OKM
GERMAN DETECTORS



OKM FUSION LIGHT

USER'S MANUAL

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Table of contents

1 Introduction **4**
1.1 Preface 4
1.2 Important Notes 5
1.3 Maintenance and Services 6
1.4 Danger of Explosion during Excavation 6

2 Technical specifications **8**
2.1 Control unit 8
2.2 Wireless data transfer 8

3 Scope of delivery **9**

4 Control elements **10**
4.1 Control unit 10

5 Assembly **11**

6 Download, install and activate application **12**
6.1 Download and Installation 12
6.2 Activation 12

7 Operating modes **15**
7.1 Establishing a Bluetooth connection 16
7.2 Magnetometer 17
7.3 3D Ground Scan 18
7.4 Open Scan 25
7.5 Settings 26
7.6 Information 27

8 Field procedure **28**
8.1 General scanning procedure 28
8.2 Special advices for field procedure 31

CHAPTER 1

Introduction

1.1 Preface

Dear customer,

all of the engineers, sales, training and support staff at OKM GmbH would like to thank you for your purchase of the Fusion Light.

The Fusion Light detector works on the principle of Electro-Magnetic Signature Reading (EMSR). Besides the detection of metallic objects this device is also capable of detecting natural features of the earth like formations of strata, cavities, voids, faults, ground water and other non-metallic objects. Then of course this equipment is best suited at detecting sepulchers, treasure, buried utilities, tanks and the like.

The Fusion Light is able to locate, document and analyze buried objects within various structures and vessels non-intrusively without having to excavate the area. Using EMSR is particularly useful in areas where detection is a must and excavation is not possible. The facile and flexible handling of the Fusion Light can easily and quickly give reproducible results.

With our team of specialists we guarantee that our products are under recurrent control. Our specialists try to implement new developments in terms of further quality improvements for you.

By purchasing or using one of our products, we cannot guarantee that during the course of your research that you will be successful and have a find. The recognition of hidden and buried objects depends on a huge number of factors. As you well may know there are different soil types all over the world with different levels of natural attenuation. Variable soil properties can and will hamper and alter ultimate scan measurements. Areas where there is an extreme amount of ground water, varying clays, sands and wet soils making scanning more difficult and may reduce the maximum depth capabilities of any and all detection equipment, regardless of make or model.

For more information regarding where this equipment has been used and operated, please visit our web site. Our equipment is constantly being tested and when improvements or upgrades are available, we will list them also on our web site.

It is necessary for our company to protect our developments and all of the information learned during the "Research and Development" phases in creating our technology. We strive to stay within the given framework of legislation, patents and trademark registration.

Please take your time to read this User Manual and familiarize yourself with the operation, functionality and how to utilize the Fusion Light. We also offer training for your equipment in our factory and on-site. We strive to maintain worldwide dealer network for assistance and support. Please visit our web site for more information.

1.2 Important Notes

Prior to using the Fusion Light and its accessories, please read these operating instructions carefully. These instructions give information on how to use the detector and potential sources where precautions should be taken.

The Fusion Light and its accessories serve for the analysis, documentation and detection of sub-surface anomalies and ground disturbances. The recorded data of the ground structure will be transmitted to a PC to give a visual representation using our proprietary software program. Any additional notes to the software should be observed. Please read the user manual of the software!

1.2.1 General Notes

Being an electronic device, the Fusion Light has to be treated with caution and treated with care as with any electronic device. Any failure to observe the safety precautions given or any use for purposes other than the ones it is designed for may result in damage or destruction of the processing unit and/or its accessories or connected components.

The device has a built in anti-tampering module which will destroy the unit if it is improperly opened. There are no end user serviceable parts on the inside of the unit.

1.2.2 Possible Health Hazards

If used properly this device normally does not pose any health hazards. According to current scientific knowledge, the high-frequency signals are not harmful to the human body on account of their low power.

1.2.3 Surrounding Area

When moving this unit from a cold place to a warmer place, watch out for condensation. Do not immediately operate the unit until any possible condensation could have evaporated. The unit is not weather proof and water or condensation can destroy the unit.

Avoid strong magnetic fields, which may occur in places where there are large electric motors or unshielded loudspeakers. Try to avoid using this equipment within 50 meters (150 ft) of this type of equipment.

Metallic objects on the ground such as cans, tin, nails, screws or debris can influence your scan data and present negative results regarding your scan data. Also it is a good habit to remove any metallic objects off of your person like cellular telephones, keys, jewelry, etc... Do not wear steel toe boots.

1.2.4 Voltage

The power supply should not be outside the indicated range of values. Use only approved chargers which are included in the scope of delivery.

1.2.5 Data safety

Data errors can occur if:

- the range of the sender module has been exceeded,

- the power supply of the device or the batteries are too low,
- the unit is operating too close to devices which send out disturbances or
- atmospheric conditions (electrical storms, lightning, etc...).

1.3 Maintenance and Services

In this section you will learn how to maintain your measuring instrument with all included accessories to keep it in good condition a long time and to get good measuring results.

The following list indicates what you absolutely should avoid:

- penetrating water
- strong dirt and dust deposits
- hard impacts
- strong magnetic fields
- high and long lasting heat effect

To clean your device please use a dry soft rag. To avoid any damage you should transport the device and accessories always in the appropriate carrying cases.

Prior to using your Fusion Light please be sure that all batteries and accumulators are fully charged. Also allow the batteries to completely discharge before recharging them, regardless if you are working with the external battery or with internal accumulators. This way your batteries will have a long and durable life.

> To charge the internal battery, use only the approved chargers which are part of our scope of delivery.

1.4 Danger of Explosion during Excavation

Unfortunately, the last two world wars also made the ground in many places of the world a potentially explosive scrap heap. A host of those lethal relics are still buried in the ground. Do not start digging and hacking for an object wildly when you receive a signal of a piece of metal from your device. Firstly, you might indeed cause irreparable damage to a truly rare find, and secondly, there is a chance that the object reacts in an insulted way and strikes back.

Note the color of the ground close to the surface. A red or reddish color of the ground is an indicator of rust traces. As regards the finds themselves, you should definitely pay attention to their shape. Curved or round objects should be a sign of alarm, especially if buttons, rings or little pegs can be identified or felt. The same applies to recognizable ammunition or bullets and shells. Leave that stuff where it is, do not touch anything and, most importantly, do not take any of it home with you. The killing machines of war made use of diabolical inventions such as rocker fuses, acid fuses and ball fuses. Those components have been rusting away in the course of time, and the slightest movement may cause parts of them to break and be triggered.

Even seemingly harmless objects such as cartridges or large ammunition are anything but that. Explosives may have become crystalline over time, that is, sugar-like crystals have formed.

Moving such an object may cause those crystals to produce friction, leading to an explosion. If you come across such relics, mark the place and do not fail to report the find to the police. Such objects always pose a danger to the life of hikers, walkers, farmers, children and animals.

CHAPTER 2

Technical specifications

The following technical indications are medial values. During operation small variations are quite possible.

Technical changes due to development are possible!

2.1 Control unit

Length	800 mm
Diameter	65 mm
Weight	about 700 g
Protection Class	IP40
Operating time (internal battery)	approx. 12 hours
Charging time (internal battery)	approx. 3 hours
Input (charger socket)	19 V DC / 3.16 A
Processor / Main CPU	Cortex M3, 32 MHz
Processor / Slave CPU	Cortex M0, 24 MHz
Sensor technology	SCMI-15-D
Sample rate	1024 values / second
Measurement resolution	16 bit
Operating temperature	-10 – 60 °C
Storage temperature	-20 – 70 °C
Air humidity	5 % – 75 %
Waterproof	No

2.2 Wireless data transfer

Technology	Bluetooth 5.1
Frequency range	2.402 – 2.480 GHz
Maximum transfer rate	1 Mbps
Receiving sensitivity	+8 dBm
Maximum range	approx. 10 m

CHAPTER 3

Scope of delivery

In the following section you can find all standard equipment and optional parts of Fusion Light. The scope of delivery can be different in some circumstances because of some optional accessories which are not included in the basic equipment.

Description	Quantity
Control Unit	1
Charger with Travel Adapter	1
Carrying Case	1
User Manual	1
Android Smartphone with App	1
Windows Tablet PC with “Visualizer 3D”	1

Table 1: Scope of delivery

CHAPTER 4

Control elements

In this section you will learn more about the fundamental use of all control elements for this measuring instrument. All connections, inputs and outputs are explained in detail.

4.1 Control unit

Figure 4.1 represents all control elements of the Fusion Light control unit. The control unit itself is the scanning probe that can be used in vertical position only.

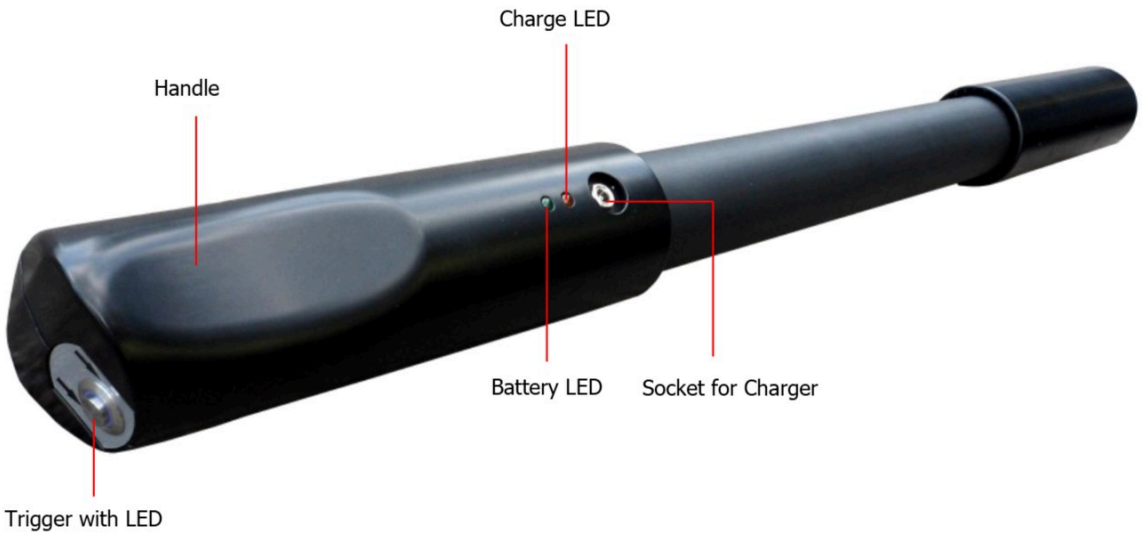


Figure 4.1: Overview of control elements

Battery LED: The battery LED indicates the current charge state of the internal battery during operation. As long as this LED shines green you have enough power to run your device. When this LED starts blinking you should recharge the battery.

