PS 1000 X-Scan Tips & Tricks

Quick Guide

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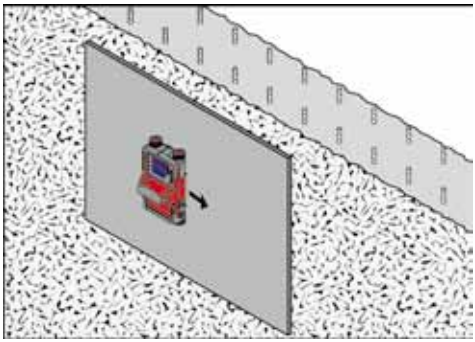
Tips & tricks

1. PS 1000 X-Scan

Scanning on rough surfaces

When the scanner is moved over a rough surface, the distance between the scanner and the surface beneath doesn't remain constant. The position and depth readings obtained are thus inaccurate. Measurement errors of this kind can be avoided by placing a thin sheet of suitable material (e.g. wood, cardboard, etc.) on this rough surface. The thickness of the sheet must be taken into account when interpreting the scan.

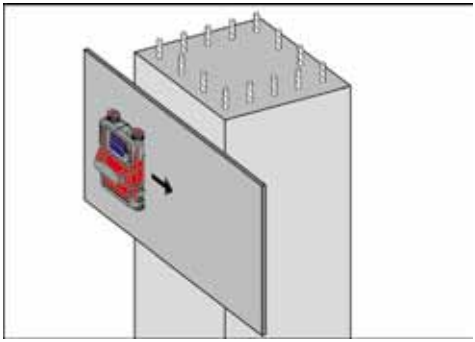


Scanning beams and columns

The reinforcement in beams and columns may be located very close to the edges.

As the scanner should never be lifted away from the surface when a scan is in progress, i.e. all 4 wheels must stay in contact with the surface at all times, sheets of a suitable material should be positioned so that they project beyond the edges of the surface to be scanned. Objects positioned close to the edge of a beam or column may be indicated less clearly than objects positioned further from the edge due to the weaker signal received.

The thickness of the sheet must be taken into account when interpreting the readings from the scan.

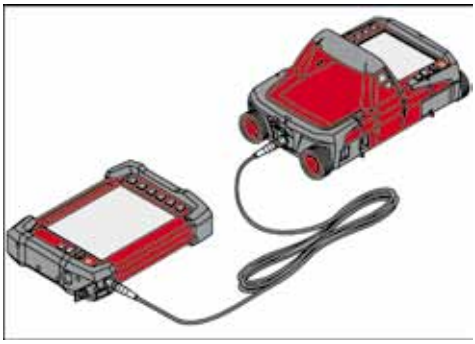


Transferring data from the scanner to the monitor

Scan data can be transferred from the scanner to the monitor in various ways.

1.) The PSA 50 / 51 data cable can be used to transfer data between the monitor and the scanner. This feature is not available with the Hilti PS 1000-B X-Scan.

2.) Alternatively, scan data can be saved on an SD card (PSA 95) and transferred directly to a PC or to the monitor unit using the PSA 96 card reader.

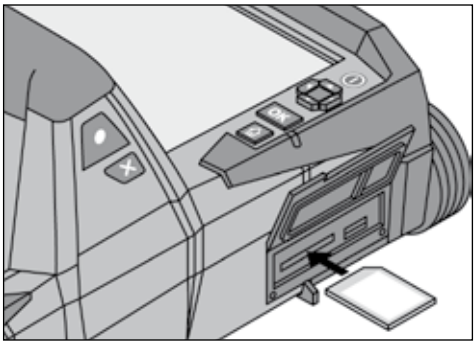


Transferring data from the scanner to a PC

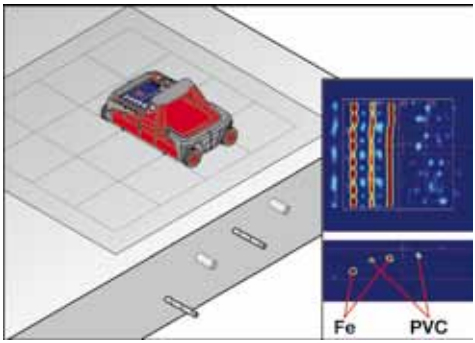
To transfer scan data from the scanner to a PC, you require an SD card (PSA 95) and a PSA 96 card reader.

