

# proceq

## PROFOMETER® PM-600 / PM-630 OPERATING INSTRUCTIONS



60 Years of Innovation

Made in Switzerland

## Scope of Delivery



- A** Profometer Touchscreen Unit
- B** Battery complete
- C** Universal Probe with Cart
- D** Profometer PM-6 probe  
Cable 1.5 m
- E** Power Supply with cable (USA,  
UK or EU)
- F** USB Cable 1.8 m (6 ft)
- G** DVD with Software
- H** Documentation
- I** Carrying Strap complete

## Overview

### USB Host

Connecting a mouse, printer, USB memory cards etc.

### USB Device

Connecting application specific probes and PC.

### Ethernet

Connecting to the internet for firmware upgrades.

### Power supply

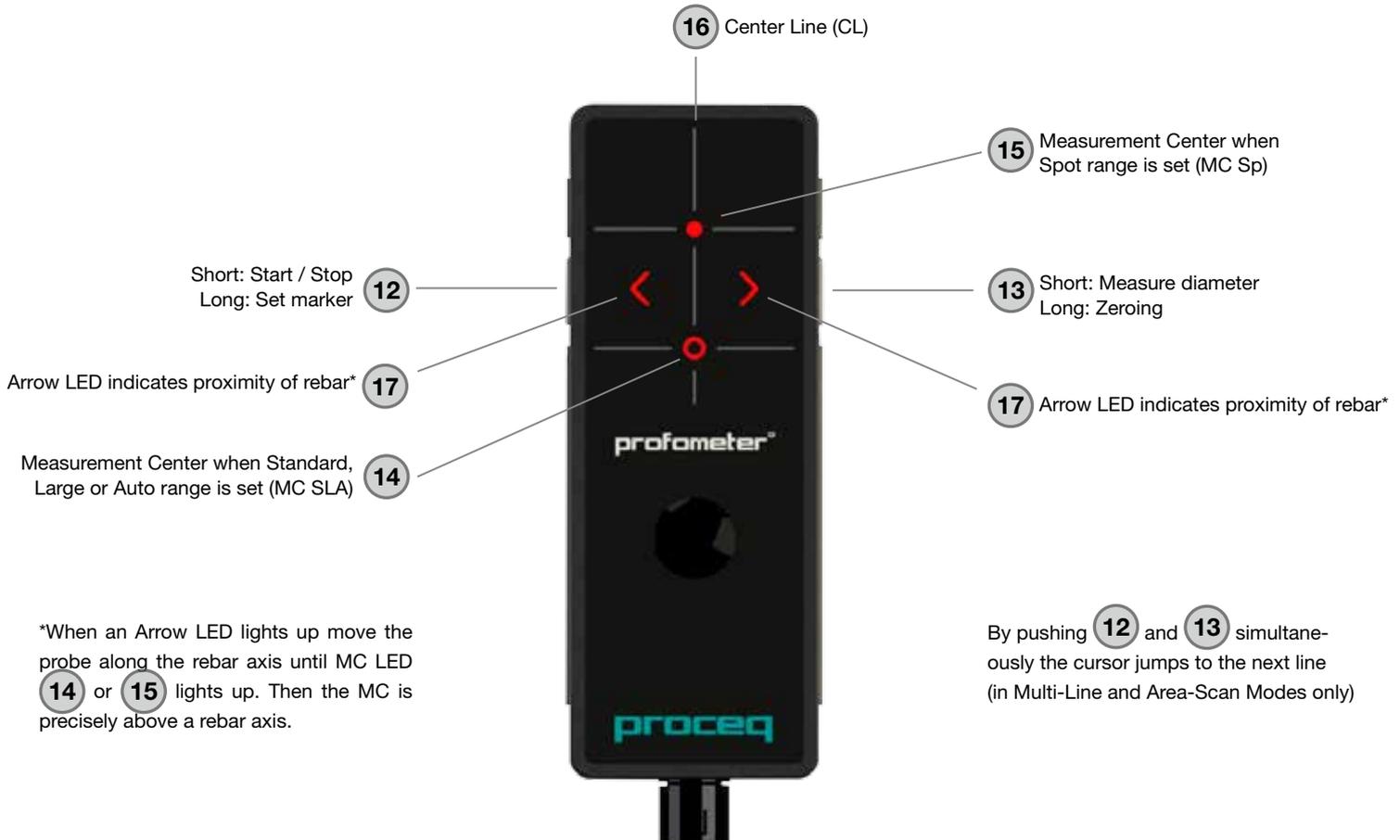
External power supply connection.



Press to power on. To power off press again and tap "X Off" on the screen.

Soft Key – Switches in and out of full screen view.

Back Button – Returns to previous screen.



\*When an Arrow LED lights up move the probe along the rebar axis until MC LED 14 or 15 lights up. Then the MC is precisely above a rebar axis.

By pushing 12 and 13 simultaneously the cursor jumps to the next line (in Multi-Line and Area-Scan Modes only)

## Table of Contents

<b>1. Safety and Liability .....</b>	<b>6</b>	<b>6. Technical Specifications.....</b>	<b>24</b>
1.1 General Information.....	6	<b>7. Maintenance and Support .....</b>	<b>25</b>
1.2 Liability.....	6	7.1 Maintenance .....	25
1.3 Safety Instructions .....	6	7.2 Support Concept.....	25
1.4 Correct Usage .....	6	7.3 Standard Warranty and Extended Warranty .....	25
<b>2. Measuring Principle .....</b>	<b>7</b>	7.4 Disposal .....	25
2.1 Measuring Principle .....	7	<b>8. PM-Link Software .....</b>	<b>25</b>
2.2 Calibrated Measuring with Profometer PM-600/630 .....	7	8.1 Starting PM-Link .....	25
2.3 The Measuring Range.....	7	8.2 Viewing Data.....	26
2.4 Resolution.....	8	8.3 Adjusting Settings .....	27
2.5 Sphere of influence by Ferromagnetic Material.....	8	8.4 Exporting Data.....	28
<b>3. Operation.....</b>	<b>8</b>	8.5 Deleting Data .....	29
3.1 Getting Started .....	8	8.6 Further Functions .....	29
3.2 Main Menu .....	9	<b>9. Appendices.....</b>	<b>30</b>
3.3 Settings.....	9	9.1 Appendix A1 Rebar Diameters .....	30
3.4 Measurement Screen .....	10	9.2 Appendix A2 Neighboring Bar Correction.....	30
3.5 Measurement Modes .....	11	9.3 Appendix A3 Minimum Cover .....	30
3.6 Review of Data .....	16		
3.7 Practical Hints .....	20		
<b>4. Explorer .....</b>	<b>23</b>		
<b>5. Ordering Information .....</b>	<b>23</b>		
5.1 Units.....	23		
5.2 Upgrades .....	23		
5.3 Parts and Accessories .....	24		

# 1. Safety and Liability

## 1.1 General Information

This manual contains important information on the safety, use and maintenance of the Profometer Touchscreen. Read through the manual carefully before the first use of the instrument. Keep the manual in a safe place for future reference.

## 1.2 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 this manual.
- Incorrect performance check for operation and maintenance of the instrument and its components.
- Failure to adhere to the sections of the manual 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 SA makes no warranties and excludes all liability as to the completeness and/or accuracy of the information.

## 1.3 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 this manual must be supervised when using the equipment.

- Carry out the stipulated maintenance properly and at the correct time.
- Following completion of the maintenance tasks, perform a functional check.

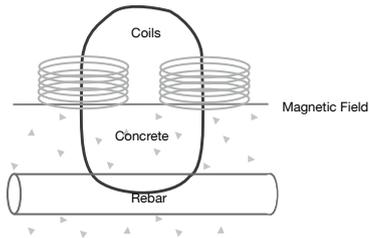
## 1.4 Correct Usage

- The instrument is only to be used for its designated purpose as describe 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 forfeit.

## 2. Measuring Principle

### 2.1 Measuring Principle

The Profometer PM-600/630 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 produced. They induce a magnetic field in the opposite direction. The resulting change in voltage can be utilized for the measurement.



**Figure 1:** Measurement principle

The Profometer PM-600/630 uses different coil arrangements to generate several magnetic fields. Advanced signal processing allows locating a rebar as well as measuring of cover and rebar diameter.

This method is unaffected by all non conductive materials such as concrete, wood, plastics, bricks etc. However any kind of conductive materials within the magnetic field (sphere of approx. 100 mm / 4" radius) will have an influence on the measurement.