Socket for Charger / Charge LED: When the green battery LED is blinking during operation you have to recharge the internal battery by connecting the appropriate charger to the socket for charger. As long as charging is in progress the charge LED is shining orange. When the charge LED turns off the battery is fully charged.

Trigger with LED: Push the trigger to power on the detector. The trigger LED shines green now and is ready to respond to incoming Bluetooth connection requests. As soon as the connection is established, the LED turns blue. Now you can use the trigger to start scanning, initiate a new scan line (ground scan) or to do a ground balance (magnetometer). To switch off the unit push the trigger for at least 3 seconds until the LED turns off.

CHAPTER 5

Assembly

In this section is explained how to assemble the device and how to prepare a measurement.

The Fusion Light itself is ready to use without any additional preparations. You just have to make sure the internal battery is charged properly. Therefor connect the charger to the socket for charger as shown in figure 5.1.



Figure 5.1: Charging the control unit before usage

As long as charging is in progress the charge LED is shining orange. When the charge LED turns off the battery is fully charged.

CHAPTER 6

Download, install and activate application

This chapter explains how to download and install the application from the Google Play store as well as its activation. If you got your Fusion Light with a pre-configured smartphone, you may skip this chapter.

6.1 Download and Installation

You can download the Fusion Light application for your smartphone directly from the Google Play store (https://play.google.com).

In order to download the application, you will need a personal Google Account for the Google Play store.

Therefor run the Google Play application from your smartphone, as shown in figure 6.1 and follow the instructions. If your account is ready, simply search for “okm fusion light” to find the application.

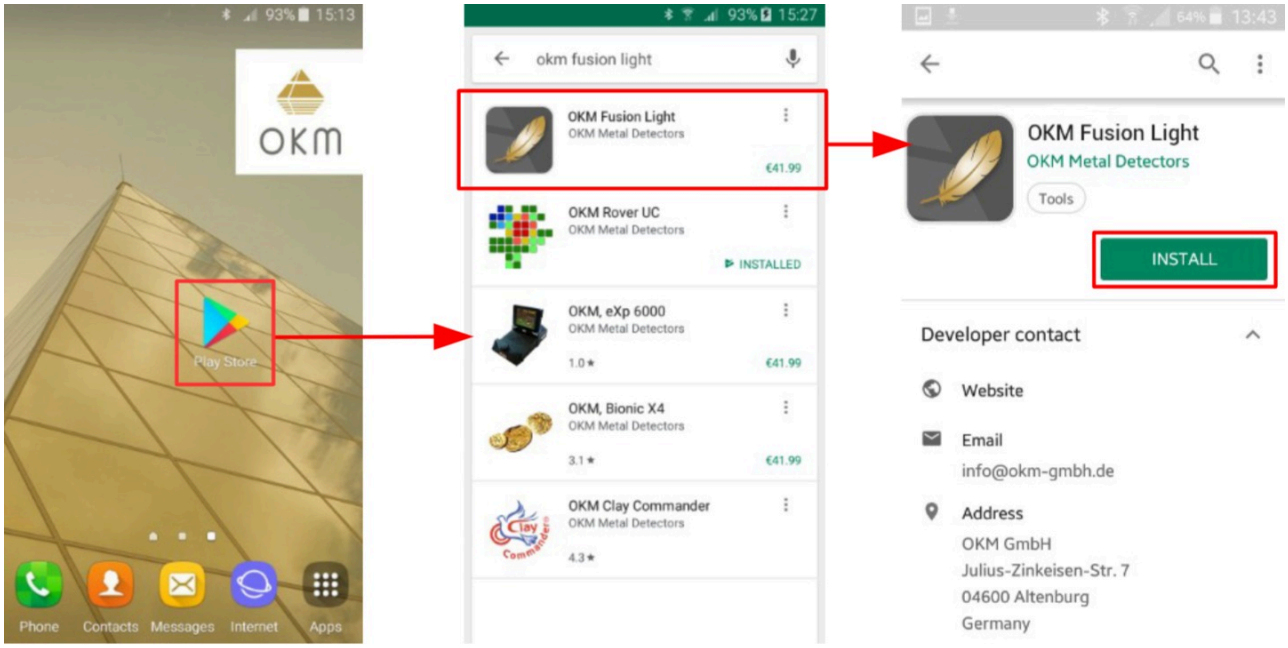


Figure 6.1: Download and installation of the application

Now click on “Install” and follow the instructions on your smartphone to download and install the application.

After the application has been installed successfully, you can run it for the first time. Now your application must be activated.

6.2 Activation

After running the application the first time, you have to process the activation to be able to use all functions.

In order to start the activation process, simply click the button "Activate application" (see figure 6.2).

There are two different ways to activate your Fusion Light application:

- **Activation via QR code**

  Simply scan a QR code with your smartphone to activate your application.

- **Manual activation**

  Enter information like serial number and activation code manually.

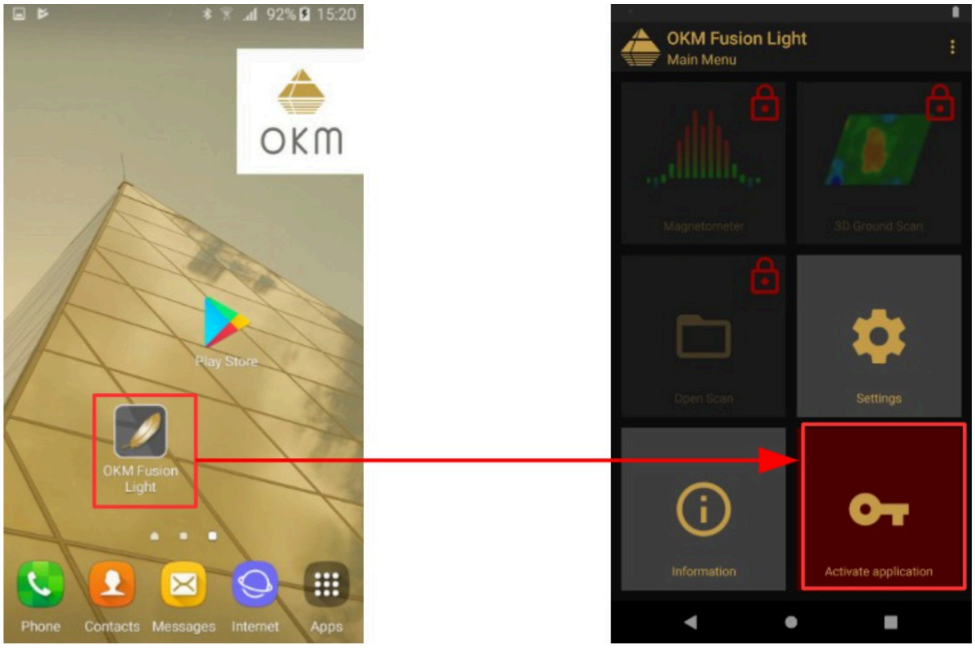


Figure 6.2: Start activation

6.2.1 Activation with QR code

One way of activating your application is using the enclosed QR code. After selecting the option "Use QR code", you have to position your smartphone's camera to the QR code.

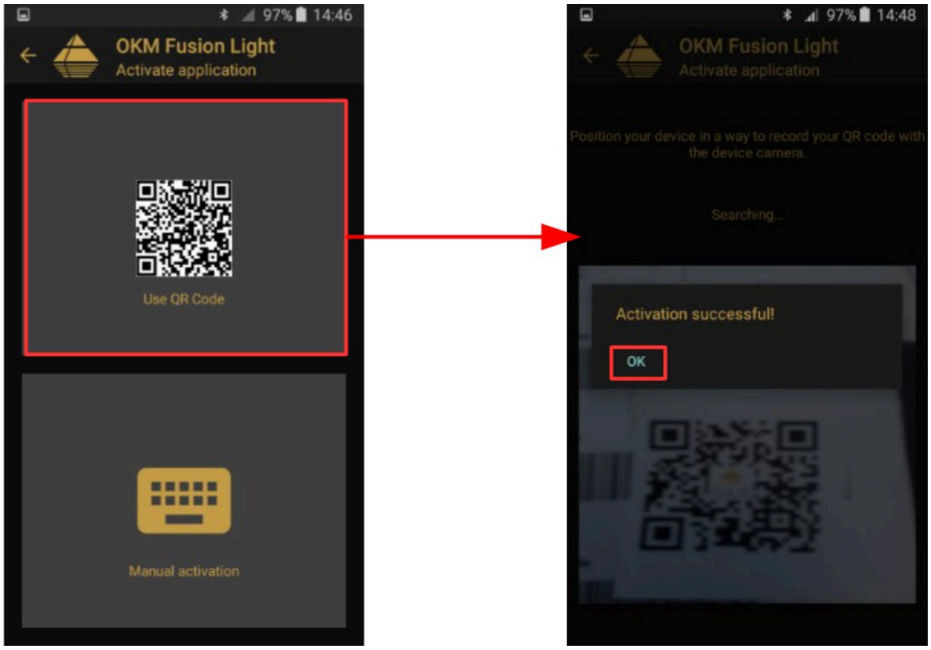


Figure 6.3: Scan QR code to activate the application

If the code gets recognized by your application correctly, the activation will succeed and you may use your Fusion Light. In case you are using a different Fusion Light with this application at a later time, you will have to change your activation accordingly and repeat the activation process.

6.2.2 Manual activation

The second way of activating your application is by entering all necessary information manually. First enter your Fusion Light serial number. Then enter the appropriate activation code. You will get all of the activation information from your OKM distributor. Safeguard this information for future use.