- First insert the SD card in the memory card slot on the scanner.
- All scan data will then be copied automatically to the SD card from the scanner's internal memory.
- The card reader can then be connected to the USB interface on the PC and the data subsequently transferred.

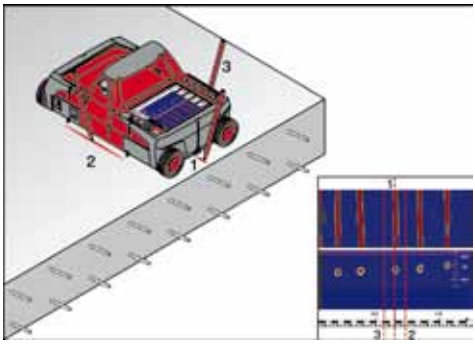
Caution: To avoid data loss, always make sure that the scanner is switched off before inserting or removing the SD card.



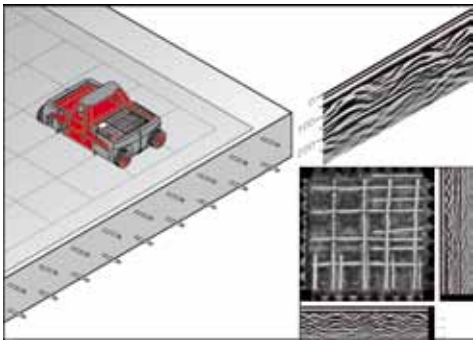
Detecting steel rebars beside PVC pipes
If PVC pipes are positioned relatively close to steel rebars, the PVC pipes detected will be shown on the screen much less clearly than the rebars., The contrast must thus be increased when evaluating the scan in order to make the PVC pipes more easily visible.



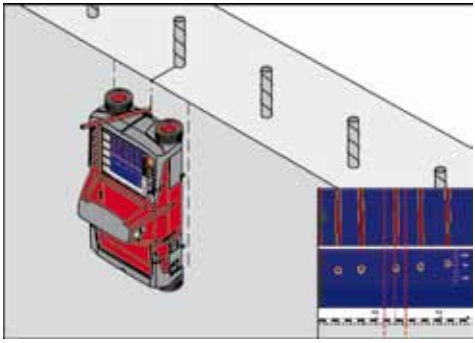
Marking an object
When using the Quickscan detection mode, objects can be marked on the spot, directly on the scanned surface beside the scanner. With the aid of the broken lines shown in the display, the scanner can be moved forward and back over the object detected until the middle line lies exactly over the object. The position of the object can then be marked on the surface at the indicator mark (1) at the top edge of the scanner. Alternatively, objects can be marked at the outside edges of the scanner. The two outer broken lines shown in the display (to the left and right of the middle line) represent the outside edges of the scanner. When one of these lines lies directly over an object in the display, the position of the object can be marked on the working surface at the corresponding edge of the scanner (2 or 3).



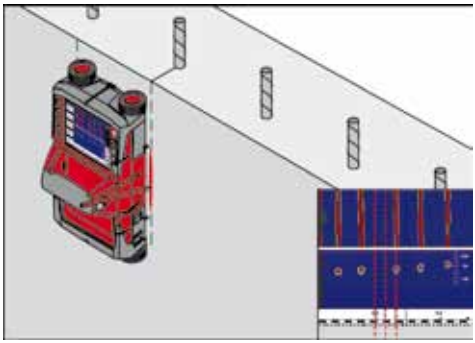
Using the raw scan data to identify the back of a wall or slab
The back surface of a steel reinforced concrete component is indicated by signal reflections.
A clearer indication of a back surface may be obtained by examining the raw scan data.
In this data, reflections from a back surface are often clearly visible in the form of a continuous line in the cross-sectional view.



Marking objects when scanning in Quickscan detection mode
In this mode, the objects found can be marked using two different methods.
With the first method, using the display as an aid, the objects are marked at the middle of the Hilti PS 1000 X-Scan.
A continuous line is shown in the middle of the display area together with two broken lines, one on each side. When the continuous line is directly over the object shown in the display, the object's position can be marked at the mid point of the top edge of the scanner.