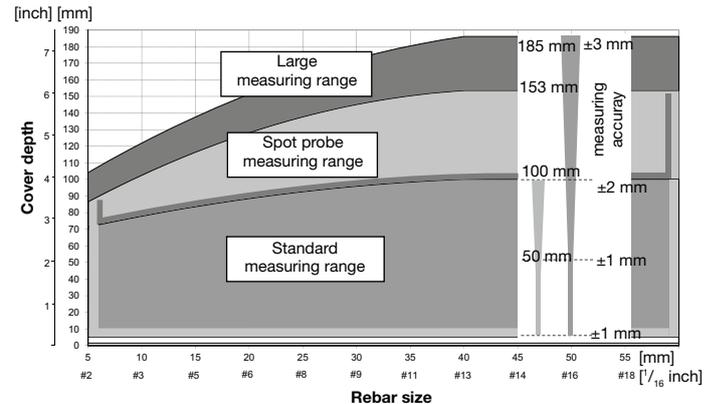
**NOTE!** Remove all metallic objects such as rings and watches before you start measuring.

### 2.2 Calibrated Measuring with Profometer PM-600/630

The Profometer PM-600/630 is calibrated to measure on a normal rebar arrangement; which is an arrangement of non-stainless steel rebars fastened with binding wires only e.g. when measuring on welded mesh wires the cover and diameter readings must be corrected (see "3.7 Practical Hints"). The following information on accuracy, measuring ranges and resolutions refer to measurements on normal rebar arrangements.

### 2.3 The Measuring Range

The measuring range is dependent on the bar size. The expected accuracy of the cover measurement is indicated in the graphic below. It complies with BS1881 part 204, for a single rebar with sufficient spacing.



Up to the indicated limits the cover is measured and displayed.

In the Locate Mode a rebar is shown. In the Single-Line Mode the cover curve is shown but a rebar is only set up to 90 % of the maximum cover.

**Figure 2:** Measuring ranges and accuracy

## 2.4 Resolution

There is a limit to the minimum spacing of bars depending on the cover depth and rebar diameter. It is impossible to distinguish between individual bars above these limits.

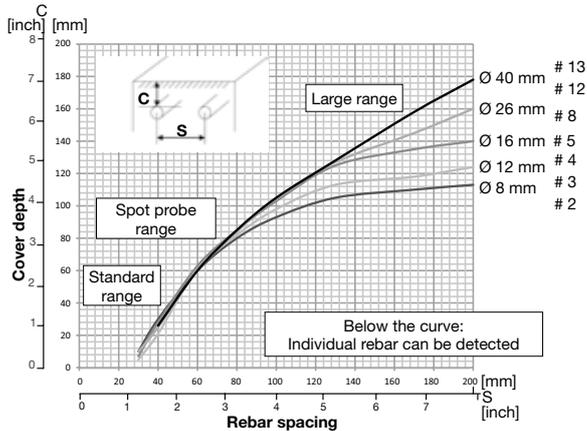


Figure 3: Resolution

## 2.5 Sphere of influence by Ferromagnetic Material

Sphere of influence, diameter 200 mm / 8"

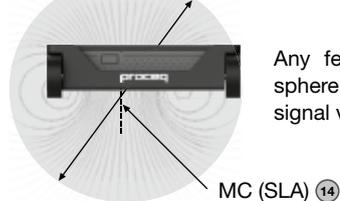


Figure 4: Influence sphere



NOTE! This effect can be reduced by the neighboring bar correction implemented in the PM-600/630.

## 3. Operation

### 3.1 Getting Started

#### Battery Installation

To install the Battery (B) into the Profometer Touchscreen Unit (A), lift the stand as shown. Insert the battery and fasten in place with the screw.



Figure 5: Insert Battery

There are two status LEDs **1** and above them a light sensor. The upper LED is red while charging and turns to green when it is fully charged. The other LED is application specific.



NOTE! Only use the battery charger provided.

- A complete charge requires <9h (Instrument not operating)
- Charging time is much longer if the instrument is in use.
- An optional quick charger (Part No. 327 01 053) can be used to charge a spare battery or to charge the battery outside of the instrument. In this case it takes <4h for a complete charge.

Connect the Universal Probe (C) to one of the sockets on the upper side of Profometer Touchscreen Unit (A) using the Probe Cable (D)



Figure 6: Top side of Touchscreen

### 3.2 Main Menu

On start up the main menu is displayed. All functions may be accessed directly via the Touchscreen. Return to the previous menu by pressing the back button or the return icon (arrow) at the top left of the Touchscreen.

- Measurement: Application specific measurement screen.
- Settings: For application specific settings.
- Explorer: File manager functionality for reviewing measurements saved on the instrument.
- System: For system settings, e. g. language, display options.
- Information: For device information and remaining storage capacity.
- Off: Power off.

### 3.3 Settings



NOTE! The settings must be checked prior to each measurement.

Scroll up and down the screen by dragging your finger up or down the screen. The current setting is displayed on the right hand side. Tap on an item to adjust it.

#### Range Selection

Select between **Standard**, **Large** or **Auto** cover ranges (see Figure 2).

**Standard** is the default setting, because it is the most accurate one. **Auto** switches automatically between **Standard** and **Large**. **Spot** should be selected for measurements on small areas, in corners and on rebar arrangements with small spacing.

#### Rebar Diameter

Select the **Rebar Diameter** (6 mm to 40 mm / #2 to #12, see also table in Appendix A1), either determined from the drawing or as measured.

#### Neighboring Rebar Correction

It mitigates the influence of neighboring rebars. By setting the spacing to the rebars running parallel to the rebar on which the measurement is taking place, the diameter and the cover are automatically corrected. This is possible for rebar spacing from 50 mm to 130 mm / 2.0" to 5.2" (see also table in Appendix A2).

#### Unit

Select **Metric**, **Metric Japanese**, **Imperial** or **Imperial Diameter, Metric Cover and Distance**.

#### Minimum Cover

A **Minimum Cover** (10 mm to 143 mm / 0.4" to 5.6") can be set. Rebars with less than minimum cover will be shown in red color, in the Single-Line and Multi-Line Mode/View. In the Single-Line View and Statistical View a horizontal, respectively vertical dotted line in red indicates the Minimum Cover Value set (see also table in Appendix A3).

#### Cover Offset

When a **Cover Offset** value is set the measured cover will be reduced by this value; e. g. when a wooden or plastic plate is used to measure with the probe cart on rough surfaces (see "3.7 Practical Hints"). In this case the plate thickness must be set as Cover Offset value). A value from 1 mm to 50 mm / 0.04" to 1.92" can be set.

### Display Inclined Rebar

By setting this feature the inclined rebar is displayed in the Locate Mode when all four wheels of the cart have passed over the inclined rebar. In the Single-Line and Multi-Line Modes it is only shown in the cart symbol.



NOTE! In areas with small rebar spacing this feature may not work properly

### Display Curve

Select **Cover Value**, **Signal Strength** or **None**. The respective curve or no curve is displayed in Single-Line View.

### Align rebar position in Multi-Line Mode

When measuring along at least two rows of at least 55 cm / 22" length, the rebar positions of the last row are aligned to the rebar positions of the first row.



NOTE! This feature should only be set, if the first rebar is running parallel to the Start line

### Return to start on new line

With this feature set, the cursor jumps back to the start line when changing row in the Multi-Line Mode.

### Line Height

The line height must be set in the Multi-Line and Area-Scan Modes. It determines the spacing between the measuring rows. A height 5 cm to 203 cm / 2" to 80" can be set.

### Grid Width

The grid width must be set in the Area-Scan Mode. It must be about 1.1 times larger than the largest rebar spacing of the first layer rebars. This ensures at least one rebar located within one grid. A width from 5 cm to 203 cm / 2" to 80" can be set.

## 3.4 Measurement Screen

The standard measurement screen is shown on page 3. All settings are directly accessible from the measurement screen.



**Zoom in** by placing thumb and index finger together on the screen and spreading them apart. This can be used in both the horizontal and vertical directions when making a measurement.



**Zoom out** by placing thumb and index finger apart on the screen and pinching them together.

**Pan** the image from left to right by dragging.

### Measuring screen controls (see page 3)

- 1 File name:** Enter the file name and tap return. Saved measurements will be stored with this file name. If several measurements are made under the same filename, a suffix increments after each measurement and follows the file name.
- 2 Measurement Mode:** Select the type of measurement to be carried out (see "3.5 Measurement Modes").
- 3** The top right hand corner of the display shows the current time, the battery status and a warning triangle for zeroing the probe: after 5 minutes in orange, after 10 minutes in red.



NOTE! Tap on the triangle to perform zeroing.

- 4 **Display** of selected Settings and Screen Mode:
- Probe Range
  - Rebar Diameter
  - Neighboring Rebar Correction
  - Cover Offset
  - Line Height (for Multi-Line and Area-Scan Modes only)
  - Grid Width (for Area-Scan Mode only)
  - Probe Direction X: Undefined direction
    - ^, v, <, >: On vertical wall, probe head towards up, down, left, right
    - ↔, ↕: On horizontal surface, on soffit

5 **Settings:** Switches to the settings menu (see “3.3 Settings”).

