

Future Series

Future I-160

User's manual

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1 Preface

Dear customer,

in the first instance we want to thank you that you made your decision on a product of OKM Ortungstechnik GmbH.

With the Future I-160 you purchased a product which is based on a electromagnetic pulse method which can be used to locate anomalies in the target area. Thus the device is able to detect natural features such as formations of strata, cavities, groundwater level as well as seplchers or buried objects such as pipes, tanks, boxes or suchlike.

The Future I-160 is able to locate, to document and to analyse buried objects with different structures, without making necessary any excavation. Particularly in areas next to the surface there are many advantages to geoelectric, seismic and magnetic procedures and it is further more a usefull complement to these methods. The Future I-160 has a facile and flexible handling and provides fast and easy 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.

Of course by selling our products we cannot guarantee that you really make a find during your research. The recognition of hidden objects and structures depends on a hugh number of factors - like you know. Determining factors are the dielectricity constant of the ground, the grade of mineralisation and the dimensions of an object relating to its depth. Specially in very wet soil, clay and sand with high conductivity of the ground, recording of the measured results can be falsified strongly.

With this product you purchased a device which stood the tests in regular operation like all other products of us. If you are interested in where our devices have gone into action please visit our homepage.

For our company it is necessary that we protect our developments within the framework of existing legislation to a patent or trademark registration. Therewith we offer you a higher warranty while using our products.

Please take your time consecutively, read this user's manual and familiarize yourself with the utilisation and operation of this Future I-160.

2 Important Notes

Please read these operating instructions carefully and closely before using *Future I-160* and its accessories! These instructions give information on how to use the device and point out potential sources of danger.

Future I-160 and its accessories serves for documentation and analysis of detect objects deposited and changes performed in the ground. The registered data of the ground structure will be transmitted to a PC for visual representation in a special software program using the components we offer. Any additional notes relating to this has to be observed. Please read attentively the manual according to the software you are using!

2.1 General Notes

Being an electronic device, *Future I-160* has to be treated with the caution and care necessary when such devices are used. Any failure to observe the safety precautions given or any use for purposes other than the ones it is conceived for may result in a damage or destruction of the processing unit and connected components.

The device will get destroyed if it is opened improperly.

2.2 Possible Health Hazards

If used properly the 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.

2.3 Surrounding Area

Having been transferred from a cold to a warmer place, the device should not be operated immediately afterwards. Any condensation, which may have formed, might cause the device to get destroyed. Avoid strong magnetic fields, which may occur in places such as near machines or loudspeakers, and avoid using a detector within a radius of 50 meters.

Metallic objects on the ground such as cans, doses, catches, nails, screw or others can influence negatively your measurement and have to be removed. Also you have to remove keys, telephones, chains and rings and all other magnetic and metallic objects from yourself.

2.4 Voltage

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

Never use the 230 Volt mains supply.

2.5 Data safety

There can be errors in the process of data collection if

- the range of the sender module is been exceeded,
- the power supply of the device is to low,
- the cables you are using are to long,
- other electronic devices sends out disturbances or
- atmospherics occurs (lightnings, ...).

3 Technical Specifications

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

3.1 Control Unit

Dimensions (H x W x D)	430mm x 150mm x 260mm
Weight	about 3kg
Voltage	12 VDC
Processor	Motorola, 4 MHz
Operating Temperature	0°C – 50°C
Storage Temperature	-20°C – 60°C
Air Humidity	5% – 75%
Waterproof	No
Maximal Penetration Depth (Horizontal Probe)	about 18 meters ¹
Maximal Penetration Depth (Verticale Probe)	about 3 meters ¹

Table 1: Technical Specifications (Control Unit)

3.2 Data Transmission

Technology	Bluetooth
Frequency	2.4 – 2.4835 GHz
Maximal Data Transmission Rate	1 Mbps
Receiving Sensitivity	-85 dBm
Maximal Range	about 100 meters

Table 2: Technical Specifications (Data Transmission)

¹depends on object size and ground conditions

3.3 Computer, Minimum Requirements

The computer is not part of the scope of delivery. The indicated values should help you for a correct selection of a suitable computer for analysis of your measured results.