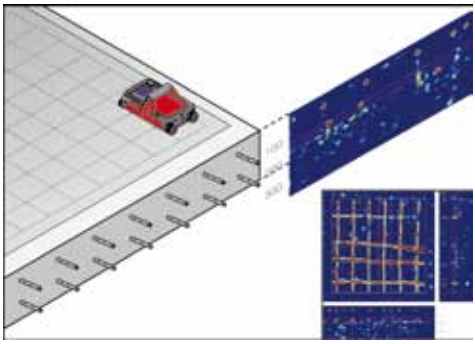


Using the second method, with the aid of the display, the objects are marked at the outside edges of the Hilti PS 1000 X-Scan.
A white line is shown in the middle of the display with a broken line on either side. When the broken line on the right lies directly over the object detected, the position of the object can be marked on the working surface at the outside edge on the right-hand side of the Hilti PS 1000 X-Scan. The same principle applies to marking objects at the left-hand outside edge of the scanner.



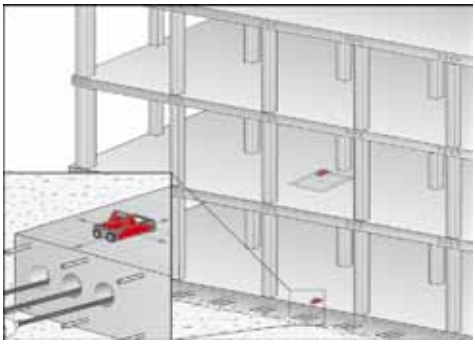
Detecting objects in a second layer
Objects that lie parallel, positioned exactly one above the other, can be detected so long as there is sufficient vertical distance between the objects. If the wall is thick enough, this can usually be carried out from one side.
If it is known that one or more layers of reinforcement are present in the structure and these are not detected by the first scan, it is recommended that a second scan is made on the other side of the wall or slab.

Tip: The Hilti PX 10 Transpointer can be used to transfer the position of the first scan to the opposite side of the wall on the basis of reference grid.



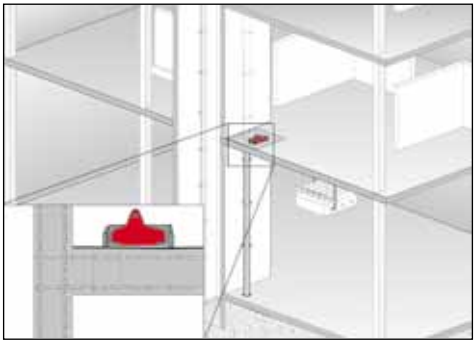
Locating pre- and post-tensioning tendons
Tendons can be quickly analyzed over their entire length by making a number of consecutive Quickscans. This is done by scanning at right angles to the presumed path of the cable and marking the positions at which the cable is detected.

Tip: If the tendons dips down too deeply into thick concrete sections, additional scans can be made on the opposite side of the wall or slab. The Hilti PX 10 Transpointer can then be used to transfer the cable positions from the opposite side back to the original side of the wall or slab.



Drilling through-holes without hitting reinforcement
The loadbearing structure of a building can be damaged by drilling into rebars and concealed objects (severing the reinforcement) when drilling or coring through-holes and making penetrations.
The wall or slab should thus be scanned with the Hilti PS 1000 X-Scan from both sides.
Where possible, e.g. on concrete beams, the area should be scanned from three sides.

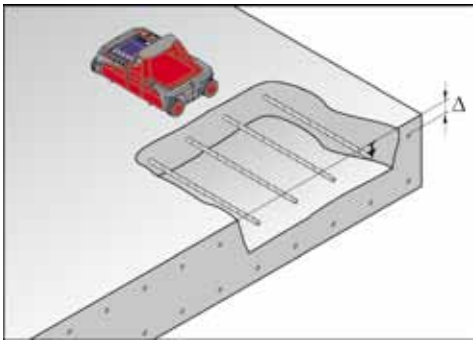
Tip: The Hilti PX 10 Transpointer can be used to transfer the position of the first scan to the opposite side of the structure.



