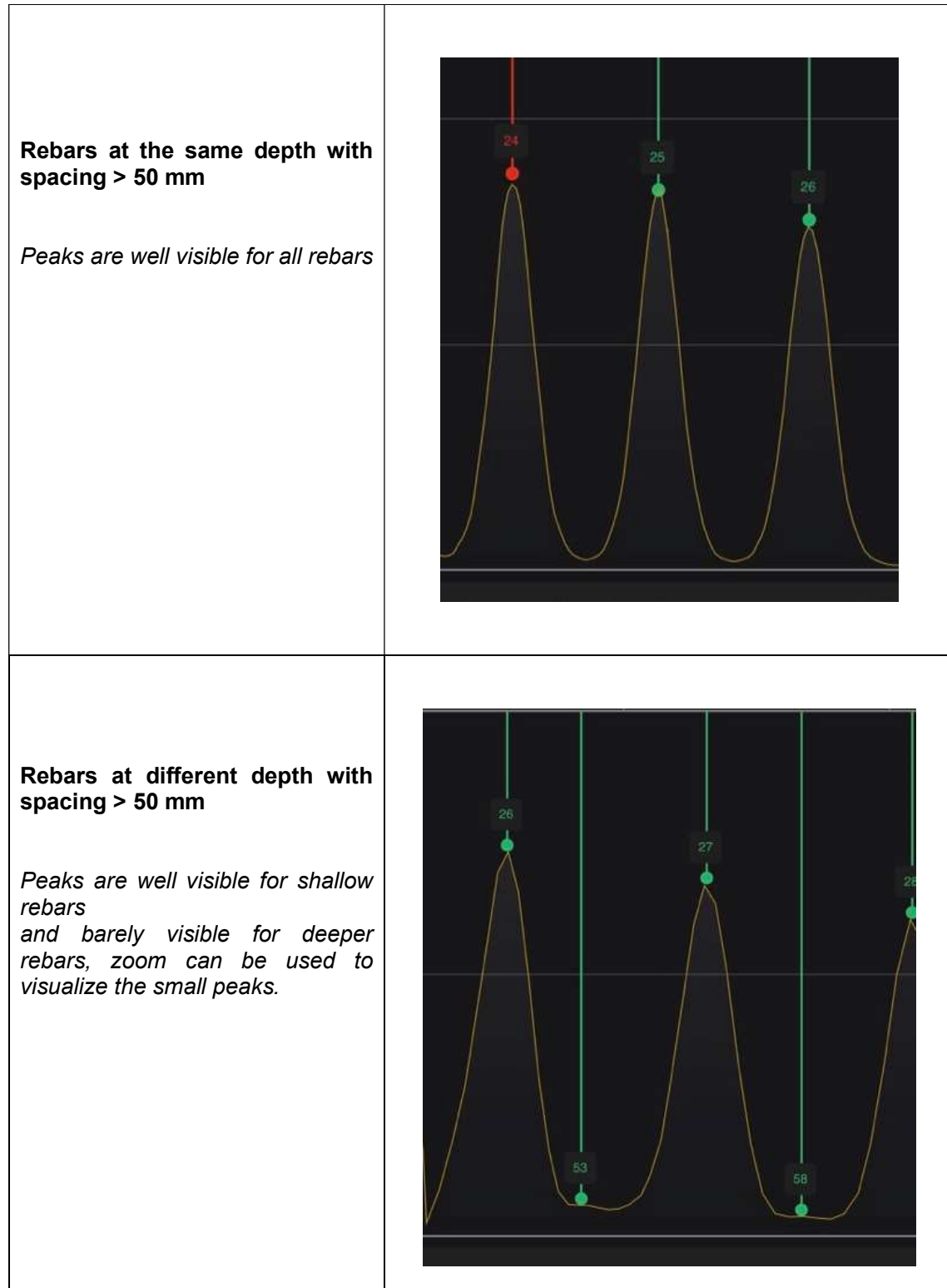| BEFORE STARTING	LOCATE A REBAR	MEASURE REBAR COVER	MEASURE REBAR DIAMETER
Read the User Manual	Locate the rebar	Set the rebar diameter (if known)	Check the rebar spacing, rebar depth, presence of closed mesh
Read the quick start guide	Check the orientation	Check the rebar spacing & rebar depth	Place the sensor on the midpoint line with minimum spacing
Watch the tutorial videos		Set the measuring range & NRC	Measure the diameter with spot, line or area scan
Set your regional units		Place the sensor on the midpoint line	Consider inspection holes if measurements are not conclusive
Check the functionality with test kit		Measure the cover with spot, line or area scan	

- ❗ Understand the limits of the pulse induction principle especially when rebars are too deep into concrete or when rebars are too close each other.
- ❗ Make sure you apply the correct measuring range; Several graphs are provided in this user manual to help you refining the range setting.
- ❗ Do not use deep mode if presence of welded or tied meshes in concrete!
- ❗ Make sure the sensor is always positioned at the midpoint line! These are the best conditions to measure the rebar cover and to estimate the rebar diameter.
- ❗ Check the orientation of rebars before measurement!
- ❗ Remember that an accurate rebar diameter setting give an accurate cover depth result.
- ❗ Understand the limits of rebar diameter estimation. Many factors affect it as described in this manual. Do not rely on one measurement. Rebar layout in concrete is never perfectly regular, there are many overlapping rebars, ties or wires. Best is to measure at several spots and if not conclusive then consider a drill inspection hole with use of as-built drawings if any.
- ❗ Make sure to apply the neighbouring rebar correction whenever necessary!
- ❗ In case of quick rebar location or check cover & rebar diameter then use the PM8000 sensor without cart in standalone operation. The use of cart is adapted for line scan and area scan with pm app software.