6 **Rebar Diameter:** Measuring or change setting of rebar diameter

7 **Start:**  Measurements or  store measured data

8 **Restart** with measurements and reposition cursor to the start line. (All data of current measurements are deleted)

9 **File Info** or delete, Cursor to Start line in Multi-Line and Area-Scan Modes

10 **Zoom in** to cursor position (for Single-Line Mode only)  
**Set cursor** to line below or above (for Multi-Line Mode only)

11 **Zoom to fit** During measurement: Goes back to standard view  
 Stored file: Complete measuring area is displayed

### 3.5 Measurement Modes

When Measurement Mode is selected for the first time after switching on the instrument, zeroing of the probe is performed. Confirm it and wait for the button assessment window. Wait or tap anywhere on the screen.

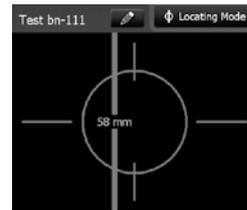
The PM-600 has Locate Mode only. The PM-630 has additionally the Single-Line, Multi-Line and Area-Scan Modes. The measurement Modes available are shown at 2 on the measuring screen.

#### Locate Mode

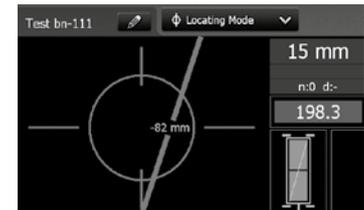
The Locate Mode is the default mode because all measurements should start with this mode (see also Note! in chapter “3.3 Settings”).

- Hold the probe cart with the CL 16 parallel to the assumed direction of the rebar to be scanned. Then scan perpendicular to the CL until the probe cart crosses a rebar. The display shows (only if probe is fixed on the cart):

Approaching a rebar



Rebar is inclined to the CL (minimum inclination for a display is 6 degrees).



When the Center Line 16 is precisely over the rebar (red LED of probe center is lit) it shows:



- Actual Cover
- Distance to next rebar
- Nos./Meas. diameter
- Signal strength
- Both rectangles Green: Ideal probe position: Both coils maximum signal strength and green
- Bad probe position: Coil rectangles of different size and red
- A rebar is shown only within the cover ranges indicated in Fig 2.

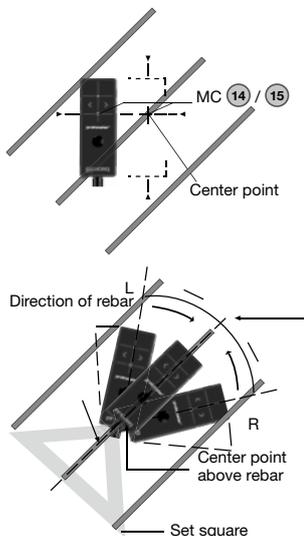
Figure 7: Screens of Locate Mode

In most cases the rebars of the first and second layers are fixed in a rectangular mesh (e. g. vertical and horizontal rebars in a wall).

In case an inclined rebar is displayed, one has to find out the exact rebar direction.

- For this purpose locate the rebar as described below, but first remove the probe from the cart.
- Once the MC ⑭ / ⑮ is above the rebar axis mark the position of the MC on the surface at CL ⑯ at the upper edge of the probe and on either side of the MC.
- Position the CL point at the lower edge of the probe precisely at the marked center point.
- Turn the probe around this center point until the maximum signal is displayed. (Placing a set square with one corner at the center point facilitates the turning of the probe).

The CL ⑯ runs parallel to and above the rebar axis, when the signal strength reaches the maximum and the MC ⑭ / ⑮ lights up.



**Figure 8:** Finding the rebar direction

Whenever possible start with locating the rebars of the first layer, e. g. on a column the horizontal stirrups.

- Holding the CL ⑯ horizontally, move vertically up or down until the Arrow LED lights up and then move back until the MC LED lights up.

After having located the first layer rebars continue with locating the second layer rebars.

- Position the MC ⑭ / ⑮ at the mid line of the first layer rebars, e. g. on a column hold the probe with the CL running vertically and move the probe cart vertically until both rectangles in the probe symbol are green and of equal, minimum size.
- Now move the probe cart horizontally until one of the Arrow LEDs ⑰ lights up and then move back until MC LED ⑭ or ⑮ lights up.
- At this position you may also measure the diameter either by pushing ⑬ on the right side of the probe or ⑥ on the Touchscreen (e. g. when the probe is fixed to the telescopic extension rod).
- If the spacing of parallel rebars is between 5 cm and 13 cm (2.0” to 5.2”), set the respective Neighboring Rebar Correction value first.

If the cover is too small for diameter measurement “too close” is displayed.

- In this case place a wooden or plastic board on the surface and set the board thickness as Cover Offset to measure the diameter.

Finally the measured diameter must be set. The cover reading will be corrected according to the diameter set.



**NOTE!** For more details about diameter measurement see “3.7 Practical Hints”.

- Tap ⑦ to store the diameter and cover measurement.
- Repeat this procedure at each rebar.

The saved readings can be seen in the Snapshot and Normal Statistics View (see “3.6 Review of Data”).



**NOTE!** Cover values are only saved for later viewing, if the diameter was measured and saved

## Single-Line Mode



**NOTE!** It is advisable to locate the first and second layer rebars with the Locate Mode to find the optimum line position prior to measuring with the Single-Line Mode.

The Single-Line Mode is mainly used if cover must be shown along one line on a rather long distance (e.g. in a tunnel). Therefore the measurements are made across the first layer rebars.

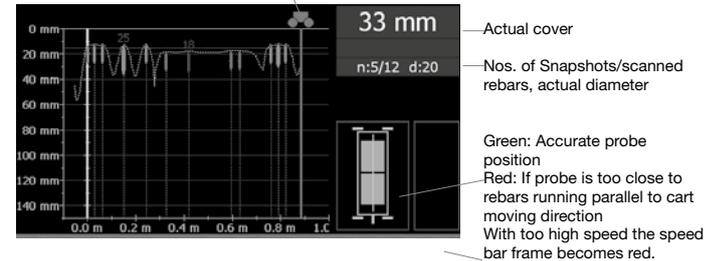
- Enter the setting menu by tapping on **5**. Set the correct settings, especially Rebar Diameter, Unit, Minimum Cover and Display Curve.

In case Single-Line scanning is done over rebars of different diameters and/or of different spacing measure each diameter.

- Position the probe cart at the start line in an optimum position (the MC **14** / **15** at the mid line of the rebars running parallel to the moving direction, both rectangles in the probe symbol are of equal minimum size).
- In case is shown at **7** tap on it and will be shown.
- Start with the measurement if the cursor is at the start line. If not perform a reset **8**.
- Move the probe cart crosswise over the rebars, not exceeding the maximum speed (speed bar half filled in green).
- Above each rebar, when the red LED of MC **14** / **15** lights up, you may measure the rebar diameter and on completion, it will be displayed in blue. The measured diameter may be deleted within 5 seconds by tapping on **6**.
- In case the spacing between the rebars is in the range of 5 cm to 13 cm (2.0" to 5.2"), set the respective Neighboring Rebar Correction value first (see Figure 23).

At the end when stopped scanning a marker (dotted blue line) is set.

Red indicates rebars with insufficient cover, others with sufficient cover  
Red dotted is the minimum required cover. Blue number indicates measured diameter.  
Probe position

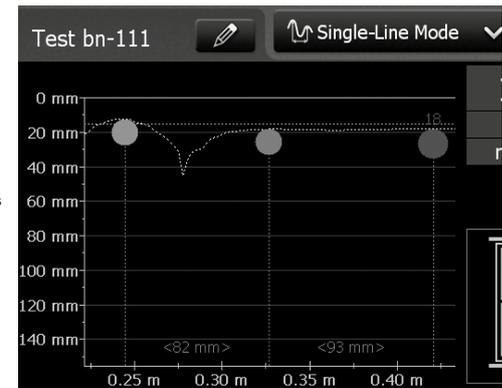


The rebars are displayed to scale depending on the diameter  
The cover curve is shown (if selected) within the cover ranges indicated in Fig 2 but a rebar will only be shown up to 90 % of those limits.

The cover curve is shown (if selected) within the cover ranges indicated in Fig 2 but a rebar will only be shown up to 90 % of those limits.

To display a rebar as a circle zoom the horizontal and vertical axis to the same scale.

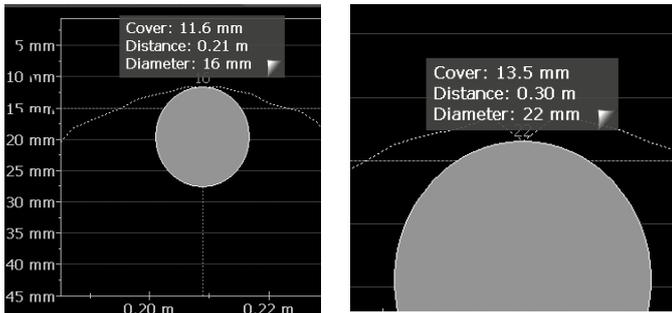
The spacings of the rebars are shown in blue.  
The distances from the start line to the first rebar and from the end line to the last rebar are shown in white color. If the figures are not shown, zoom in.