Calibrating detection results

For technical reasons, depth readings from objects located by scanners employing the radar principle are generally not very accurate as long as the concrete permittivity is unknown. In contrast to scanners that make use of the induction principle, the exact depth of an object cannot be determined.

In order to be able to make a more accurate statement about the depth of objects when using a radar-based scanner, the characteristics of the concrete (its permittivity) or the depth of one of the objects must already be known. The corresponding parameters (concrete parameters) can then be adjusted during analysis of the results and a more accurate estimate of the depth of the objects thus achieved.

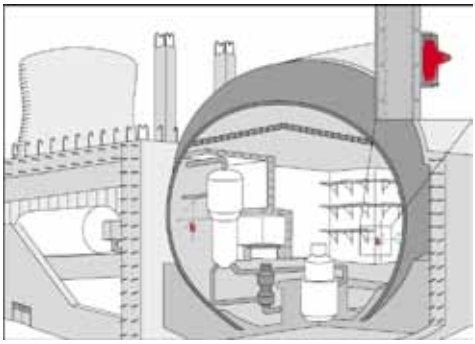


Plausibility test

The results of scans can always be assessed or interpreted in different ways.

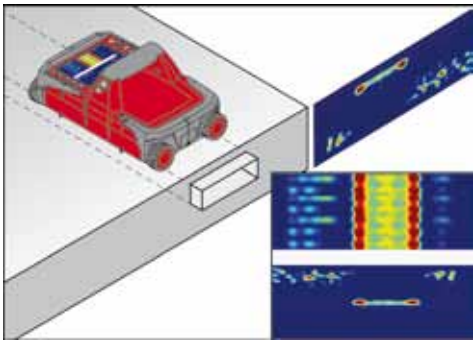
However, in any case, before beginning with the analysis of scan results it is important to clarify, from a technical point of view, whether detection is actually possible at the location in question.

Tip: Consult the plans of the building before beginning.



Detecting and interpreting plates

Plates are often difficult to detect and interpret, especially as these are often found in the structure together with other objects. In the analysis of a scan of a plate, the edges of the plate are reflected more strongly than the rest of the object. This may seem to suggest that two objects are present. In cases such as this, the 3D view is more meaningful. Basically speaking, however, the contrast at these points of the image is higher than in the rest of the background.

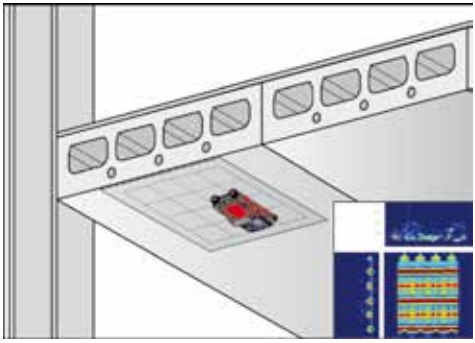


Interpreting scans of prestressed precast hollow-core concrete components

The cavities generally have a rounded cross-section. Accordingly, signal reflection is strongest at the highest point of the cavity and drops off gradually at both sides. Cavities can be made more easily visible by varying the depth of the cross-sectional view.

Changing the color to gray for the analysis of the scan may also be advantageous. In Quickscan mode, the cavity appears like a large object. It may not always be obvious that it is, in fact, a cavity.

Tip: Compare the scan data with the building plans.



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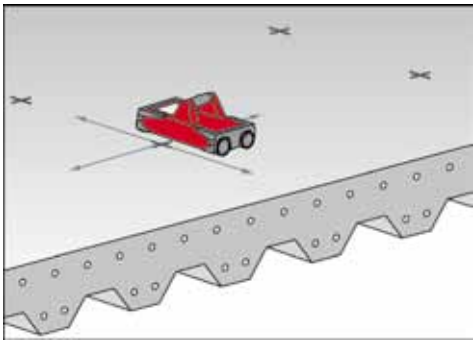
Interpreting scans of profile metal sheet composite decks

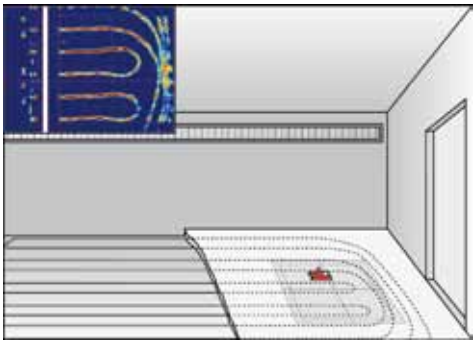
Concrete decks are often formed by pouring concrete over profile metal sheets.