CD-ROM Drive	minimum 4x
COM-Port (Data Transmission)	USB
Free Memory	minimum 20 MB
Working Memory (RAM)	minimum 128 MB
Graphic Card	minimum 64 MB, OpenGL-compatible
Operating System	Windows 98SE, Me, 2000, XP

Table 3: Technical Specifications (Computer, Minimum Requirements)

4 Scope of Delivery

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

- 1 Control Unit
- 1 Horizontal Probe
- 1 Verticale Probe
- 1 Linkage for Probe
- 1 USB Bluetooth Dongle
- 1 USB Setup CD
- 1 External Power Supply
- 1 Charger for External Power Supply
- 1 Cable for External Power Supply
- 1 3D Software (Standard)
- 1 Control Chip
- 1 Headphones
- 1 Manual
- 1 Carrying Case

Table 4: Scope of Delivery

Beware that pictures in this manual could be different to delivered parts.

Control Unit



Control Chip

Horizontal- and Vertical probe



USB Bluetooth Dongle



Linkage for Probe



Headphones



Cable for External Power Supply



External Power Supply



Charger for External Power Supply

Figure 1: Scope of Delivery

5 Assembly

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

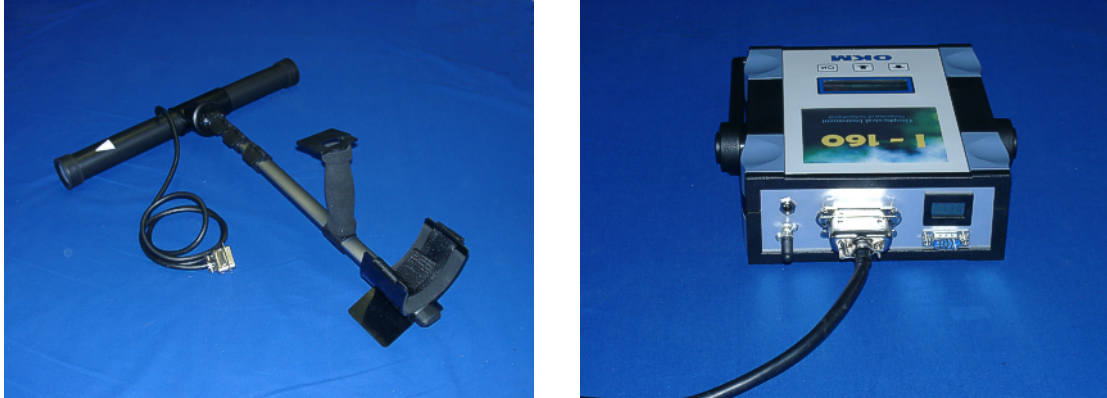


Figure 2: Assembly and Connection of the Probe

Figure 2 shows how to assemble the horizontal probe to the linkage. You have to put in the probe into the T-linkage. Then connect the cable of the probe with the control unit. Do it without any unnecessary application of force! The vertical probe has to be used without any linkage. You can simply hold it in your hand perpendicularly to the soil.



Figure 3: Connection of Control Chip and External Power Supply

Figure 3 shows how to plug in the control chip in the suitable connection of the device. Without this control chip the device cannot operate. If you connect the external power supply with the control unit you have to use the 12V output for the correct cable connection.



Figure 4: Connection of the USB Dongle

Figure 4 indicates the connection of the USB Dongle to the PC. Additional information about the usage and installation of the USB-driver you can find in section ?? on page ??.

6 Installation of Radio Transmission (Toshiba)

This section describes the installation of the USB Bluetooth Dongle. Consider that the represented figures not necessarily agree with the current version of your operating system or the version of your USB installation.

The instructions in this chapter are only valid for the Toshiba usb-drivers. If you are using the Conceptronic usb-drivers, please read chapter 7.

6.1 Install Software & Drivers

Now it is time to install the software and driver on your system. Therefore you have to insert your Bluetooth CD into the CD ROM drive of your computer. If the CD does not start automatically, please double click on Desktop and then double click on the symbol of your CD ROM drive. With a further double click on file `setup.exe` you start the installation.