**Figure 9:** Screen of Single-Line Mode with cover curve

- To change a diameter tap on the rebar. A window opens.
- Tap on the window and change diameter. To erase set diameter to zero.

The new diameter is set and shown in orange. The cover changes accordingly but the cover curve remains except above the rebar axis. (see Figure 10)



New set diameter shown in orange

**Figure 10:** Single-Line View zoomed, showing change of rebar diameter

In the Single-Line Mode one can also change from cover curve to signal strength curve or no curve (see also “3.6 Review of Data”).

The path length measurement accuracy depends on the test surface. The accuracy of measurements done on a smooth concrete surface (concrete poured in metallic shuttering) is shown in the specifications, chapter 5. On rougher surfaces the measured length may be reduced or checked at certain intervals by setting markings on the test surface and comparing with marks set on the display (long push on 12).

After storage (tap 7), the data can be seen in the Statistics View, the Single-Line View and also in the Snapshot View if at least one diameter was measured (see “3.6 Review of Data”).

## Multi-Line Mode



**NOTE!** It is advisable to locate the first and second layer rebars with the Locate Mode to find the optimum line position prior to measuring in the Multi-Line Mode.

The Multi-Line Mode is often used if cover, rebar location and rebar diameters of mainly rectangular areas of different sizes must be shown (see chapter “3.6 Review of Data”), thus mainly for the first layer rebars.

- Enter the settings menu by tapping 5.
- Set the correct settings as for the Single-Line Mode. Additionally set the Line Height and “Return to start on new line” in which case the measurement starts at the start line for each new row.



**NOTE!** For larger areas it is advisable not to set “Return to start on new line” and to measure the lines alternatively start to end, back from end to start.

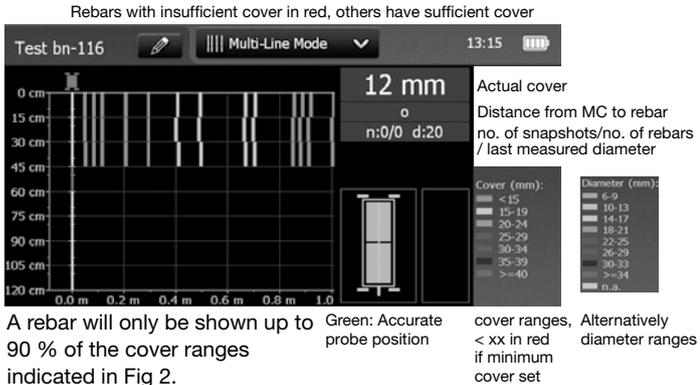
- Position the probe cart at the first start line in a optimum position (the MC 14 / 15) at the mid line of the rebars running parallel to the moving direction, both rectangles in the probe symbol are green and of equal, minimum size) and perform a reset 8.
- Move the probe cart crosswise over the rebars. Above each rebar, when the red LED of MC 14 / 15 lights up, you may measure the rebar diameter and on completion, it will be displayed. If the spacing between the rebars is in the range of 5 cm to 13 cm (cm (2.0” to 5.2”)), set the respective Neighboring Rebar Correction value first.

At the end of the first line a marker (dotted blue line) is set.

- To proceed with the next line tap 10 or push 12 and 13 simultaneously on the probe. The cursor jumps to the next measuring row, either to the start line or remains at the end line, depending on whether “Return to start on new line” is set or not.

- At each rebar you may measure the rebar diameter. At the end, set one common diameter, normally the smallest one (see “3.7 Practical Hints”).

Figure 11 shows the rebars in a plan view in different colors depending on the measured cover. Red means the cover is smaller than the minimum set.



**Figure 11:** Screen of Multi-Line Mode

Alternatively the diameter can be displayed in different colors by tapping on the cover spectrum. Rebars of which the diameter was not measured or set are shown in white. Diameters measured are shown in the respective color. Diameters set in the Single-Line View are shown additionally with an orange cross bar in the middle of the rebar (see Figure 19).

After storage (tap ) , the data can be seen in the Statistics View, the Single-Line View, the Multi-Line View and also in the Snapshot View if at least one diameter was measured (see “3.6 Review of Data”).

## Area-Scan Mode



**NOTE!** It is advisable to locate the first and second layer rebars with the Locate Mode to find the optimum line position prior to measuring in the Area-Scan Mode.

The Area-Scan Mode is mainly used if only cover of the first layer rebars must be shown. The shape of the measured area can be quite different from measuring on a very long distance on a Single-Line only or measuring of multiple lines, e. g. on concrete slabs in a car park. The measuring procedure is the same as for the Single-Line, respectively Multi-Line Mode. The Area-Scan Mode is best suited for a combination with potential field measurements; e. g. combined with Canin+ measurements. But in this case the line height and grid width must be the same for both measurements (square grid required).

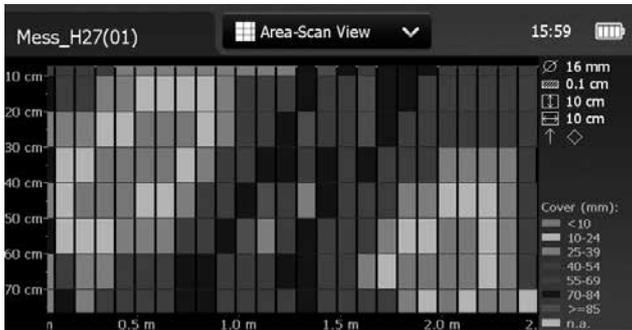
- Enter the settings menu by tapping .
- Set the correct settings as for the Single-Line and Multi-Line Mode. Additionally the grid width must be set. It must be about 1.1 times larger than the minimum rebar spacing of the first layer rebars. This guaranties at least one rebar located within one grid.



**NOTE!** Since the Area-Mode is used on rather large areas, “Return to start on new line” should not be set.

Figure 12 is a plan view, where the cover values are shown as rectangles of different colors. Red means the cover is smaller than the minimum set.

After storage (tap ) , the data can be seen in the Statistics View, the Multi-Line View and also in the Snapshot View if at least one diameter was measured (see “3.6 Review of Data”).



A cover will only be shown up to 90 % of the cover ranges indicated in Fig 2.

**Figure 12:** Screen of Area-Scan Mode

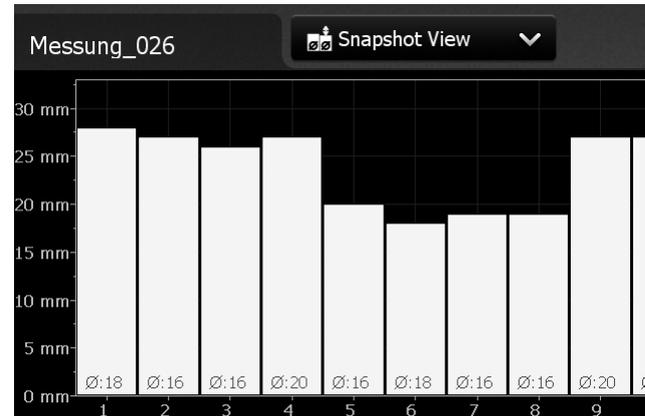
### 3.6 Review of Data

Measured data can be displayed in five different views: Snapshot View, Statistics View, Single-Line View, Multi-Line View and Area-Scan View. All the settings stored with the measurements can be changed afterwards. The views will change accordingly. To store the measuring series with the changes tap (7). To return to the initial settings tap (8).

#### Snapshot View

The Snapshot View can be displayed if at least one diameter was measured and stored in one of the measurement Modes.

The cover values are shown as vertical bars to scale and the diameter as a figure, both in the unit set. The Minimum Cover is not displayed in the Snapshot View.



**Figure 13:** Snapshot View

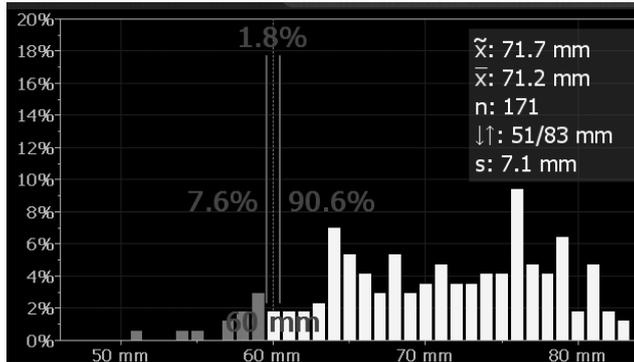
#### Statistics View

The Statistics View can be displayed for measurements done and stored in one of the measurement Modes. It shows the statistical calculation of the cover values measured.