Layers of reinforcement or other cast-in objects are positioned above the profile metal sheets, making detection more difficult. The uppermost layer of reinforcement can be detected without any problem. Detection of the profile sheet metal is much more difficult as it cannot be made clearly visible as a sheet, and tends to look like another layer of reinforcement.



Interpreting scans of floor heating systems

In the analysis view, floor heating systems are characterized by the way the pipes are typically laid in a pattern of loops. At a depth of approx. 50 mm under a layer of screed, the pipes are generally equally spaced but are often positioned closer together at potential cold spots. If a metallic insulating foil has been placed beneath the pipes, the signal from the scanner is reflected over the entire area. Such reflections can make it more difficult to detect the objects in the floor. The scanner's detection performance can also be negatively affected by multiple layers or coverings consisting of a fine mesh. Accordingly, the plans showing details of the installation should be checked first in order to determine whether a scanner employing radar technology is capable of providing meaningful results.

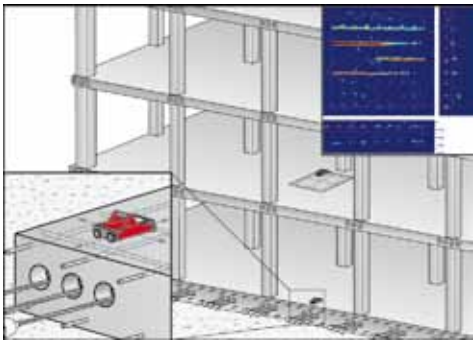


Interpreting scans of pre- and post-tensioning tendons

Tendons are typical "second-layer" objects, over which there is usually a layer of reinforcement in a grid with the bars spaced at various intervals. In the analysis view, tendons are characterized by the fact that their depth does not remain constant.

This means that they may be shown at one side of the image but gradually disappear due to the change in depth at other positions allong their length.

Furthermore, tendons usually do not lie parallel to the bars in the reinforcement grid.



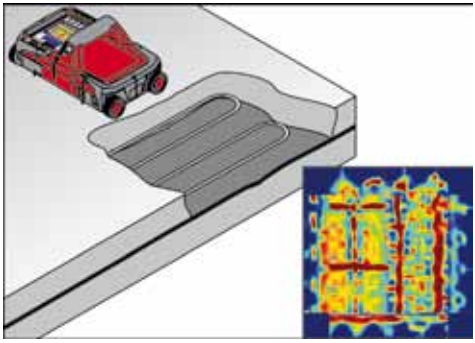
Interpreting insulating layers

Scanning through an insulating layer has, in principle, an adverse effect on the quality of the results obtained. A layer of this kind often causes reflections, similar to those caused by the back surface of a wall or slab. "Ghost" objects (objects that don't exist) may be shown as result. When possible, structures such as this should be scanned from both sides.

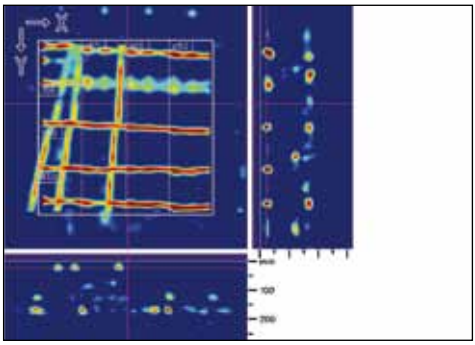
Tip: Try two different permittivity values (in the settings under "Concrete") when using Hilti PROFIS PS 1000 to analyze the scan results.

An insulating layer consisting of a metallic material always causes strong signal reflection.