Figure 5: Bluetooth-Installation

The first window of your installation will open. Click here on the entry *Toshiba Driver* and follow the instructions on the screen.

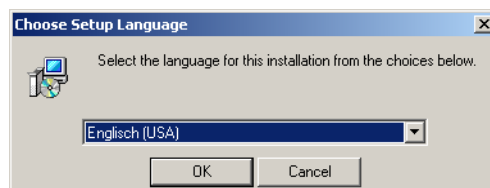


Figure 6: Bluetooth-Installation, Select Language

First there is a possibility to select the language of the installation. Click on *OK*, to change to the installation dialog from figure 7.

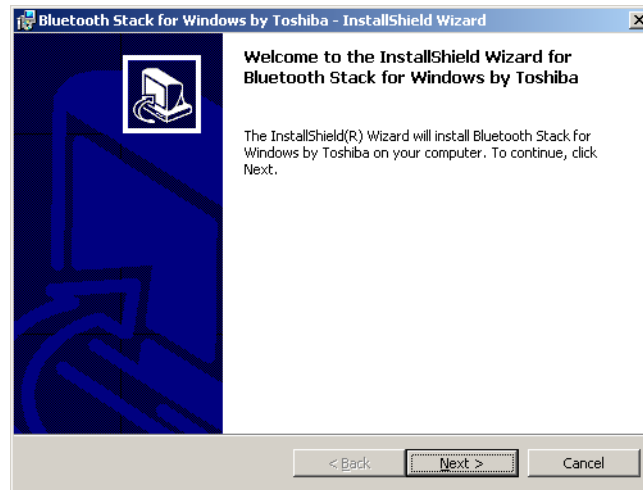


Figure 7: Bluetooth-Installation, Start

Now simply click on *Next*, to continue the installation. A dialog like in figure 8 appears on your screen.



Figure 8: Bluetooth-Installation, Licence Agreement

Select the option *I accept the terms in the licence agreement* and confirm it with a click on *Next*.

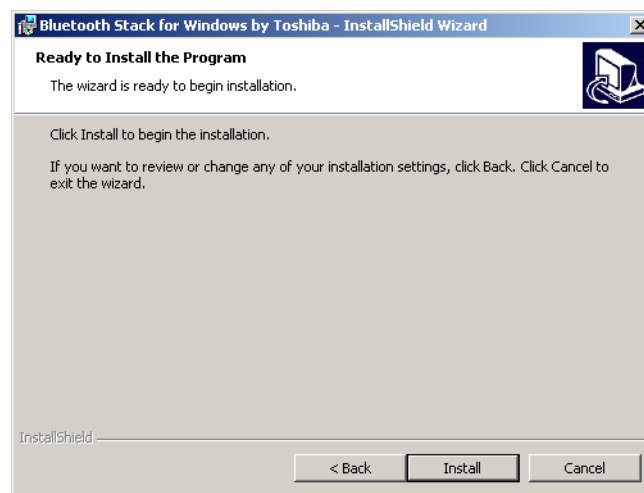


Figure 9: Bluetooth-Installation, Setup

Click now on the button *Install*, to start to copy the files. Afterwards you will be referred that the installation process can take about 15 minutes. Answer this question with a click on *OK*. If you did not connect the Bluetooth Dongle until now you will be asked to do so during the installation of the driver. Now wait until the installation is finished and all files has been transferred to your computer.

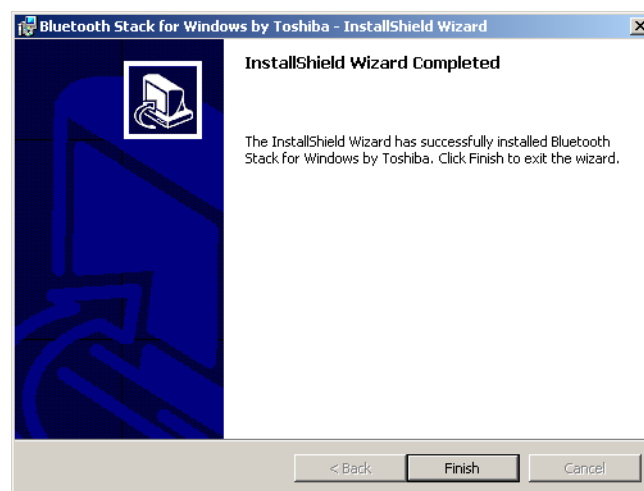


Figure 10: Bluetooth-Installation, Finish

As soon as the installation is finished, a dialog as in figure 10 appears. Click on the button *Finish*.