On the horizontal axis the cover values in the unit set are displayed. The vertical bars show the percentage of the respective cover values measured and stored. The vertical cursor bar can be moved to any cover value. The figure on the left of the cursor bar shows the percentage of measured cover values smaller than the cursor position. The value on the right shows percentage of measured cover values larger than the cursor position. The cover value is displayed at the bottom of the cursor bar and at the top the percentage of measured covers for that cover is shown. Minimum required cover is shown as a vertical dotted line in red (if set). Covers below the minimum are shown as red bars, covers above the minimum as yellow bars.

There are two different Statistics Views, the **Normal** (see Figure 14) and the **DBV-Evaluation** (see Figure 15). Tap on the statistical values windows to switch from Normal to DBV.

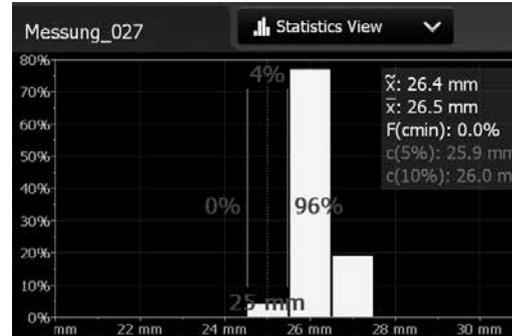
Statistics values box "Normal" showing Median, Mean, Number of covers measured, lowest/highest, Standard Deviation.



**Figure 14:** Statistics View Normal

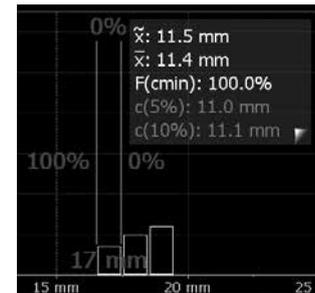
The DBV-Evaluation is an evaluation of the cover readings according to the German Concrete and Construction Association DBV (Deutscher Beton- und Bautechnik Verein). It is also recommended by RILEM. The DBV-Evaluation requires at least 20 cover readings. The distribution function  $F(c_{\min})$  as well as the threshold values  $c(5\%)$  and  $c(10\%)$  are calculated. The  $c(x\%)$ -values are displayed in green when the measuring series is accepted, respectively in red if not.

Statistics values box DBV:



Above the measuring series is accepted, below not.

Cover values above the calculated upper boundary are not considered and shown as bars with a yellow frame only (see on the right side bars at cover values 17 mm, 18 mm and 19 mm).

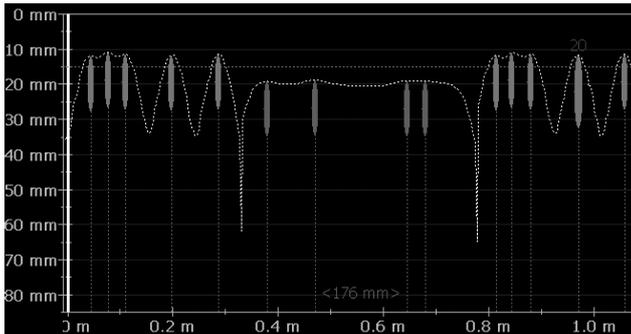


**Figure 15:** Statistics Views DBV-Evaluation

For more details of the DBV-Evaluation please refer to the Info sheet "Statistics according to DBV-Evaluation" available as pdf-file on the Proformeter Touchscreen under Information/Documents and in the download section of [www.proceq.com](http://www.proceq.com).

## Single-Line View

The Single-Line View can be displayed if measurements have been done and stored in the Single-Line or the Multi-Line Mode (not from Area-Scan Mode). It shows the rebar positions in a cross section. The rebars are shown to scale depending on the diameter set. To show them as a circle zoom the horizontal and vertical axis to the same scale. However, for measurements over a long distance, like in a tunnel the scale of the horizontal axis will be much smaller and the rebars shown as vertical bars.

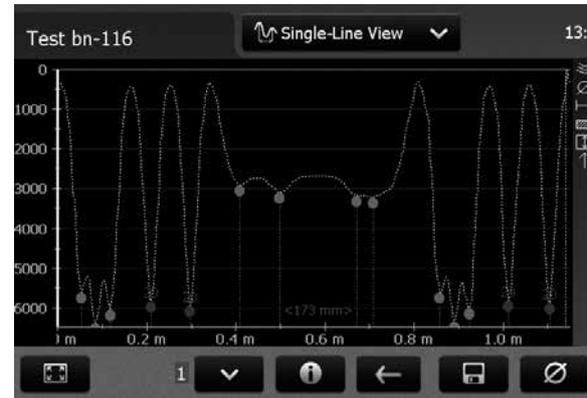


**Figure 16:** Single-Line View with cover curve

Figure 16 shows a Single-Line View with Metric Unit, Minimum Cover (dotted horizontal line in red) and Cover Curve (dotted curve in yellow). In case a diameter was measured its value is shown in blue above the rebar in the unit set. In case the diameter was manually set it is shown in orange.

Figure 17 shows a Single-Line with the Signal Strength Curve (dotted curve in yellow) set. The vertical axis shows the signal strength; hence the Minimum Cover line is not shown.

It is a Single-Line View from measurements done in the Multi-Line View, because at position ⑩ the 1 refers to the measuring row displayed. Tap on ⑩ to display the Single-Line View of the next row.



**Figure 17:** Single-Line View with Signal Strength Curve

The spacing among the rebars as well as the distance from the start line to the first rebar and from the last rebar to the end line are displayed as figures in the unit set, but only if the spacing on the screen is large enough. If not shown zoom in until the figures appear.

For more details like changing a diameter refer to Single-Line Mode in chapter “3.5 Measurement Modes”. To set a new diameter you may have to measure it first at the particular location of the structure in the Locate Mode and set it manually.

## Multi-Line View

The Multi-Line View can be displayed only if measurements have been done and stored in the Multi-Line or Area-Scan Mode. It is a plan view, in most cases of the first layer rebars. A Multi-Line View of the second layer - main layer in columns and girders - may also be of interest.

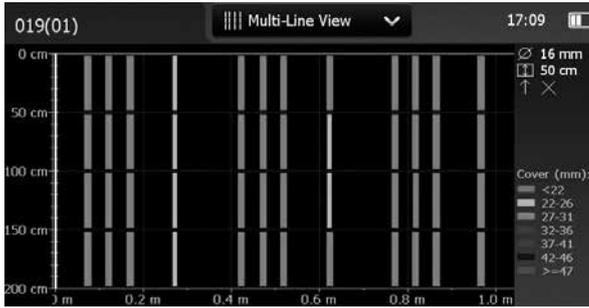


Figure 18: Multi-Line View with cover values displayed

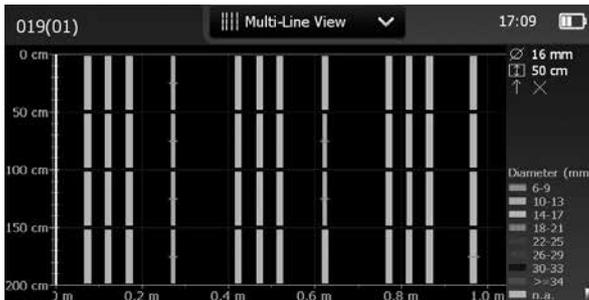


Figure 19: Multi-Line View with diameter values displayed (if measured)

## Area-Scan View

The Area-Scan View is in fact a simplified Multi-Line View which only shows the cover values in a predefined grid. It is mainly used in combination with potential filed measurements; e.g. combined with Canin+ measurements.



Figure 20: Area-Scan View (X- and Y-axis with different scale)

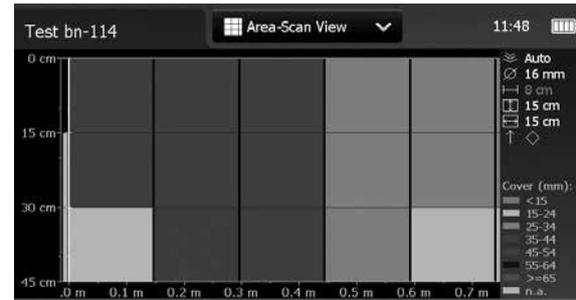


Figure 21: Area-Scan View (zoomed to show X- and Y-axis in the same scale)

### 3.7 Practical Hints

#### Effect of Setting Incorrect Bar Diameter

The accuracy of the cover measurement is also dependent on setting the correct bar diameter.

The following chart gives an estimation of the error of the cover reading for different rebar sizes if a default size of 16mm / #5 is set.



NOTE! The correct diameter can be set any time prior to and after storage of data, see "3.5 Measurement Modes".