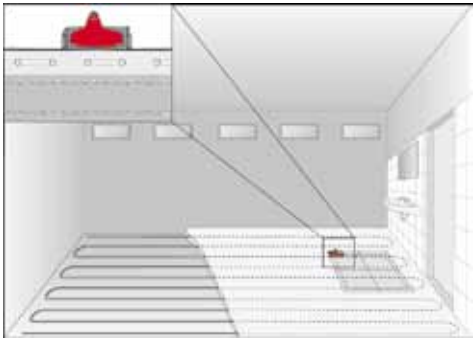
It is thus not possible to detect objects positioned beneath layers of this kind.



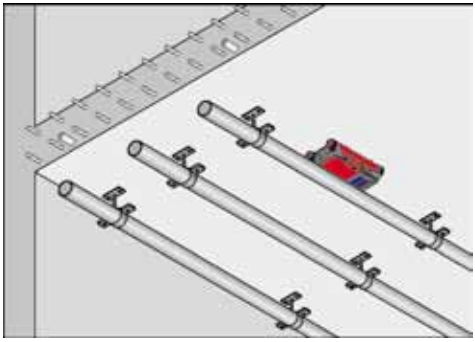
Scanning and interpreting objects that lie at an angle
Before scanning an area in Imagescan mode, it can be helpful to first obtain an overview of how the objects are positioned by using the scanner in Quickscan mode. Due to their position relative to the scanner, inclined objects can be made only partially visible. For example, objects inclined at a steep angle (e.g. in supporting beams) can be shown only to a limited extent.



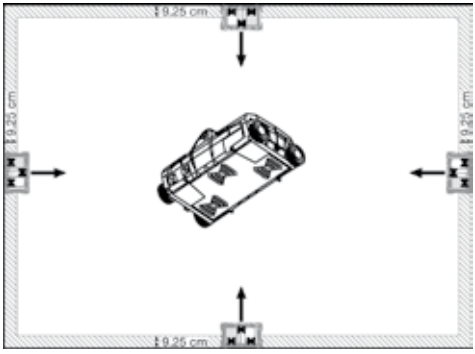
Tips for analyzing multiple layers
When analyzing scans of areas containing objects in multiple layers, adjustment of the parameters on the scanner or monitor (concrete, contrast, color scheme) may allow a more definite statement to be made about the position of the objects. An example of a situation of this kind is where a layer of screed is laid on top of concrete in a floor heating installation.



Using the scanner without the grip
The grip of the Hilti PS 1000 X-Scan can be removed in order to allow use of the scanner on surfaces where installations such as pipes etc. present an obstacle.
Scanning thus becomes possible even in tight corners.



Wall/Corner accessibility
For better wall/corner accessibility it is recommended that Quickscan Detection mode is used with the scanner placed so that the two antennas are positioned closest to the wall/corner.
This reduces the minimum wall/corner accessibility distance from 18.5 cm to 9.25 cm.



2. PS 1000 X-Scan EM-Sensor

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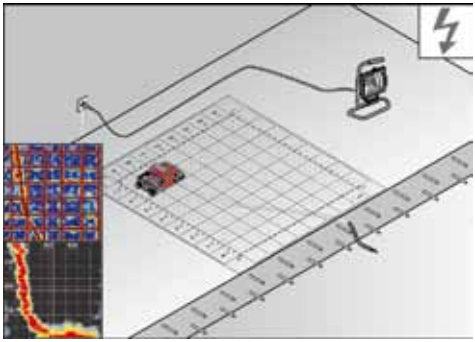
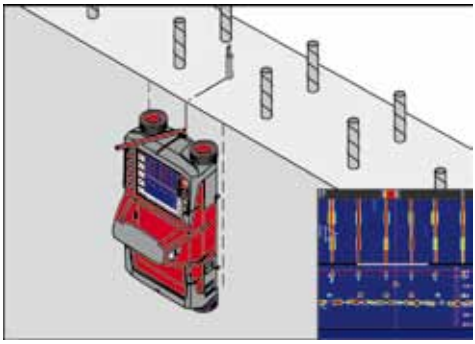
Detecting live electric cables
In addition to radar-based detection for locating various objects concealed in concrete, the EM sensor incorporated in the PS 1000 X-Scan can be used to detect and classify live electric cables (50/60 Hz). Electric cables within the structure which carry no current (i.e. not live) cannot be detected by the EM sensor, but under certain circumstances it may be possible to detect these with the radar sensor.