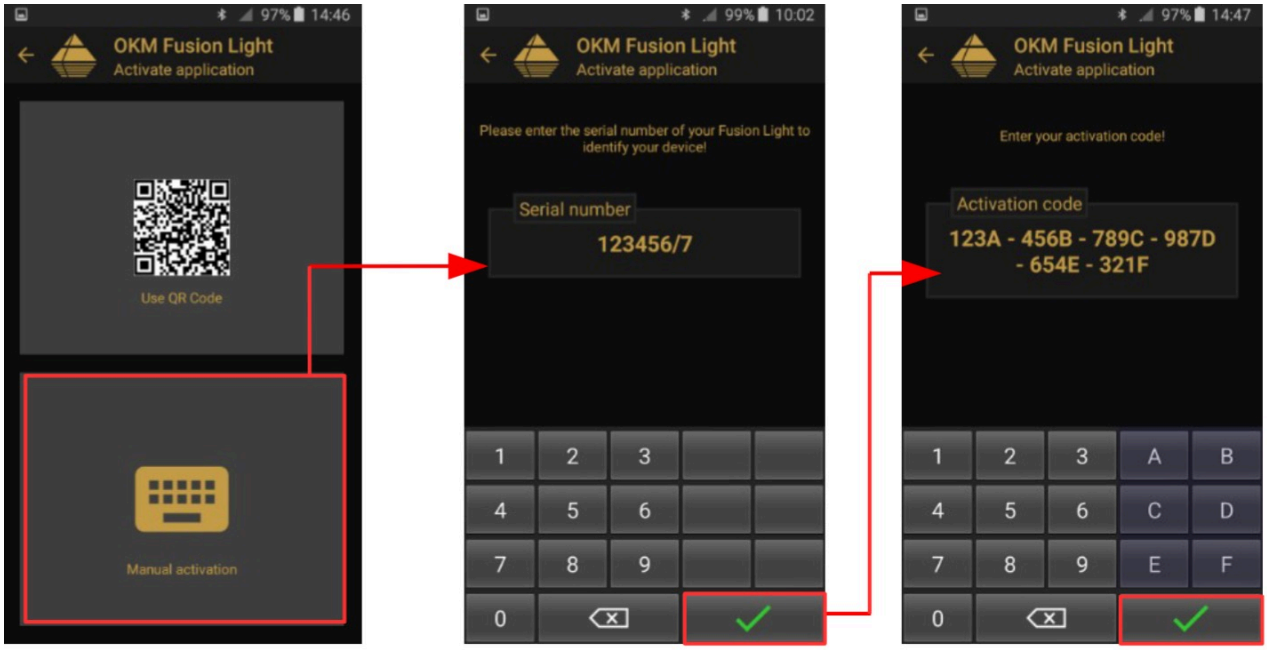


Figure 6.4: Enter serial number and activation code manually

After entering all the requested information correctly, the activation will succeed and you can use your Fusion Light. In case you are using a different Fusion Light with this application at a later time, you will have to change your activation accordingly and repeat the activation process.

CHAPTER 7

Operating modes

In this section we will familiarize you with the various functions of the unit. All of the available functions and features will be explained in detail.

The unit's functionality is controlled by a smartphone with installed Fusion Light application. Turn on your smartphone and select the Fusion Light icon by tapping on it with your finger. The application will start and then the main menu is visible.

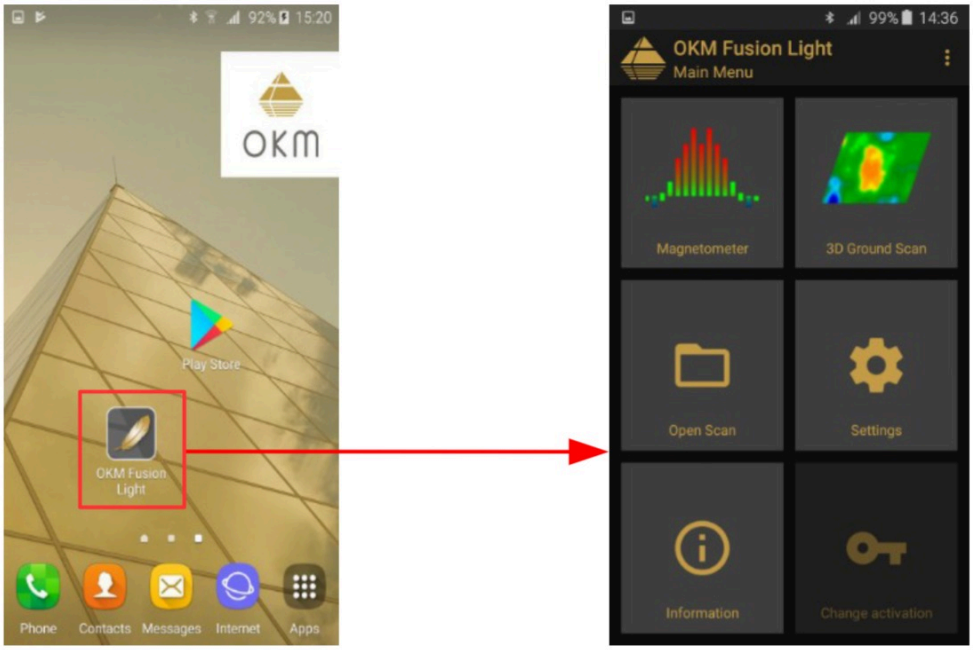


Figure 7.1: Starting the application and viewing the main menu

The following functions can be started from the main menu:

- **Magnetometer**

  A visual representation of the earth's magnetism. In this mode no data can be stored.

- **3D Ground Scan**

  A graphical scan of an area whereas the data can be stored for further analysis. This is the mode where the 3D image is created. The scan analysis can be done directly on the smartphone or transferred to a PC and analyzed with OKM's optional “Visualizer 3D” software.

- **Open Scan**

  When this function is selected, it will display all of the scans that are in the memory. When you select a scan it can be viewed and analyzed.

- **Settings**

  Adjust several options like language or font size.

- **Information**

  This will show detailed information about the current software version and serial number.

7.1 Establishing a Bluetooth connection

Before any data can be transferred, a Bluetooth connection must be established between the Fusion Light control unit and the smartphone. This process will start automatically when a connection is required. Figure 7.2 is a graphical depiction of the Bluetooth connection process when entering the "Magnetometer" function.

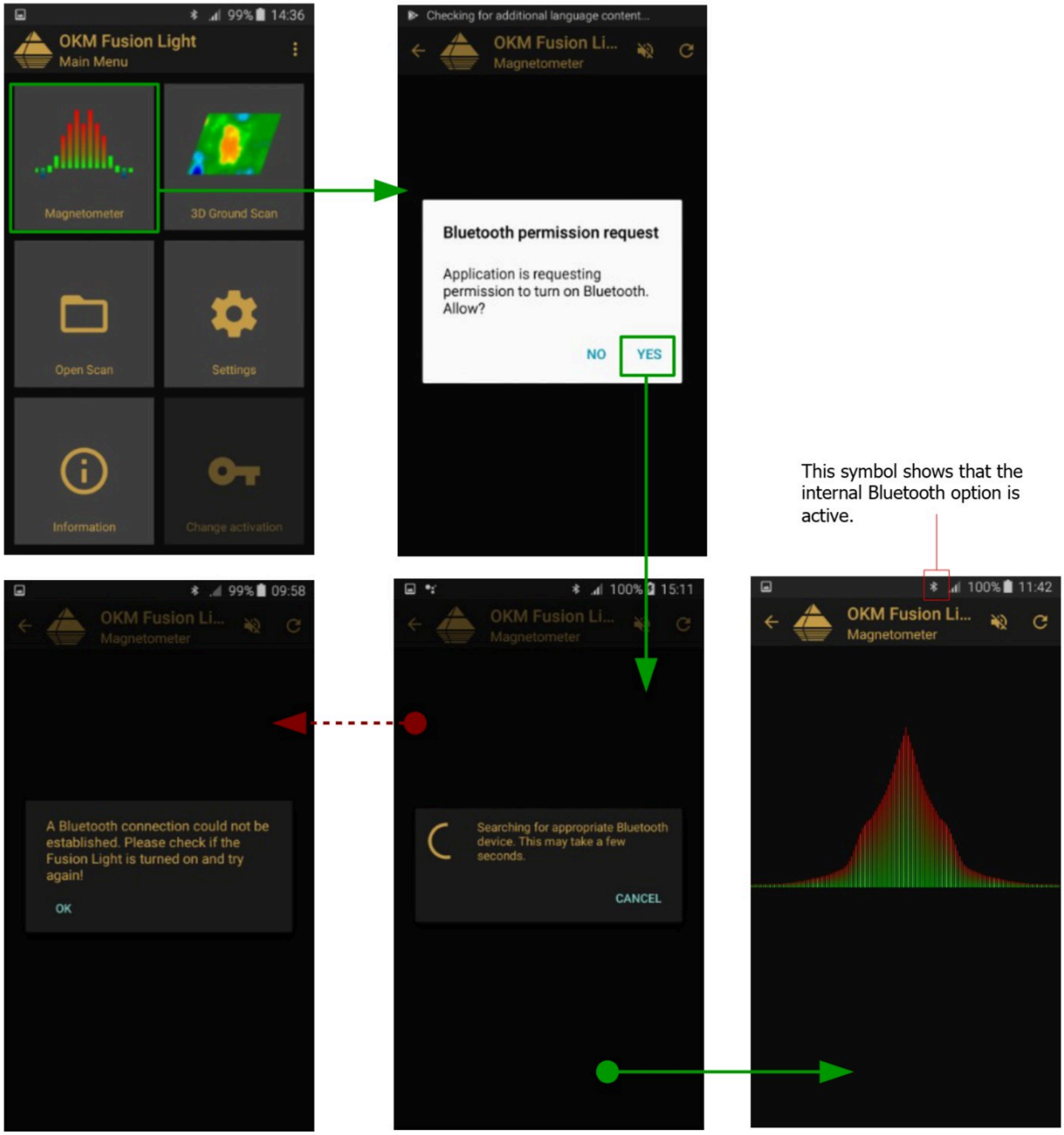


Figure 7.2: Graphical depiction of a Bluetooth connection

After the desired function is selected, the internal Bluetooth module should be automatically activated. In the event that it does not automatically activate, then a prompt will appear stating that it is not active and will

ask you if you would like to activate it. To confirm the activation, press "Yes" and wait for the connection to be made.

In the event that a connection still cannot be made, check the Fusion Light control unit to ensure that it is powered on and that the trigger LED is shining. After the connection is made, the LED will illuminate with a blue color. If the battery LED is blinking then the internal battery must be charged.