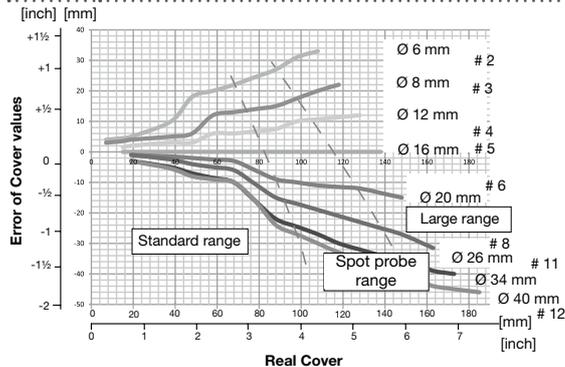


Figure 22: Error of cover measurement with diameter 16mm / #5 set.

#### Factors Affecting the Diameter Measurement

Two factors affect the determination of the rebar diameter. One is the cover depth. The second is the spacing between neighboring bars. For accurate determination of the diameter, the spacing between the rebars must be greater than the limits shown in the drawing below with reference to the MC 14 / 15.



NOTE! Diameter can be determined for rebars with cover not exceeding 80 % of the standard range. (63 mm, 2.5")

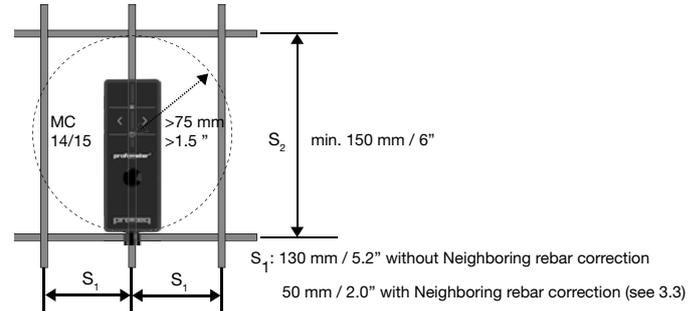


Figure 23: Minimum rebar spacings for correct readings

#### Measure Rebar Diameter

In case the rebar diameter is not known, the Profometer PM-6xx can accurately determine the diameter of a rebar under certain conditions.



NOTE! The Determination of the rebar diameter with PM-6xx is limited to a maximum cover of about 63 mm (2.5 inch).

The Tutorial chapter on the pulse induction principle describes the limitations of the technology and clearly outlines the conditions whereby accurate readings of rebar diameter CANNOT be made if there is too much interference from neighboring rebars or other metallic objects within the sphere of influence.

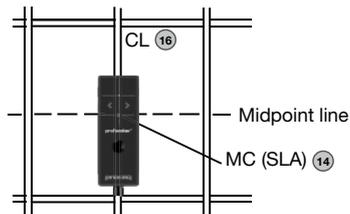


**NOTE!** In any case, it is advisable to expose at least one first layer rebar of each rebar arrangement to measure the real diameter. The obtained diameter values can then be compared and if necessary corrected with the measured real diameter.

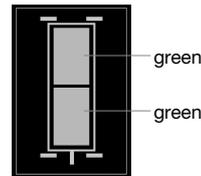


**NOTE!** When measuring a diameter on an older structure set the unit “Metric” and convert the displayed diameter from Millimeter to the “Imperial” or “Japanese” bar size if necessary.

- Step 1** Locate and mark a rebar grid of the first and second layer rebars as described under “Locate Mode” in 3.5.
- Step 2** Select one rebar that has the largest spacing from neighboring rebars.
- Step 3** Use a ruler and confirm that the spacing is at least as indicated in Figure 23. If not, redo Steps 1 and 2 until a rebar is located with the required spacing to a neighboring rebar.
- Step 4** Place the MC (14) or (15) of the PM-6xx over the rebar at the centerline of the rebars running crosswise to the rebar under test and measure the diameter.

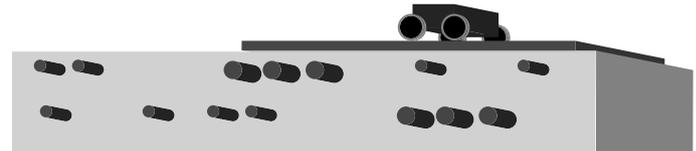


Correct probe position indication on display



**Figure 24:** Correct Probe positioning for diameter measurements

The diameter displayed for the settings “Metric”, “Imperial” and “Japanese” are shown in appendix A1.



**Figure 25:** Rebar diameter measurements on thin slab

### Rebar Orientation

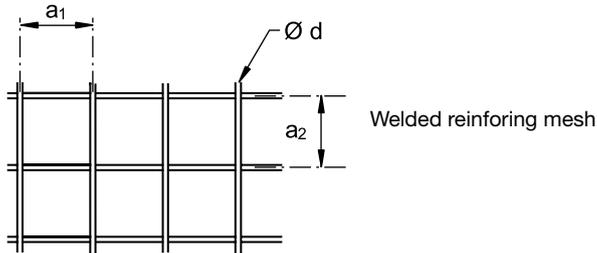
The strongest signal results when the Center Line (CL) of the probe is parallel to a bar. The CL (16) of the Profometer PM-6 probe is the longitudinal axis of the probe. This property is used to help determine the orientation of the rebars (see Locate Mode, chapter “3.5 Measurement Modes”).

### Welded Meshes

The instrument cannot detect whether the rebars are welded to one another or connected with binding wires. The two reinforcement types with the same dimensions however create different signals.

The setting of the bar diameter must be slightly higher than the actual diameter of the mesh rebar. The input depends on the bar diameter and

on the mesh width. This input value should be determined by means of a test measurement on an open system with specific rebar mesh wire arrangements. Measure on each arrangement with different covers to find out the diameter setting at which the correct cover is indicated.



$a_1$ [mm]	$a_2$ [mm]	current d [mm]	d to be set [mm]
100	100	5	8
150	150	6	7

**Figure 26:** Examples for diameter settings at welded meshes to measure correct cover values

Select the “Standard” measuring range. The “Large” measuring range cannot be used with welded reinforcing meshes. Locate and measure the cover as explained in the previous chapters.



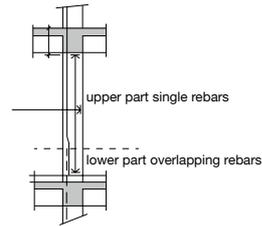
**NOTE!** If the rebars of the first layer are too close to each other, it is likely to be impossible to locate the bars of the second layer.

#### Diameter Measurements on welded Reinforcement Meshes

In most cases a diameter can be measured but the displayed value is far too large and cannot be used. The only way to determine the diameter is by an inspection hole.

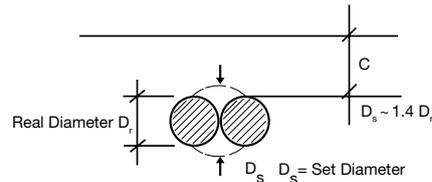
#### Line-Scanning on Different Rebar Arrangements

Single-Line, Multi-Line and Area-Scanning are mainly done to measure and show the cover values along a long line, respectively on a large area. However, for accurate cover readings the diameter must be measured first, thus on each different rebar arrangement. The measured diameter is to be set prior to scanning the cover. Therefore it is advisable to open for each area of different rebar arrangement a separate test file and to scan over rebars only with the same measured rebar diameter.



For example: To scan a wall of a cut and cover tunnel section at least two test files must be opened. One for the lower part with overlapping vertical rebars with a larger diameter measured, one on the upper part with single vertical rebars, (see Figure 27).

**Figure 27:** Line scanning on different rebar arrangements



In case the diameter cannot be measured the rebars should be exposed in one area. The diameter to be set is in general 1.4 times the real diameter of a single bar.

**Figure 28:** Measured diameter  $D_s$  at overlapping areas

## Scanning on Small Surfaces and Near to Edges

On small areas and near edges you may have to place a cover sheet for scanning with the probe cart.



For correct cover measurements the sheet thickness must be set as Cover Offset value.

Figure 29: Scanning near to the edge

## 4. Explorer

From the main menu select Explorer to review saved files.



Tap on a saved file to open it.

Return to the Explorer list by pressing the back button.

To delete a file tap in the check box to the left of the file and delete it.