Tip: If the current in the electric cable is too low to allow classification, or the cable lies too deep in the structure, the EM sensor will not be able to provide any useful information.



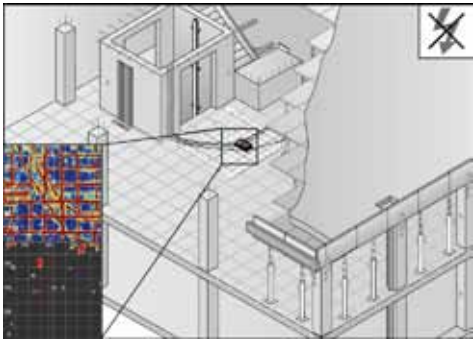
Quickscan detection using the EM sensor
With the PS 1000 X-Scan set to Quickscan detection mode, the data from the EM sensor is presented graphically in an additional area of the display above the radar sensor data, thus allowing object classification on the basis of the radar images.

Tip: This can be particularly helpful when a live electric cable is not visible in the radar image, e.g. in situations where the electric cable has been fastened directly to a steel reinforcing bar.

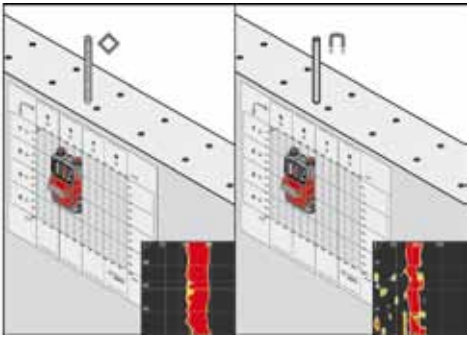


Operating limits in new buildings / electric cables carrying no current (not live)
The course taken by objects can be detected with the aid of the PS 1000 X-Scan but the objects cannot be classified. In this case the EM sensor can be used to differentiate between live cables and non-live cables. If the EM sensor data provides no helpful indication, it may be because the current carried by the cable is too low or that the cable is positioned too deeply in the structure.

Tip: Always analyze the radar images first and then subsequently switch to EM sensor images as an aid to classification.

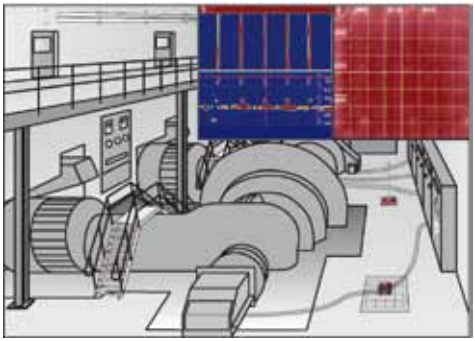


Differences in detection performance with electric cables in metal or PVC conduits
Live cables are typically positioned inside metal or plastic conduits. A live electric cable carrying a certain current can generally be more easily located by the EM sensor when situated in a plastic conduit rather than in a metal conduit, as the shielding effect of the plastic conduit is considerably lower. The radar sensor, however, works much more effectively with metal conduits as these reflect the radar waves better, producing a stronger signal than that obtained from the electromagnetic field picked up by the EM sensor in the PS 1000 X-Scan.



Influence of external interference fields on the EM sensor
When taking readings in areas affected by undesired magnetic fields (e.g. in the vicinity of transformers, electric motors or other appliances causing high magnetic interference) the data from the EM sensor is shown shaded in transparent red. Please note that, in this case, the readings from the EM sensor in the PS 1000 X-Scan may not be correct.

Tip: If possible, try to switch off the source of potential interference.



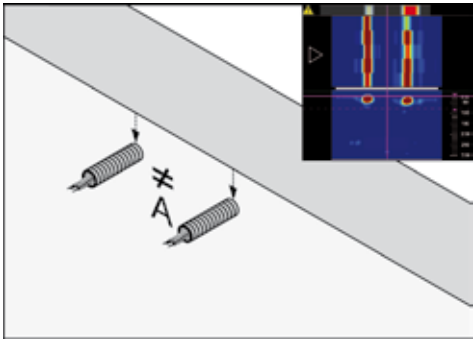
Starting behavior of the EM sensor in the PS 1000 X-Scan during Quickscan detection and recording
The EM sensor of the PS 1000 X-Scan reacts to electromagnetic fields. When starting a Quickscan with the EM sensor active it is possible that an electromagnetic field in the vicinity may be detected and indicated.