7.2 Magnetometer

By using the "Magnetometer" function, you can actively see ferromagnetic metals in the ground in real time.

This is a visual search mode only and the data cannot be stored for further analysis. Also you cannot determine the depth of the object or the size of the object.

On the smartphone start the Fusion Light application, select the option "Magnetometer" and a Bluetooth connection will be established (see also figure 7.2 on page 16). When the connection has been successfully established then the trigger LED on the control unit will illuminate in a blue color and on the smartphone the results will be displayed immediately.

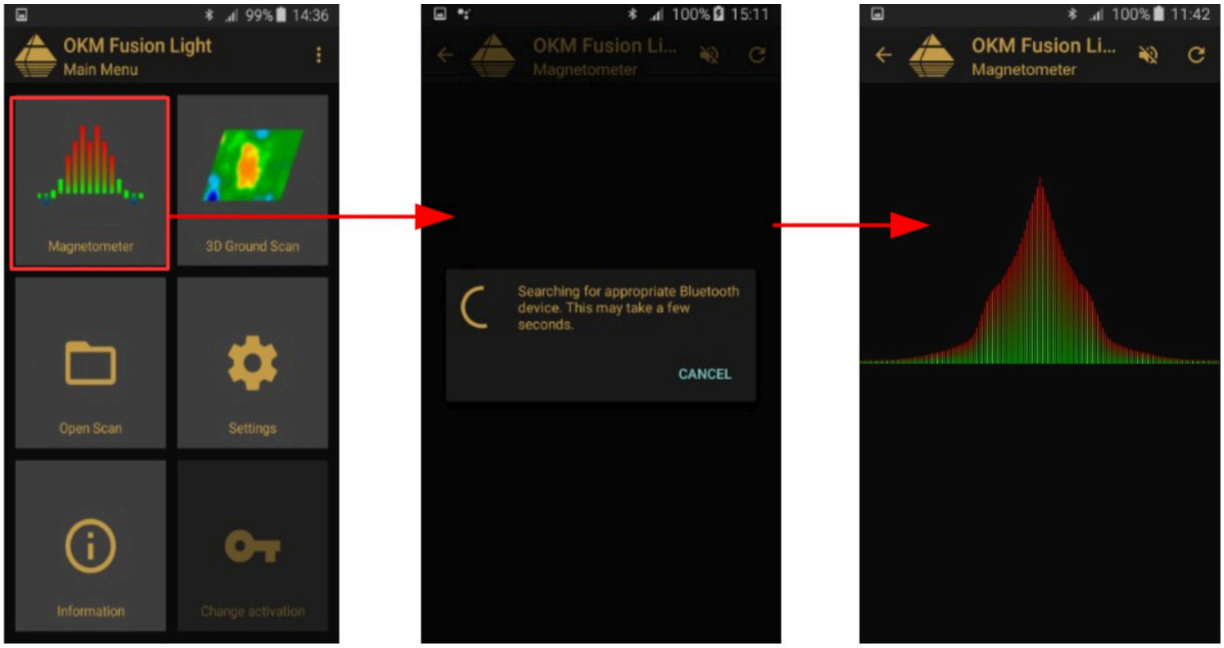


Figure 7.3: Activating the operating mode "Magnetometer"

At this moment in time the control unit can be moved slowly in any direction: forward, left, right and in reverse. The control unit must remain in a vertical position. The control unit will not properly detect objects if it is rotated on it's own axis or if it is not vertical.

As soon as a strong signal is detected, the values in the image will grow and be at a peak when it is directly over the object that is being detected. Most of the times this technique is used to detect small subsurface objects. This is helpful for clearing away objects, which can make a better scan when using the "3D Ground Scan" mode.

Should the signal become unstable, stop moving the control unit and hold it vertical and still. Then push the trigger button so that the unit can perform a ground balance. Once the unit has re-balanced itself, you can continue on with your scanning. This task can be performed as often as you like or as is needed.

Use the "Magnetometer" function to look for smaller objects like nails, screws or other ferromagnetic items which have a tendency to give off undesirable results in other scans, like those created by using the function "3D Ground Scan". Not only will you be able to find the smaller objects that lie on the surface but of course you will be able to located larger ferromagnetic objects that are buried deeper in the ground. The more of the smaller targets that are absent in a scan, the easier it is to locate items that are deeper.

If your desired target is a ferromagnetic item in the ground, then you can use the "Magnetometer" as a pin pointing tool and localize its exact position from the surface. For ferromagnetic items this is a quick and easy way to locate and pin point sub-surface targets.

When you are finished with the "Magnetometer" mode, simply tap on the arrow ← to end the function and return back to the main menu on the smartphone.

7.3 3D Ground Scan

The function "3D Ground Scan" allows for the production of a graphical measurement, also known as a 3d scan, to be created and stored on the unit for later evaluation of the representation on a computer or in this case the smartphone. Start the software by clicking the Fusion Light application and select "3D Ground Scan". Also as a note, to go back to a previous scan or function on the smartphone, you can push the return button ← and this will take you back one step to the previous function and/or screen.

7.3.1 Ground Scan Preparation

After you have selected the function "3D Ground Scan" from the main menu, you will be taken to a configuration screen as shown in figure 7.4 to choose additional options in how the scan is going to be performed.

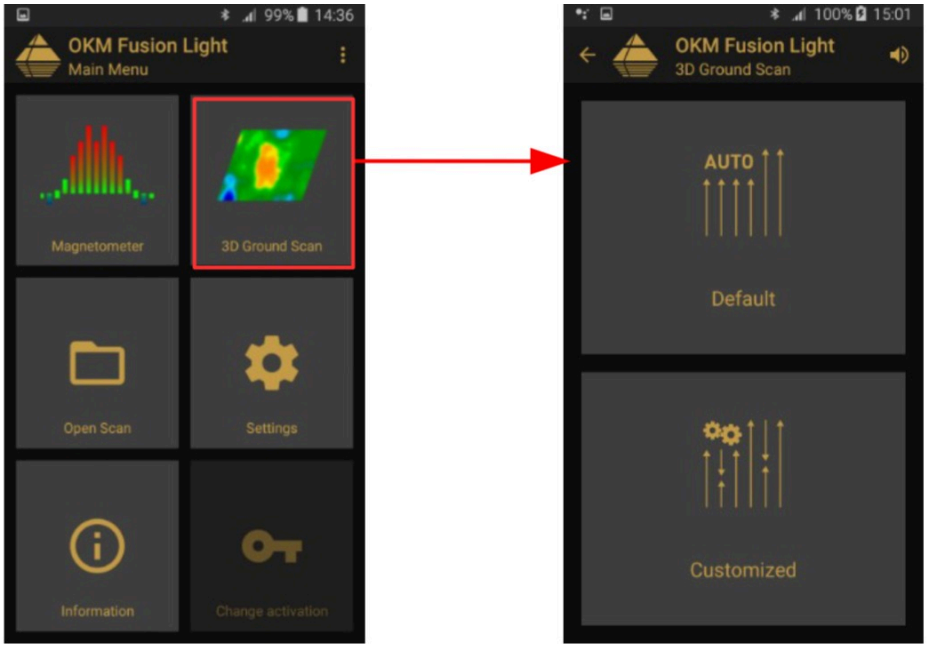


Figure 7.4: Activating operating mode "3D Ground Scan"

You can choose between the options "Default" and "Customized" as explained in the next sections.

7.3.1.1 Default

This option is a predefined configuration (quick start) with following non-changeable settings:

- **Scan Mode:** Parallel
- **Impulse Mode:** Automatic
- **Field Length:** Automatic

7.3.1.2 Customized

If you like to individually adjust the scan settings, you have to select the "Customized" option. There you can change all settings by yourself.

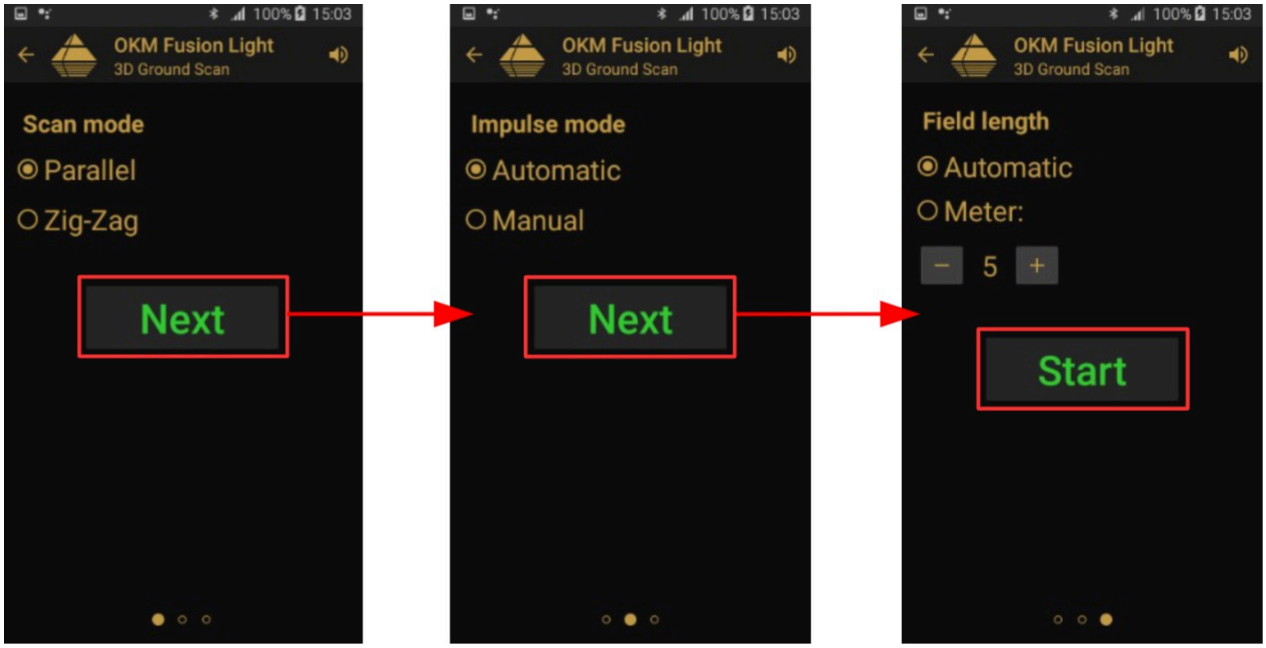


Figure 7.5: Adjusting scan parameters individually

Figure 7.5 illustrates the process of configuring the scan settings. You can change the following options:

- **Scan Mode**

  The scan mode determines the manner in which the measurement field or scan area is to be performed. Further information can be found in Chapter 8.1.1 “Scan Mode” on page 28. The following options are available:

  - *Parallel*

    A method of measurement whereas the operator will gather and store information traveling in only one direction. This method will give a more precise method of making a scan.