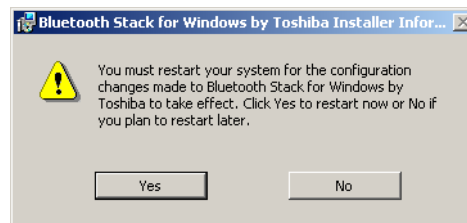


Figure 11: Bluetooth-Installation, Reboot

To terminate the installation you have to reboot your computer. A message like in figure 11 will appear. Confirm it with a click on the button *Yes*.

6.2 Software Configuration

To find out on which COM-Port your Bluetooth connection is been installed, click on *Start* → *Settings* → *Control Panel*. Double click the entry *Bluetooth Local COM*. A dialog will open like it is represented in figure 12.

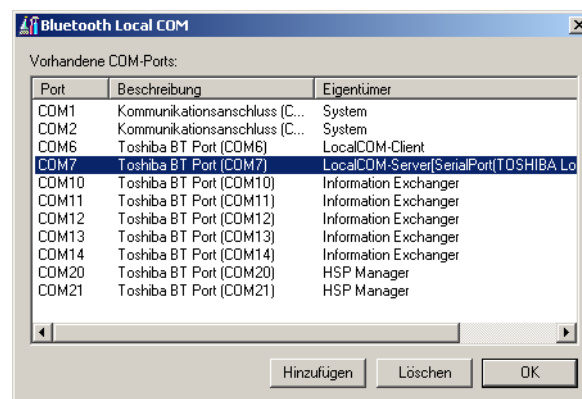


Figure 12: Determining the given COM-Port

There you can find the entry *LocalCOM-Server[SerialPort(TOSHIBA LocalCOM)]*, which indicates on which COM-Port your Bluetooth Dongle has been installed. This COM-Port you always have to indicate for the data transmission to the software program.

6.3 Configure connection

After installation and configuration of your Bluetooth connection you should test if the data transmission from your measuring instrument to the computer is working correctly.

Be sure that the USB Dongle is attached to your computer. Take your measuring instrument and power on the device. Select a operating mode, which includes the direct data transmission to PC. Additional information on direct data transmission to PC you can find in section 9 on page 32.

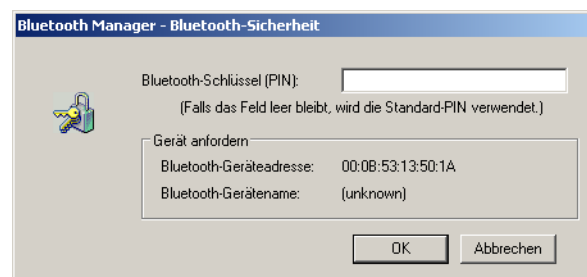


Figure 13:

As soon as you confirm your selected operating mode the device will try to get a radio connection to the computer. If this connection is successful a message like in figure 13 appears.

In this dialog you have to enter OKM. It is necessary to write in capital letters!

7 Installation of Radio Transmission (Conceptronic)

This section describes the installation of the USB Bluetooth Dongle. Consider that the represented figures not necessarily agree with the current version of your operating system or the version of your USB installation.

The instructions in this chapter are only valid for the Conceptronic usb-drivers. If you are using the Toshiba usb-drivers, please read chapter 6.

7.1 Install Software & Drivers

Now it is time to install the software and driver on your system. Therefore you have to insert your Bluetooth CD into the CD ROM drive of your computer. If the CD does not start automatically, please double click on Desktop and then double click on the symbol of your CD ROM drive. With a further double click on file `autorun.exe` you start the installation.