## 5. Ordering Information

### 5.1 Units

Part No.	Description
392 10 001	Profometer PM-600 consisting of Profometer Touchscreen, universal probe with probe cart, probe cable 1.5 m (5 ft), battery charger, USB cable, chalk, DVD with software, documentation, carrying strap and carrying case
392 20 001	Profometer PM-630 consisting of Profometer Touchscreen, universal probe with probe cart, probe cable 1.5 m (5 ft), battery charger, USB cable, chalk, DVD with software, documentation, carrying strap and carrying case

### 5.2 Upgrades

Part No.	Description
392 00 115	Software Upgrade from Profometer PM-600 to PM-630

## 5.3 Parts and Accessories

Part No.	Description
392 40 010	Profometer Touchscreen
392 40 020	Profometer PM-6 Universal probe
392 40 030	Profometer PM-6 Scan cart complete
327 01 050	Profometer PM-6 Probe cable 1.5 m (5 ft)
392 40 040	Profometer PM-6 Telescopic extension rod 1.6 m (5.3 ft) with probe cable 3 m (10 ft)
327 01 063	Profometer PM-6 Probe cable 3 m (10 ft)
327 01 068	Profometer PM-6 Probe cable 10 m (33 ft)
392 00 004S	Profometer PM-6 Self-adhesive protective film for probe (set of 3)
325 34 018S	Chalk (set of 10)
327 01 045	Carrying strap complete
327 01 033	Battery complete
327 01 053	Quick charger
351 90 018	USB-cable 1.8 m (6 ft)
327 01 061	Power supply
711 10 013	Power supply cable USA 0.5 m (1.7 ft)
711 10 014	Power supply cable UK 0.5 m (1.7 ft)
711 10 015	Power supply cable EU 0.5 m (1.7 ft)

## 6. Technical Specifications

Cover Measuring Range	Up to 185 mm (7.3"), see Figure 2
Cover Measuring Accuracy	$\pm 1$ mm to $\pm 4$ mm (0.04" to 0.16"), see Figure 2
Measuring Resolution	Depending on diameter and cover, see Figure 3
Path Measuring accuracy on smooth surface	$\pm 3$ mm (0.12") + 0.5 % to 1.0 % of measured length
Diameter Measuring Range	Cover up to 63 mm (2.5"), Diameter up to 40 mm (# 12)
Dia. Measuring Accuracy	$\pm 1$ rebar size
Display	7" colour display 800x480 pixels
Memory	Internal 8 GB Flash memory
Regional settings	Metric and imperial units and multi-language supported
Battery	Lithium Polymer, 3.6 V, 14.0 Ah
Mains	9 V – 15 V / 2.0 A
Weight (of display device)	About 1525 g (incl. Battery)
Dimensions	250 x 162 x 62 mm
Operating temperature	0°C – 30°C (Charging*, running instrument) 0°C – 40°C (Charging*, instrument is off) -10°C – 50°C (Non-charging)
Humidity	< 95 % RH, non condensing
IP Classification	IP54
Standards and Guidelines	BS 1881 part 204, Din 1045, SN 505262, DGZfP-guideline B2
Battery Lifetime	> 8h (in standard operating mode)

\*charging equipment is for indoor use only (no IP classification)

## 7. Maintenance and Support

### 7.1 Maintenance

To guarantee consistent, reliable and accurate measurements, the instrument should be calibrated on a yearly basis. The customer may however, determine the service interval based on his or her own experience and usage.

### 7.2 Support Concept

Proceq is committed to providing a complete support service for this instrument by means of our global service and support facilities. It is recommended that the user register the product on [www.proceq.com](http://www.proceq.com) to obtain the latest on available updates and other valuable information.

### 7.3 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. An extended warranty for one, two or three years for the electronic portion of the instrument may be purchased up to 90 days of date of purchase.

### 7.4 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.

## 8. PM-Link Software

### 8.1 Starting PM-Link



Locate the file “PM-Link Setup.exe” on your computer or on the DVD and click on it. Follow the instructions on the screen.



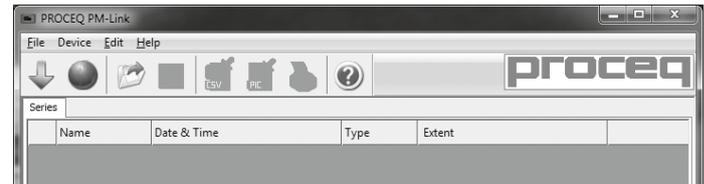
Make sure that the “Launch USB Driver install” tick is selected.

The USB driver installs a virtual com port which is needed to communicate with the Profometer Touchscreen Unit.



Double click on the PM-Link Icon on your desktop or start the Link via the start menu.

The Link starts with a blank list.



### Application Settings

The menu item “File – Application settings” allows the user to select the language and the date and time format to be used.

## Connecting to a Profometer Touchscreen Unit

Connect the Profometer Touchscreen Unit to a USB port, then select  to download data from the Profometer Touchscreen Unit.

The following window will be displayed: Select “USB” as the communication type. Click on “Next >”.



When a Profometer Unit has been found its details will be displayed on screen. Click on the “Finish” button to establish the connection



Click on “Next >”. When a Profometer Touchscreen Unit has been found its details will be displayed on screen. Click on the “Finish” button to establish the connection.



Measurement files stored on the device will be displayed as shown on the left.

Select one or more measurements and click “Download”.

## 8.2 Viewing Data

The selected measurements on your Profometer Touchscreen Unit will be displayed on the screen:

Name	Date & Time	Type	Extent
Messung_040	11/21/2013 10:43 AM	Single Line	lines: 1, snapshots: 1, length: 0.9 m
Messung_072	11/19/2013 4:03 PM	Multi Line	lines: 8, snapshots: 0, length: 40.5 m
Messung_096	11/19/2013 4:03 PM	Area Scan	lines: 5, snapshots: 1, length: 4.1 m
Messung_097	11/21/2013 4:09 PM	Single Line	lines: 1, snapshots: 0, length: 0.1 m
Messung_100	11/22/2013 10:58 AM	Single Line	lines: 1, snapshots: 0, length: 10.4 m

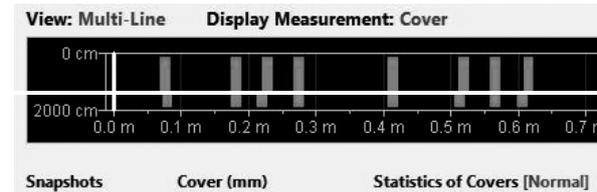
Click on the double arrow icon in the first column to see more details.

By clicking on the respective colored words one can switch:

- Among Views **Snapshot**, **Statistics**, **Single-Line** and **Multi-Line**
- Between Statistics **Normal** and **DBV-Evaluation**
- In Single-Line View additionally between the measured lines **x** and cover curve **on / off**



- In Multi-Line View additionally between Display Measurement **Cover** and **Diameter**



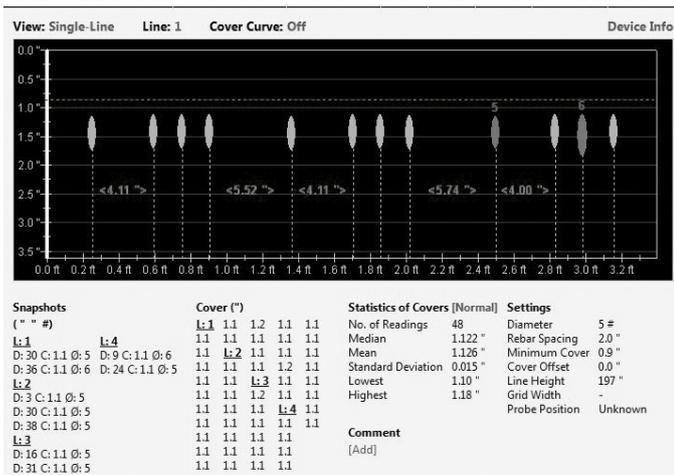
Rebar	Lines	Distance	Snapshots	Unit
1	1	1.000 m	0	Metric
36	4	3.004 m	0	Metric
21	1	10.423 m	0	Metric
4	1	0.910 "	1	Imperial
22	2	11.027 "	0	Imperial
6	0	0.900 "	0	Imperial
40	4	13.009 "	0	Imperial
6	1	1.640 "	0	Imperial
0	1	0.426 m	0	Metric
6	1	0.960 m	0	Metric
0	0	0.900 m	0	Metric

By right click with the cursor in a marked cell of the column "unit" the unit can be changed for the marked measurements.

By holding the cursor on **Device Info** the information about, hardware, software and probe is displayed.

At the end comments can be added.

Sample of View in the PM-Link (Single-Line View, no Curve, Normal Statistics).



To paste or delete one or more measurements select one or more rows then right click the mouse and choose one of these options: "Copy", "Paste" or "Delete".

Name	Date & Time	Type	Extent
Messung_040	12/10/2013 10:46 AM	Single Line	lines: 1, snapshots: 1, length: 0.9 m
Messung_072	12/10/2013 10:46 AM	Single Line	lines: 8, snapshots: 0, length: 40.5 m
Messung_096	12/10/2013 10:46 AM	Single Line	lines: 5, snapshots: 1, length: 4.1 m
Messung_097	12/10/2013 10:46 AM	Single Line	lines: 1, snapshots: 0, length: 0.9 m
Messung_100	12/10/2013 10:46 AM	Single Line	lines: 1, snapshots: 0, length: 0.9 m
Messung_101	12/10/2013 10:46 AM	Single Line	lines: 0, snapshots: 6, length: 0.9 m
Messung_102	12/10/2013 10:46 AM	Single Line	lines: 7, snapshots: 0, length: 13.0 m



NOTE! Click on "Add" to attach a comment to the object.