  - *Zig-Zag*

    A method of measurement whereas the operator will gather and store information traveling in both directions. Once going away from the starting point, moving to the left of the start point and returning.

- **Impulse Mode**

  The impulse mode sets the way how the individual measurements or scans are taken. The following options are available:

  - *Automatic*

    The individual measured values are recorded in succession without a break and controlled by the software. There is no user interaction until the cycle is complete.

  - *Manual*

This method is completely controlled by the user by pushing on the trigger button to manually record a measurement value.

- **Field length**
  - *Automatic*

    The length of a scan line is determined when reaching the end of the first path. There you have to push the trigger button of your Fusion Light to indicate the end of the first scan line. All succeeding scan lines will have the same length as the first one.

  - *Meters*

    The length of a scan line that is defined prior to the begin of a scan. Each scan line has the same length and will run automatically to the end of each predetermined line. At the end of each scan line, the device will stop and will wait for the user to either start a new scan line or save the current scan.

After all of the parameters have been selected, tap the "Start" button.

7.3.2 Measurement Procedure

Before the actual measurement starts, a Bluetooth connection between Fusion Light control unit and smartphone must be established.

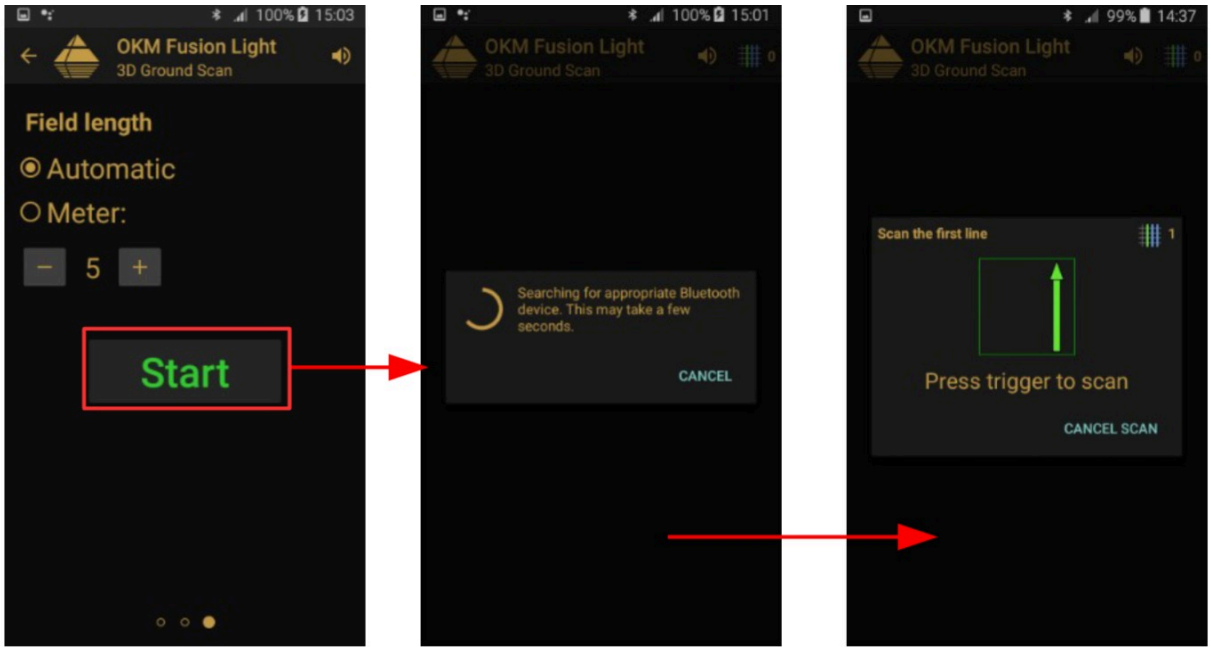


Figure 7.6: Establishing a Bluetooth connection in operating mode "3D Ground Scan"

As soon as the connection is established, stand at the beginning of the first scan line in order to begin the scan. As indicated in figure 7.6 you have to press the trigger button of your Fusion Light to scan the first line.

Once depressed the unit will now begin to record the measurement.

a) When the "Impulse Mode" automatic was selected, the operator must immediately begin his line. Move slowly forward until you reach the end of your line or until the unit no longer beeps. Once the unit has stopped the first row then prepare for your next row. To start the next row, again click on the trigger button on the grip or tap on the screen of the smartphone.

b) If the manual function was selected in the "Impulse Mode", then the operator will be in complete control of the unit. After depressing the trigger button on the Fusion Light control unit then the unit will record the measurement. Move forward to the next point and again push on the trigger button to record the next measurement and so on. The unit will wait for a manual entry until it reaches the end of the predetermined length initially input. Once the end has been reached then prepare for the second measurement row, and so on.



Figure 7.7: "Zig-Zag" scan in operating mode "3D Ground Scan"

Measure every row until you have completed your scan. Once you have completed every row do not push the trigger again, but tap "Finish scan" on the screen of your smartphone to move onto the next screen and save the scan.

Please ensure that the Fusion Light is held vertically to the ground. Also it is important that the unit be off the ground and stay at the same height. We recommend holding the unit at or approximately 10 cm above the ground.

7.3.3 Saving a Scan

Upon deciding to save a scan, press on the "Yes" button and the next screen will appear asking you if you like to give the scan a name, as shown in figure 7.8.

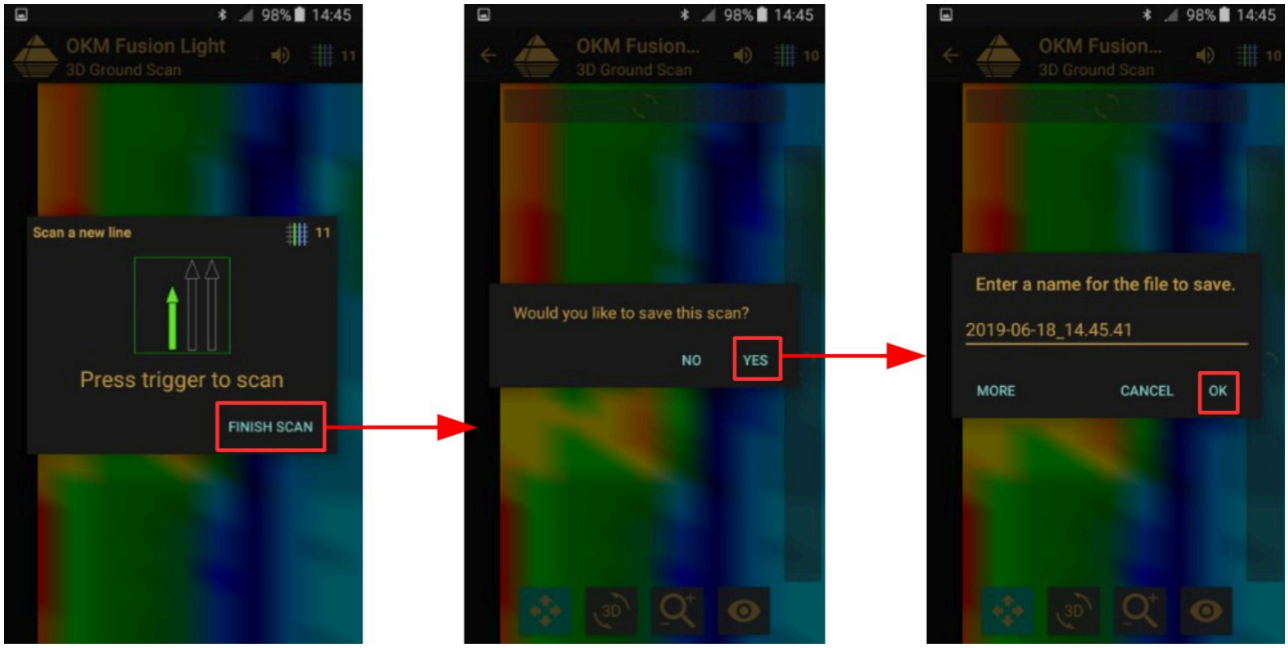


Figure 7.8: Saving the current scan

By default the date and time are given, we highly recommend that you either give it an identifying name or make note of the name and location so that in the event that you see a target or an item of interest within the scan, you can return to the same location to verify it.

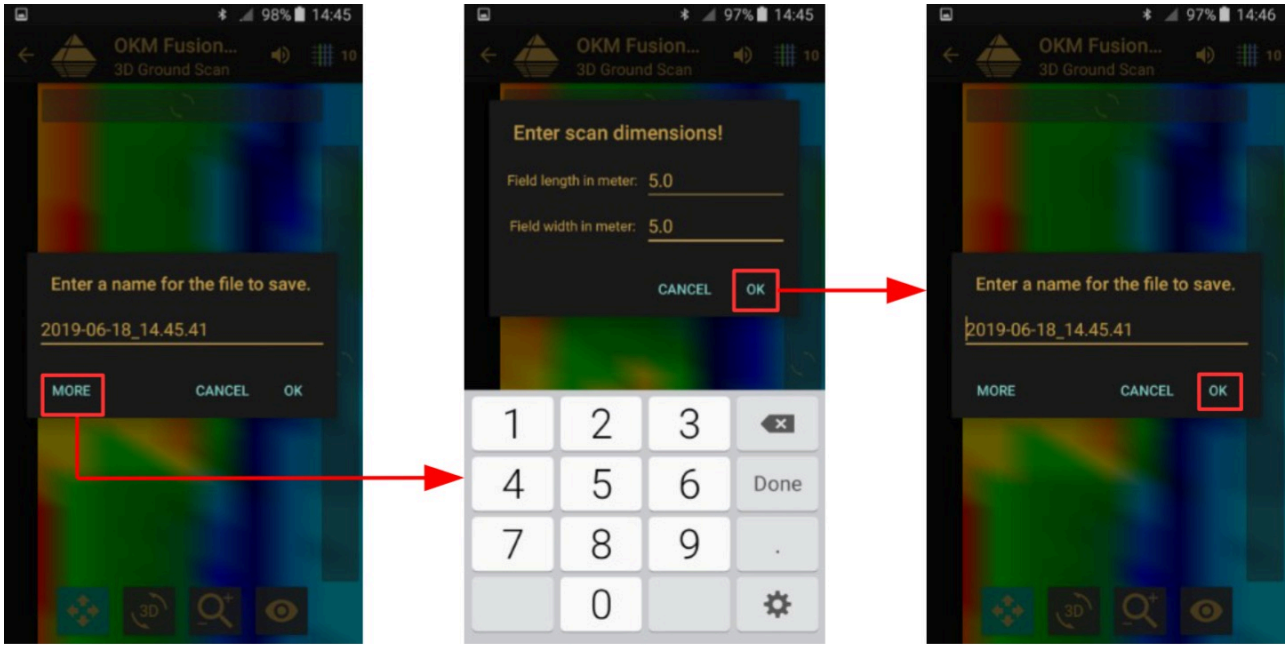


Figure 7.9: Adding field dimensions to the current scan

After the scan has been given a name, you may also add the field dimensions of the scan area by clicking the "More" button, as shown in figure 7.9. After that you click on the "OK" buttons to save the scan to memory.