6.2 Signal strength interpretation

The signal strength visible in the line scan complete view provides qualitative information on the rebar setup; here are some typical cases when scanning reinforced concrete with PM8000 or PM8000 Pro:

|	
Rebars at the same depth with spacing > 50 mm *Peaks are well visible for all rebars*	
Rebars at different depth with spacing > 50 mm *Peaks are well visible for shallow rebars* *and barely visible for deeper rebars, zoom can be used to visualize the small peaks.*	

Rebars with large differences in depths and/or with spacing > 50mm *The line scan signal strength measured is always a superposition of all signals in the influence sphere of the device (see Figure 29: PM8000 sphere of influence).* *Rebars which are closer to the surface, meaning having smaller cover values, have much larger signals.* *The signal strength of single rebar is proportional to $1/(cover)^6$).* *If a rebar is much closer to the surface than the neighboring one's, its signal can hide the peaks of the lower one's. The peaks are not visible.*	
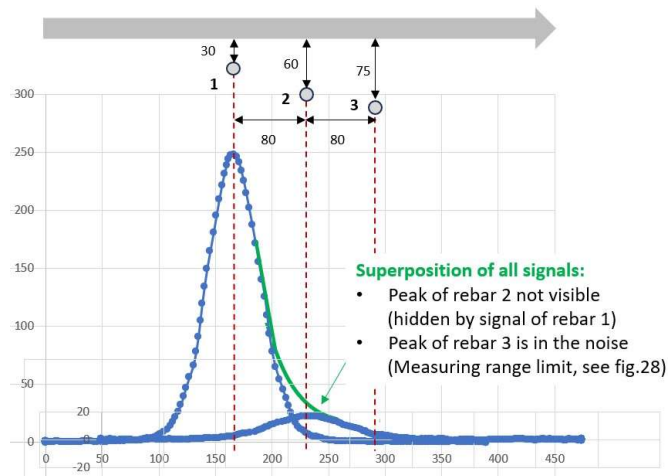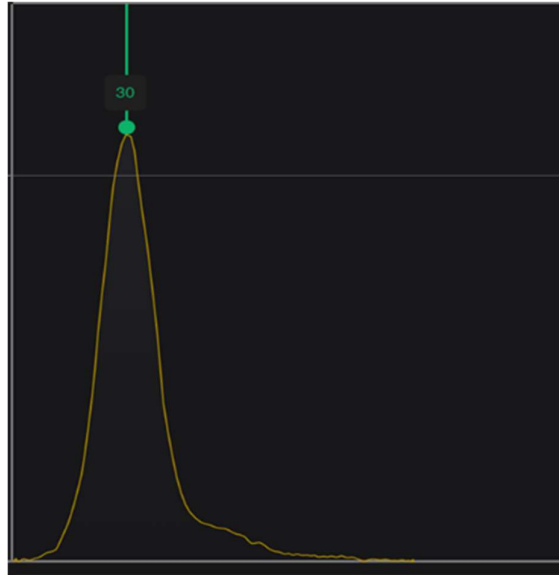
❗ Any cover value triggered by a low-quality signal (low strength or superimposition) can be excluded manually with long push on selected rebar (through iPad screen). Only available only with Profometer PM8000 & PM8000 Pro users.

❗ For DBV statistics (see 5.4.5), cover values triggered by a low-quality peak signal (low strength or superimposition) should be considered for exclusion with long push on selected rebar (through iPad screen).

7 Technical Specification

Measurement Principle	Eddy current

Cover Measurement

Max. Depth	Up to 185mm / 7.3 in
Accuracy	Depending on Depth +/- 1mm to 4 mm / 0.04in to 0.16 in

Rebar Diameter

Max. Depth	Up to 63 mm / 2.5un
Accuracy	+/- rebar diameter

Encoder accuracy	+/- 0.5mm / 0.02 in + 0.5% of measured length
Max. scanning Speed	0.5 m/s / 1-7 ft/s
Max. Line Scan Distance	Up to 1km / 0.6 miles
Display	High contrast OLED display
Connection	Wireless, BT
Warranty	2 years
Operating Temperature	5°C to +40°C
Storage Temperature	- 10°C to +60°C
Relative humidity	up to 85 %, non condensing
Protection against water and dust	IP 54
Dimensions	With cart: 250 x 130 x 45 mm / 9.8 x 5.1 x 1.8 in Without cart 190 x 75 x 45 mm / 7.5 x 3.0 x 1.8 in
Weight	With cart: 690g / 1.5lb Without cart 300g / 0.7lb
Power Supply	AA NiMH Batteries (2x, removable and flight safe) Over cable USB-C (power adapter or power bank)
Battery Life	8 hours (in typical use)

SWISS MADE

The English version of the content remains the official version. All translated content should bear an appropriate notice to this effect.

For safety and liability information, please download at

www.screeningeagle.com/safety-and-liability

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