Tip: Verify the readings as follows:
- Repeat the scan from the opposite direction
- Make an additional scan along an offset, parallel path
- Change the orientation of the scanner (turn it through 180°) before making the scan

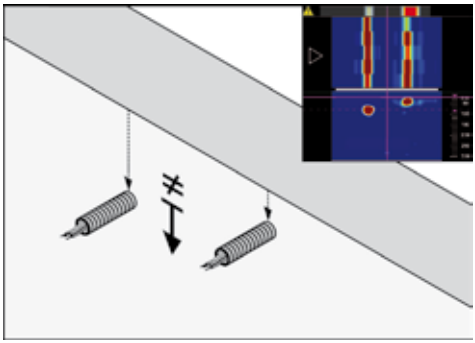
Behavior of the EM sensor when scanning speed is too high
Moving the scanner too quickly may cause the position of the EM sensor data image to be shifted relative to the radar data image. The shift is always in the direction of the scan.

Classification of closely adjacent live electric cables
Two or more adjacent live electric cables may each carry higher or lower electric currents (A). In such cases it is possible that only the live cable with the highest electromagnetic field (cable carrying the highest current) can be classified clearly.

Tip: When detecting and locating objects, the radar images should also always be used as an assessment aid.

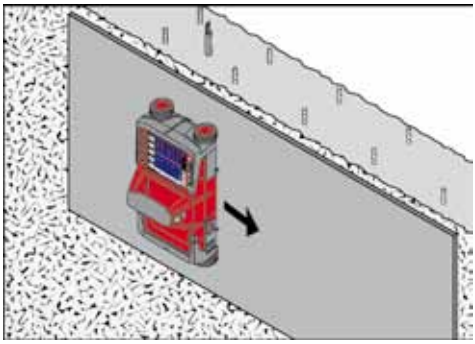


Classification of live electric cables at different depths
Two adjacent cables carrying the same electric current but positioned at different depths (↧) in the structure may produce different readings. It will be difficult or even impossible to classify a live cable that is positioned at greater depth in the structure than another cable carrying the same current but positioned closer to the surface. The higher electromagnetic field present at greater depth is weaker at the surface of the structure.



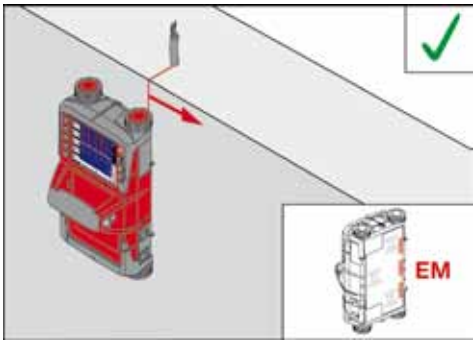
Classification of live cables when scanning rough surfaces
Due to the principle employed, images of objects may be corrupt or contain errors when scans are made on rough surfaces.

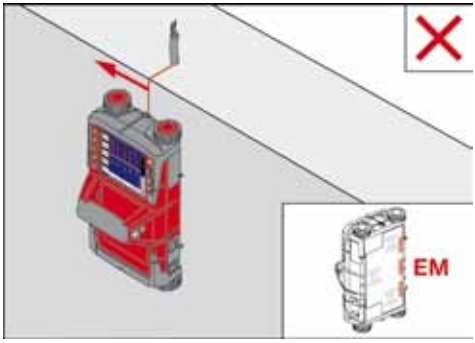
Tip: Problems of this kind can be avoided by laying a thin sheet of material (e.g. Perspex/Plexiglass or cardboard) on the surface before making the scan.



Detecting and locating live cables correctly
In order to be able to classify live cables clearly, the EM sensor of the PS 1000 X-Scan must be moved completely over the object in the structure (see illustration above left). Depending on the direction of the scan, a live cable that is not passed over completely by the scanner cannot be detected.

Tip: Turn the scanner through 180° to allow better EM sensor access in corners or at edges in order to ensure that objects located in these positions can be classified.





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