7.3.4 Scan Analysis

Regardless of whether the scan was saved or not, you are still in the view mode, able to see the recently performed scan. Here you can still control the analysis by zooming in and out, rotating the graphic and repositioning it.

In figure 7.10 you can see the available controls. Press on any of the icons to activate it. When you have selected an icon and it is available, it will illuminate in a greenish/highlighted color. As in the example below, that is the position scan button which is highlighted.

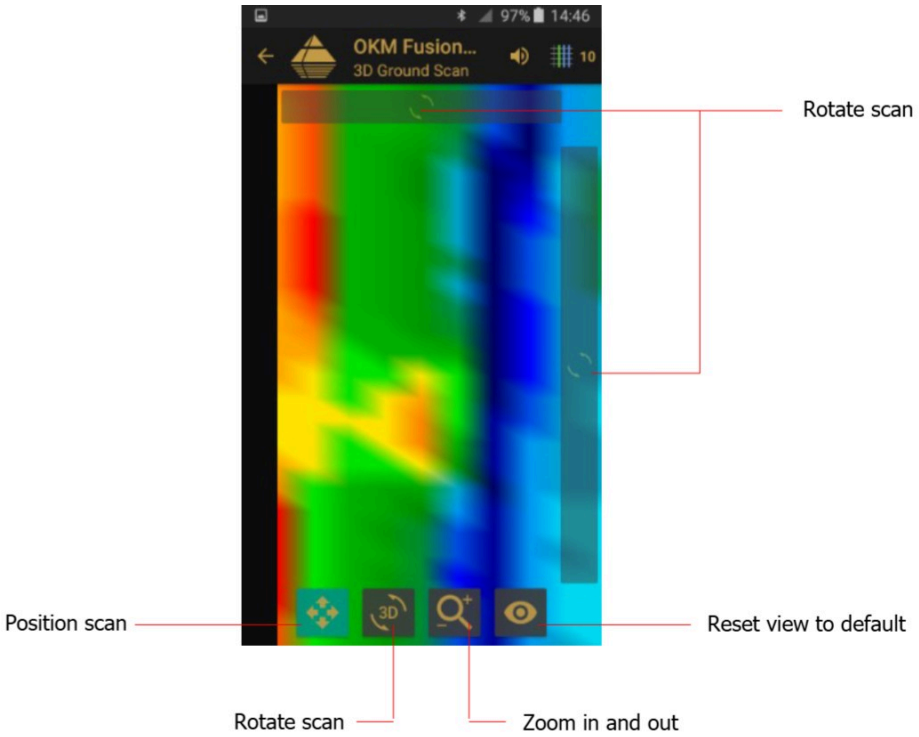


Figure 7.10: Analysis controls in operating mode "3D Ground Scan"

To end the scan analysis, push the back button of your phone to get back into the main menu.

7.3.5 Data Transfer to PC (optional)

To perform further data analysis, the measurements can be transferred to a PC via USB cable. The data must be saved on the PC's hard drive prior to opening the individual scans with "Visualizer 3D" software.

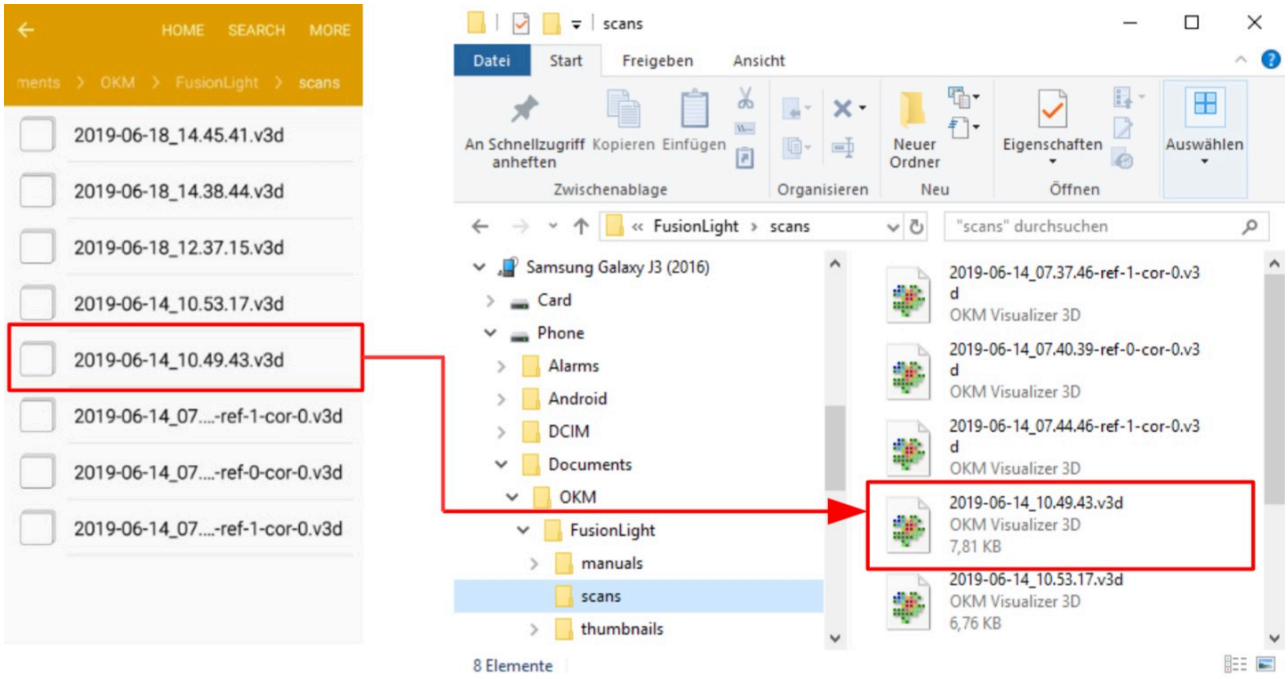


Figure 7.11: Locating the folder with scan images

Figure 7.11 shows previously saved scan images within the Android folder system. The scan images are usually located in Device Storage > Documents > OKM > FusionLight > scans.

The following folders are used by the Fusion Light application:

- **Device Storage > Documents > OKM > FusionLight > thumbnails**

  This folder contains all generated thumbnails that are shown inside the application to preview the stored scan images. If you delete those files you won't see any preview image when opening stored scans.

- **Device Storage > Documents > OKM > FusionLight > scans**

  This is the folder where all scan images are stored. These can be transferred for additional data analysis to a computer with “Visualizer 3D” software.

- **Device Storage > Documents > OKM > FusionLight > manuals**

  This is the folder where all user manuals are located. If you delete one of the manuals you can download the current one from the right top menu bar in the main menu.

7.4 Open Scan

You can view scans at any moment from the main menu. Simply start the application and select “Open Scan”. Afterward the memory will open up all of the available scans. Push on the desired scan to open it!

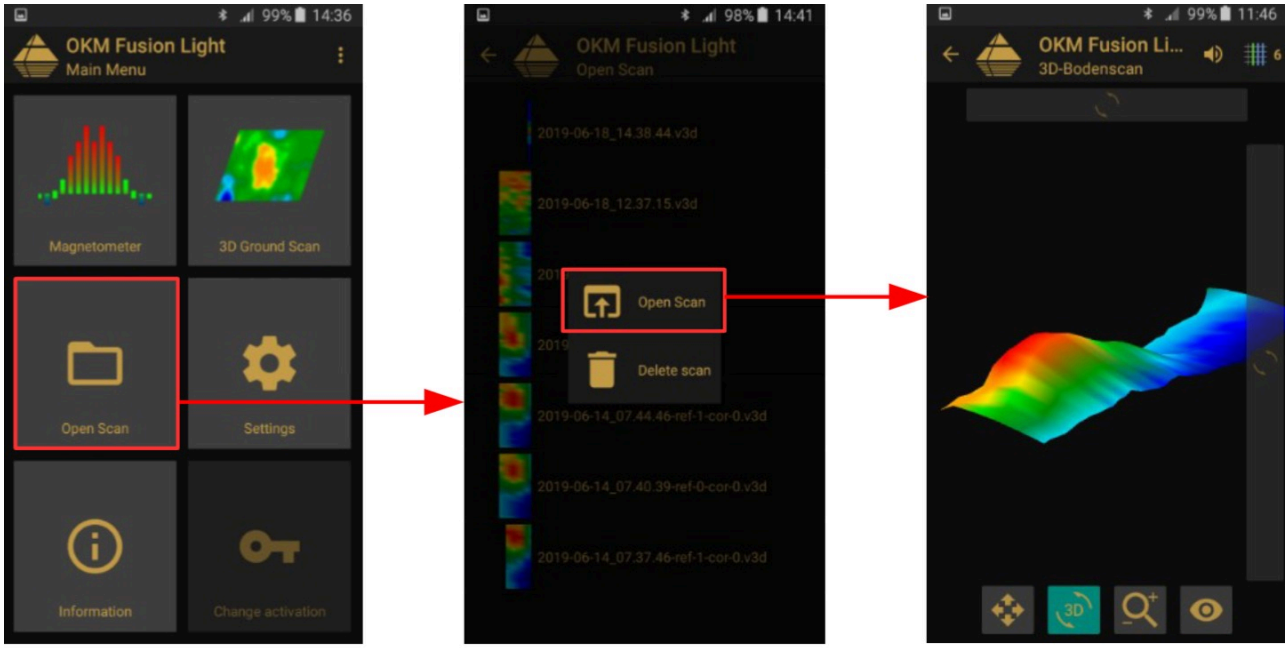


Figure 7.12: Browse scans in memory

Shown above is the scan selection screen. Click on any of the files to open a popup menu with following items:

- **Open Scan**

  Select this item if you like to open the scan image for graphical display and analysis.