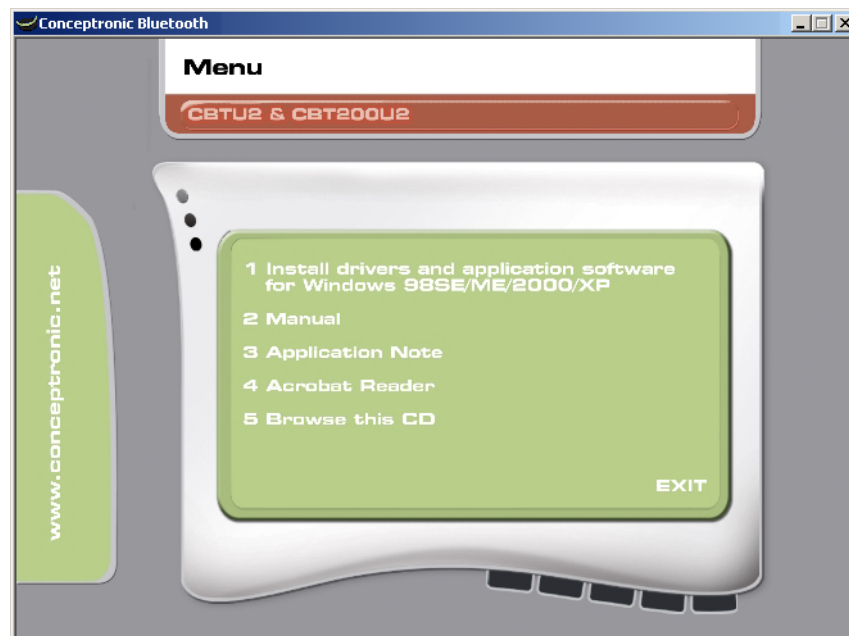


Figure 14: Bluetooth-Installation

The first window of your installation will open. Click here on the entry *1 Install drivers and application software* and follow the instructions on the screen.

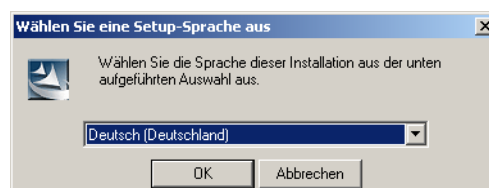


Figure 15: Bluetooth-Installation, Select Language

First there is a possibility to select the language of the installation. Click on *OK*, to change to the installation dialog from figure 16.

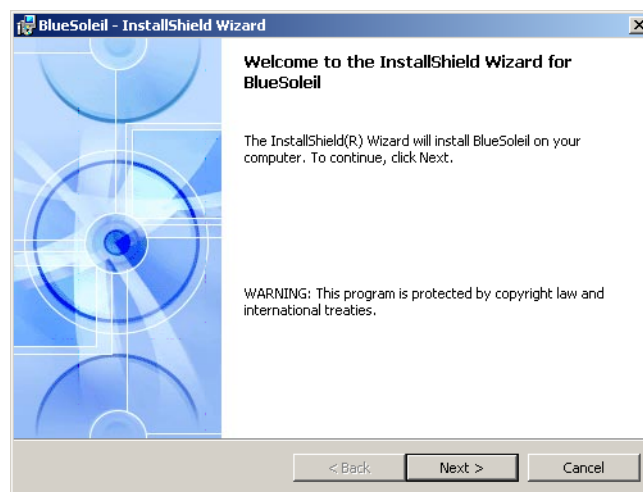


Figure 16: Bluetooth-Installation, Start

Now simply click on *Next*, to continue the installation. A dialog like in figure 17 appears on your screen.



Figure 17: Bluetooth-Installation, Licence Agreement

Select the option *I accept the terms in the licence agreement* and confirm it with a click on *Next*.