### 8.3 Adjusting Settings

The settings including Diameter can only be adjusted in the Profometer Touchscreen. To change settings you may store the objects with another name on the PC. Then open the relevant objects again on the Touchscreen to change settings and transfer the objects with the changed settings to the PC.

### Adjusting date and time

Right click in the "Date & Time" column.

**Adjust time**

Current time stamp of objects: Date 06/08/2010 Time 10:31:11 A

Time stamp after adjustment: Date 06/08/2010 Time 10:31:11

Info: Every selected measurement will be adjusted by the same amount of time.

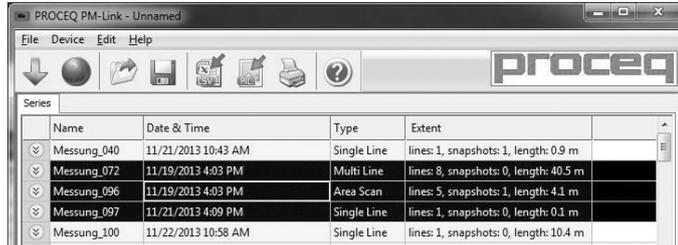
Cancel OK

The time will be adjusted for the selected series only.

In “Data Logging” mode it is the date and time at which the measurement was made.

## 8.4 Exporting Data

PM-Link allows you to export selected objects or the entire project for use in third party programs. Click on the measurement object you wish to export. It will be highlighted as shown.



Name	Date & Time	Type	Extent
Messung_040	11/21/2013 10:43 AM	Single Line	lines: 1, snapshots: 1, length: 0.9 m
Messung_072	11/19/2013 4:03 PM	Multi Line	lines: 8, snapshots: 0, length: 40.5 m
Messung_096	11/19/2013 4:03 PM	Area Scan	lines: 5, snapshots: 1, length: 4.1 m
Messung_097	11/21/2013 4:09 PM	Single Line	lines: 1, snapshots: 0, length: 0.1 m
Messung_100	11/22/2013 10:58 AM	Single Line	lines: 1, snapshots: 0, length: 10.4 m



Click on the “Export as CSV file(s)” icon. The data are exported as a Microsoft Office Excel comma separated file or files. The export options may be chosen in the following window:



Set the detailed Cover data to export, if you wish so (data may be huge!)



Click on the “Export as graphic” icon to open the following window which allows the various export options to be chosen.



In both cases, the preview window shows the effects of the current output selection.

Prior to export data set the appropriate

- . View: “Snapshot”, “Statistics”, “Single-Line”, “Multi-Line” or “Area-Scan”
- . Unit: “Metric”, “Metric Japanese”, “Imperial” or “Imperial Diameter, Metric Cover and Distance”
- . Curve: either “None” or “Cover Curve”



NOTE! In Multi-Line View one can switch between Cover and Diameter, in Statistics between Normal and DBV.



NOTE! In normal cases the Curve should be set to “None”, especially when exporting huge files to an Excel-sheet because the cover and distance of the curve are copied each in one cell, thus in distance intervals of 2.7 mm only.

Set the appropriate View, Display Measurements, Display Curve

Finish by clicking on export to select the file location, name the file and in the case of a graphical output to set the output graphic format: .png, .bmp or .jpg

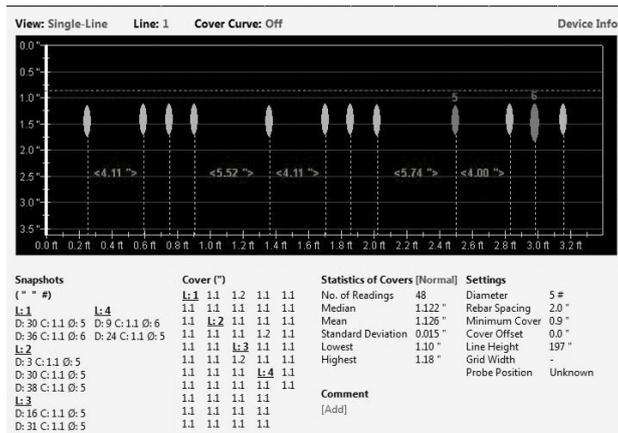
## Sample of an exported CVS-file

PM-Link Version	3.0.2.0	Statistical Data (mm)	Snapshots	Rebars	Cover Thickness	Unit 1	Unit 2	Unit 3
Device Information		No. of Readings	0	36	Distance	62.0	0	24
Product Name	PM-430	Median	0	26.9		81.2	0	30.4
Serial Number	UP01-000-0008	Mean	0	27		80.6	0	30
Software Version	3.0.0.0	Standard Deviation	0	2.2		12.0	0	10.0
OS Version	3.0.0	Lowest	0	20		13.0	0	10.0
Hardware Revision	03	Highest	0	34		100.0	0	30.0
Probe Type	Profil, 1.0m	Total Distance	-	3384		100.0	0	30.0
Probe Serial Number	PL000-000-0001	Only Statistical Data (mm)				275.0	0	107.0
File Data (mm)		No. of Readings		27		262.0	0	107.0
File Name	2	Median		26.2		406.0	0	160.0
Time	27.02.2014 10:05:29	Mean		26.2		406.0	0	160.0
Comments		CO(1%)		0.00%		475.0	0	175.0
Measurement Mode	Multi-Line	CO(2%)		25.8		513.0	0	192.0
Diameter	16	CO(3%)		25.9		588.0	0	216.0
Rebar Spacing	0	CO(4%)		25.9		663.0	0	240.0
Cover Offset	0	Line				738.0	0	288.0
Minimum Cover	20	Snapshots Data (mm)				813.0	0	312.0
Line Height	300	Distance	1	762	29	100.0	0	30.0
Grid Width		Cover	1	96.3	38	100.0	0	30.0
Probe Position	Unknown	Rebar	2	74	29	15		
			2	77.0	29	15		

All Data (starting with PM-Link Version to Statistic Data up to Cover Data) are written in the first columns starting with column A.

The diameters set in the Single-Line Mode are not shown.

## Sample of an exported Graphics-file



## 8.5 Deleting Data

The menu item “Edit – Delete” allows you to delete one or more selected series from the downloaded data.



NOTE! This does not delete data from the Profometer Touchscreen Unit, only data in the current project.

The menu item “Edit – Select all”, allows the user to select all series in the project for deletion, exporting etc.

## 8.6 Further Functions

The following menu items are available via the icons at the top of the screen:



“PQUpgrade” icon - Allows you to upgrade your firmware via the internet or from local files.



“Open project” icon – Allows you to open a previously saved .pqm project.



“Save project” icon – Allows you to save the current project.



“Print” icon – Allows you to print out the project. You may select in the printer dialog, if you want to print out all of the data or selected readings only.

## 9. Appendices

### 9.1 Appendix A1 Rebar Diameters

Following rebar diameters can be selected:

Metric		Imperial			Japanese	
Bar size	Diam. (mm)	Bar size	Diam. (inch)	Diam (mm)	Bar size	Diam. (mm)
6	6	#2	0.250	6	6	6
7	7	#3	0.375	10	9	9
8	8	#4	0.500	13	10	10
9	9	#5	0.625	16	13	13
10	10	#6	0.750	19	16	16
11	11	#7	0.875	22	19	19
12	12	#8	1.000	25	22	22
13	13	#9	1.125	29	25	25
14	14	#10	1.250	32	29	29
...	...	#11	1.375	35	32	32
35	35	#12	1.500	38	35	35
36	36				38	38
37	37					
38	38					
39	39					
40	40					

### 9.2 Appendix A2 Neighboring Bar Correction

Following rebar spacings can be selected:

Metric, Imperial cm, Japanese		Imperial inch	
5	cm	2.0	inch
6	cm	2.4	inch
7	cm	2.8	inch
8	cm	3.2	inch
9	cm	3.6	inch
10	cm	4.0	inch
11	cm	4.4	inch
12	cm	4.8	inch
13	cm	5.2	inch

### 9.3 Appendix A3 Minimum Cover

Following minimum covers can be selected:

Metric, Imperial mm, Japanese		Imperial inch	
10	mm	0.40	inch
11	mm	0.44	inch
12	mm	0.48	inch
...	mm	...	inch
142	mm	5.56	inch
143	mm	5.60	inch







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The Proceq logo consists of the word "proceq" in a bold, lowercase, sans-serif font. The letters are a vibrant blue color. The 'p' and 'c' are connected, and the 'e' and 'q' are also connected. The 'r' is slightly taller than the other letters.

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