- **Delete Scan**

  Select this item if you like to delete the scan image from your smartphone.

To return to the previous screen press on the back button of your smartphone or use the arrow ←.

7.5 Settings

There are several configuration settings that can be changed individually while working with the Fusion Light application. In figure 7.13 all options are shown.

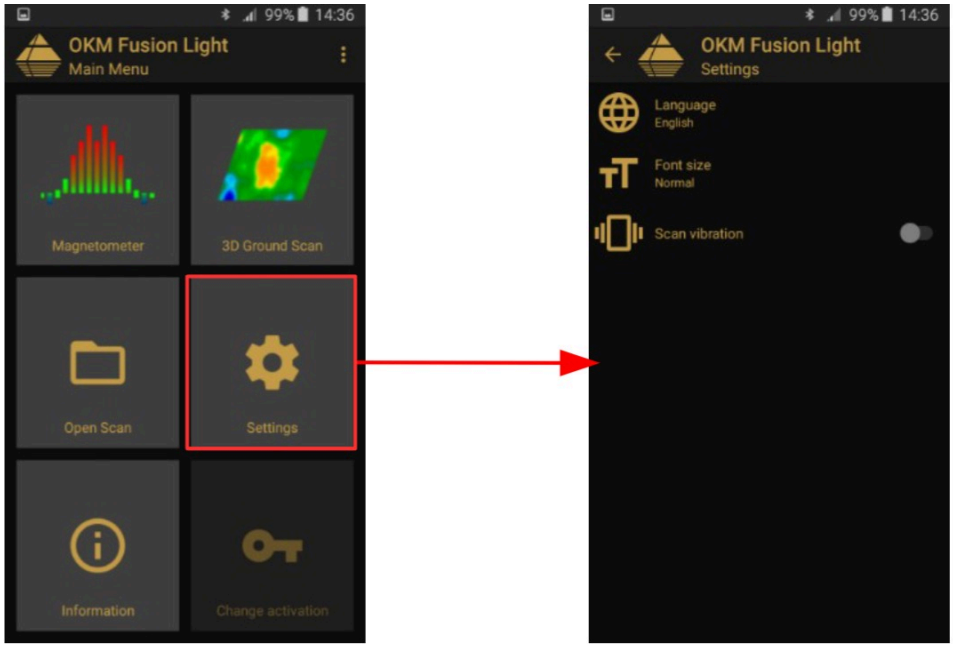


Figure 7.13: Settings

Following options can be adjusted:

- **Language**

  You may select a language of your choice. This will ease the operation of the application.

- **Font size**

  You can also change the size of the font, that is used within the application. There are three sizes available: Normal, Large and Huge.

- **Scan vibration**

  If this option is enabled, the smartphone will vibrate to indicate specific progress. Thus you can turn off the sound and will instead "feel" the scanning process.

7.6 Information

When selecting "Information" from the main menu, a new screen will appear showing the software version as well as the device's serial number, that is necessary for any support requests.

CHAPTER 8

Field procedure

This chapter gives practical instructions about the general procedure of scanning an area. The different scanning methods and procedures will be explained in detail.

8.1 General scanning procedure

In general every scan always starts on the bottom right corner of your scan area. Starting from this point, you should walk scan path by scan path, whereby every following path is situated on the left side of its previous path. During walking these lines, the measurement values will be recorded and depending on the selected operating mode either transferred directly to a computer or saved into the memory of the device.

The device stops at the end of each finished scan line, so that the user can find the starting position of the next line. In this way, all paths will be recorded and the area will be measured.

Figure 8.1 shows all 4 possible starting positions and the corresponding first scanning path. Depending on the composition of your terrain you can determine the optimal starting point for your measurement by yourself.

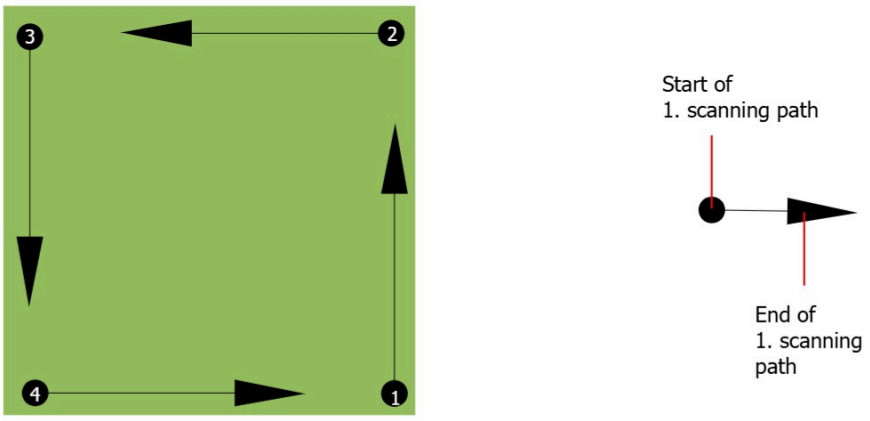


Figure 8.1: Starting position of a scan area

The scanning paths may be referred as "Zig-Zag" or "Parallel" traverses. Also the number of impulses (measure points), which are recorded during one scanning path can be adjusted individually depending on the size of your scan area (length of scanning path).

8.1.1 Scan Mode

There are two general techniques to surveying an area with the Fusion Light:

- **Zig-Zag**

  The starting position of two scanning paths next to each other is on the opposite side of the measured area. You will record data on your scanning path and on the return path as well.

- **Parallel**

The starting position of two scanning paths is always on the same side of the measured area. You will only record data in one way and in one direction, while you should return and walk back to the starting position of the next scanning path without recording data.

Figure 8.2 represents both techniques schematically.

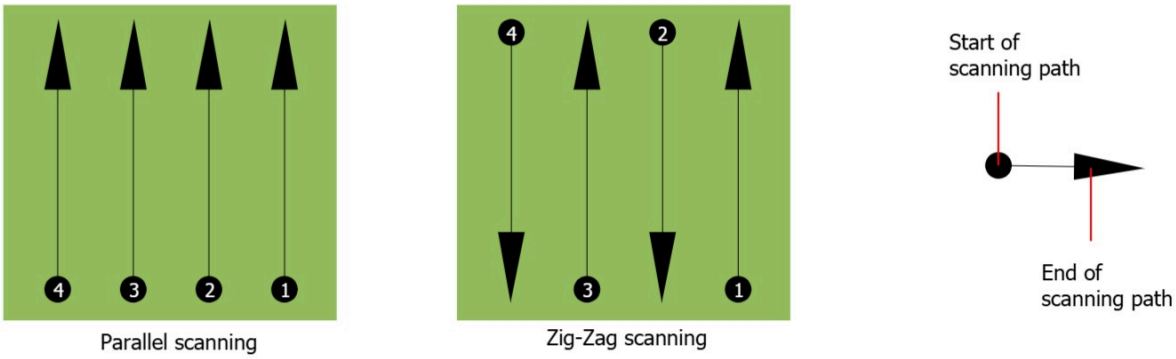


Figure 8.2: Scan modes to measure an area

Doing the scan in "Parallel" mode you will start on the bottom right corner of your scan area (point ❶) to walk and record a scan path towards the upper right corner of the area. After recording the first line, you should walk back to the starting point and move to the left of the first scan line to start the scan path 2 (point ❷), to start there the second scanning path. In this way all other paths will be scanned, until you have reached the left side of your measure area.

Doing the scan in "Zig-Zag" mode you will start also from the bottom right side of your measure area (point ❶) to walk and record a scanning path towards the right upper corner of the measure area. Different from the parallel measurement, you should continue recording data while walking back the second scanning path.

So you go to the starting point of the second scanning path (point ❷) and scan in the opposite direction. In this way, all other paths will be scanned in the scan mode "Zig-Zag" until you have reached the left side of your measure area.

The distance between the scanning paths should be consistent during one measurement but can vary from measure area to measure area. If you mostly look for smaller targets than you should also select a smaller distance between the lines. A standard rule is: The smaller the distance between the paths, the more accurate your scans will be. When you are conducting your first scans the lines should not be to close together to locate possible targets.

8.1.2 Regulation of the number of impulses per scanning path

It is possible to select the number of impulses before starting the measurement or selecting the automatic mode ("Auto") to adjust the number of measure points after finishing the first scanning path.

When the number of measure points has been configured, the device will stop automatically when this number has been reached and waits for the start of the new scanning path.

In the automatic mode you should stop the measurement of the first scanning path by yourself, by pressing the appropriate button, as soon as you have reached the end of the first scanning path. This effective amount of measure points will be used for all further scanning paths of this measurement. Starting from the second scanning path, the device now stops automatically after the assumed number of impulses has been reached.

Keep in mind the number of impulses which you have recorded per scanning path. This amount should be entered later in the software program, when transferring the data to a PC, to receive all measured data correctly from your measuring instrument!

There is no special rule for selecting the right number of impulses. But there are different aspects which should be considered. These are some considerations

- the length of your measured area and
- the size of the objects you are searching for.

A preferable distance between two impulses is about 15 cm to 30 cm. The smaller the distance between two impulses is, the more exactly the graphical representation will be. If you are looking for small objects you have to select a smaller distance, for big objects you can increase the distance between the impulses.

Figure 8.3 shows the effects of the distance and the number of impulses per scanning path for some objects.

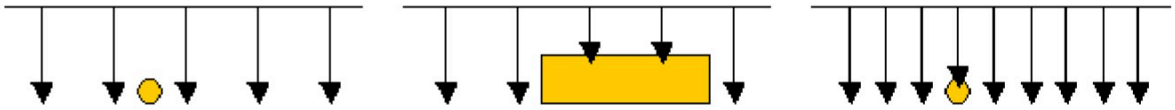


Figure 8.3: Effects of changing the number of impulses and their distance

Figure 8.4 shows the difference between very few impulses (left side) and much more impulses (right side) on the same length of scanning path. Therefor the second record (right side) shows much more details and also smaller objects can be seen.

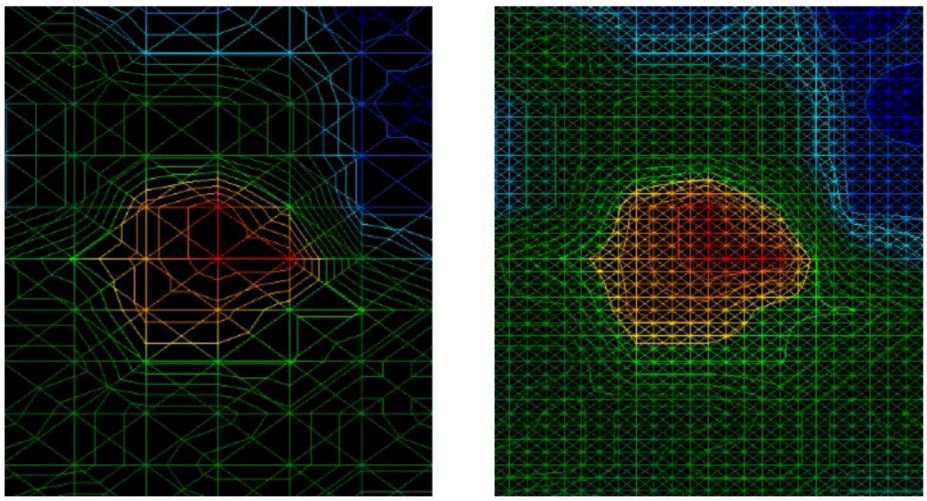


Figure 8.4: Comparison of low and high number of impulses

Do not hesitate to record more measurements with different numbers of impulses. For example you can scan a large area before doing a second detailed precision measurement. Especially if searching for bigger objects you can proceed like this. With this manner you can measure a larger area very quickly and afterward you make new scans localizing the suspect targets.

When conducting a scan it is important to not only make note of how many impulses are being used but to get a clear picture of what you are scanning, it is very important to watch your speed. Every scan line should be measured at the same speed as the previous line.

Figure 8.5 shows what can happen, if you walk at different speeds during your scan.

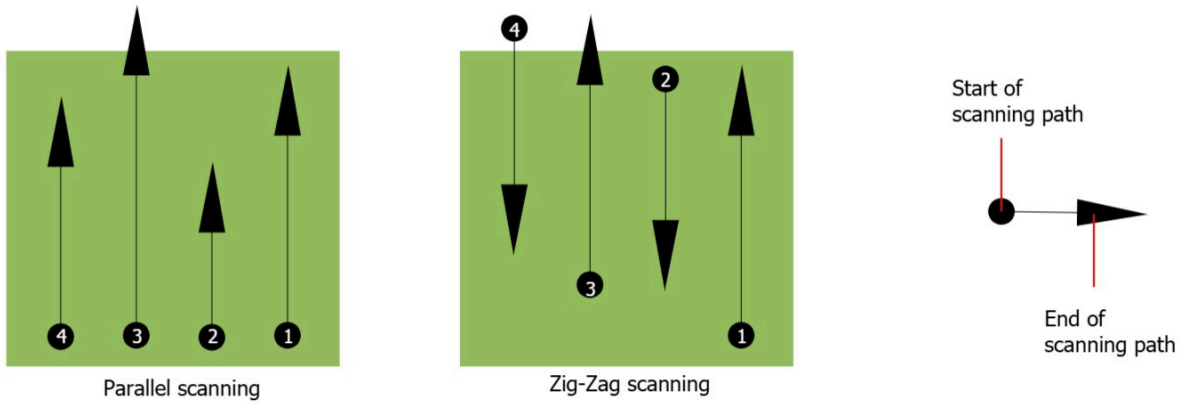


Figure 8.5: Different walking speeds during scanning

Using a different walking speed in the scanning paths, will cause displacements in the scanning path. As a matter of fact, a target can get cut into several smaller items or completely lost because it was missed. Later when the data is downloaded for further analysis, speed errors can make a target completely unidentifiable and may be discarded.

In general, the following rule is valid: Keep scans at practical sizes where you can see the beginning and stop lines and can comfortably traverse an area to keep your speed and the distances reasonable.

8.2 Special advices for field procedure

There are some aspects which you should take note of when conducting scans. In principle, a scan is only as good as the path that was taken. Making errors while scanning will show up in the final graphical representation also as an error. This will cause frustration and lost time.

Before you start with a measurement in the field, you should think of what you are looking for and if the selected area is suitable. Measuring without a plan usually will produce unacceptable results. Please consider the following advice:

- What are you looking for (graves, tunnel, buried objects, ...)? This question has direct effects on how a scan is conducted. If you are looking for larger targets, the distance between the single measure points and scanning paths can be larger, as if you are looking for small targets.
- Inform yourself about the area, where you are searching. Does it make sense to detect here? Are there historical references which confirms your speculation? What type of soil is on this area? Are there good conditions for data recording? Is it allowed to search at this place (e.g. private property)?

- Your first measurement in an unknown area has to be large enough to get representative values. All further control measurements should be adjusted individually.
- What is the form of the object you search? If you are looking for an angular metal box, the identified object in your graphic should have a form according to this.
- To get better values concerning depth measurements, the object has to be in the center of the graphic, which means it has to be framed by normal reference values (normal ground). If the object is on the side of the graphic and not totally visible an estimated depth measurement is not possible and also measurement of size and form are limited. In this case, repeat the scan and change the position of your scan area, to receive an optimal position of the anomaly inside of the graphic.
- There should not be more than one object in a scan. This will influence the depth measurement. It is useful to scan partial areas over such targets.
- You should do at least two controlled scans to be more sure about your results. This is also important to recognize areas of mineralization.
- Most important rule when dealing with mineralization. REAL TARGETS DON'T MOVE! If your target moves then it is most likely mineralization.

8.2.1 Orientation of probe

During one measurement the probe should have always the same distance to the ground. Generally we recommend a height of about 5 – 15 cm from the surface of the ground if possible.

In the event that you are going to go over stones, wood or high grass that is higher, start your scan with the sensor higher right from the beginning. In circumstances like these, then perhaps you will need to start the scan with the probe at a height of 2 feet (50 cm) and keep it at that level for the entire scan. It is important to maintain the height, this will eradicate many errors. As a rule, do not change the height during a scan for it may create unnecessary errors.

Another important aspect is the physical orientation of the probe. During the "Parallel" scan mode the orientation of the probe does not change because you are always measuring in the same direction. Even in the "Zig-Zag" scan mode the orientation of the probe must not be changed. That means you are not allowed to turn yourself with the device and the probe at the end of the scanning path. Instead you should walk

backwards and continue scanning. Otherwise your obtained graphic includes red or blue stripes. These stripes throughout a scan are commonly referred to as “Rotational Errors”.

8.2.2 Parallel or Zig-Zag?

For skilled users of the Fusion Light both scan modes are suitable. According to experience the best graphics has been received in the "Parallel" mode, because you are starting at the same point and traveling in the same direction. It is also easier to control your walking speed.

Especially in uneven territories like mountain sides, acclivities or other inclined layers the parallel mode is preferred. When it comes to speed, the experienced user will very often use the Zig-Zag mode for the initial scan to determine if there are anomalies in the area worth further research.

8.2.3 Tips from the trainers themselves

When conducting scans, there are some extremely important items that need to be noted. First of all it is crucial that you relax. When you are tense, you are putting too much pressure on yourself to do the scan correctly; often resulting in errors.

- **Newly buried targets are difficult to see. Many users receive the equipment and the first thing they do is go out and bury an object. When an object goes into the ground it changes the natural signature of the soil and creates some kind of noise. Usually the buried object has a weaker signature than the unnatural noise and therefor is not detectable. So taken scan images will not show the buried item but visualize the noisy area in blue colors. After the item has been seasoned, meaning it has been in the ground for a complete cycle of seasons (usually a year), the noise gets reduced and the signature of the buried object becomes visible again.**
- **Train on known targets. In the training course at the factory we have several objects that have been buried for years, just like real targets in the field. These targets can be quickly and easily identified because they are not natural to the soil. Other targets that you can use in your own area are buried utilities. Pipes, tanks, electrical, sewers, graveyards, etc... Most of these items can be found in every community, town or city. This is where you need to begin your training if you are going to self-train.**
- **Get professional training. When you take advantage of receiving the training, either from the factory or a qualified dealer, you will understand not only the use and operation of the OKM detector but also the software so much easier and be able to identify targets as well as errors.**
- **Do not rely on just one scan measurement. So many users go out into the field and they make a measurement and see a target. Instead of repeating the scan and reproducing it several times, they go out and get a shovel and dig. On very rare occasion will the first scan be perfect. Even the trainers do multiple scans to ensure that they are not looking at areas of mineralization or an error.**
- **Soil Mineralization – Oh! Very frustrating! We will all experience it. When you are in an area that is known to have pockets of mineralization, be prepared to conduct more scans than normal.**
  - Clay is probably the number one foe. Depending on the iron content of the clay will determine how strong the attenuation will be. A quick rule of iron content is how dark it is, it can vary from a light gray up to a dark orange. The darker the more iron it will have in it.
  - Sand is usually very clear and easy to hunt in. There are two factors of sand that need to be noted. Sand where the ground water is very shallow, meaning that the ground water is usually just a couple of meters from the surface or desert sand where it is very arid. In desert sand, the targets can be situated 3x deeper than indicated.
  - Farmland is another area to take note of. In modern farms, so many nutrients and fertilizers are introduced creating an unnatural area of mineralization.
  - Rocky mountainous areas. Areas with many mountains are also riddled with patches of mineralization. Mountainous areas are created from faults in the earth and this is probably the biggest area for natural treasures as well as mineralization.

OKM GERMAN DETECTORS

Based in Altenburg, we have been developing and manufacturing geophysical detectors since 1998. Our unique detection technology makes buried objects and structures visible.

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