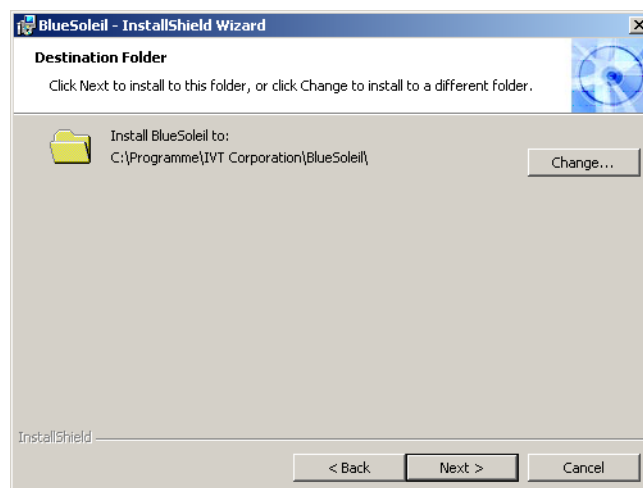


Figure 18: Bluetooth-Installation, Destination Folder

Inside the dialog from figure 18 you have the possibility to select another destination folder. Normally there is no changing necessary. Click only on the button *Next*.

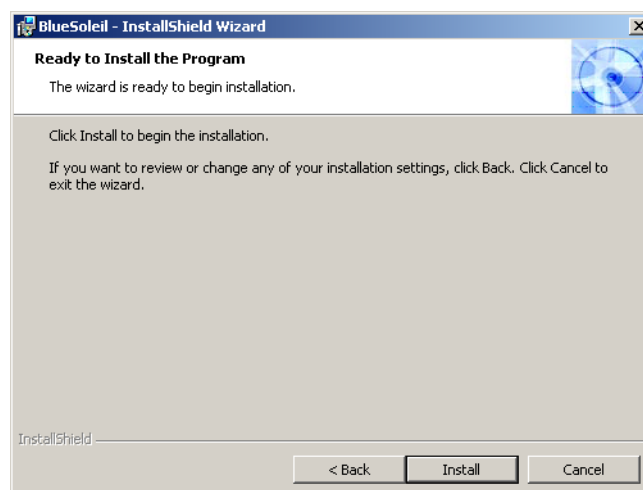


Figure 19: Bluetooth-Installation, Setup

Click now on the button *Install*, to start to copy the files. Now wait until the installation is finished and all files has been transferred to your computer.

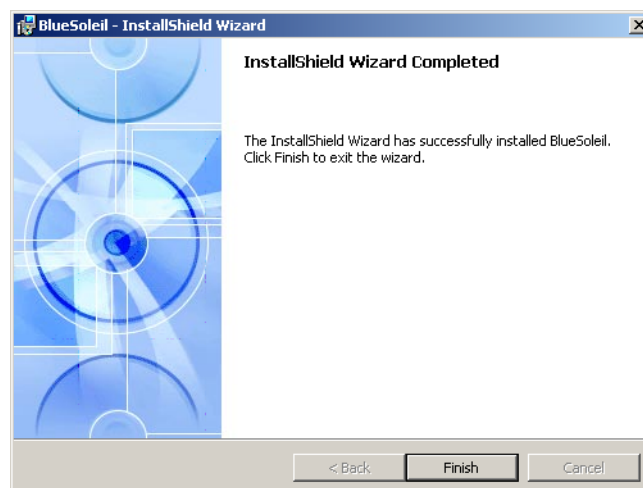


Figure 20: Bluetooth-Installation, Finish

As soon as the installation is finished, a dialog as in figure 20 appears. Click on the button *Finish*.

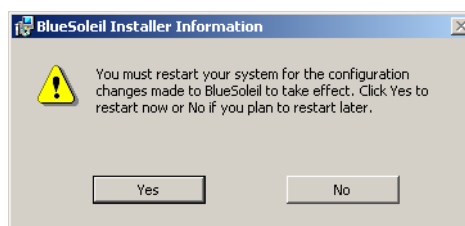


Figure 21: Bluetooth-Installation, Reboot

To terminate the installation you have to reboot your computer. A message like in figure 21 will appear. Confirm it with a click on the button *Yes*.

7.2 Install Bluetooth-Dongle

After you have reboot the computer the message from figure 22 appears on your screen. Now you have to plug in the Bluetooth-Dongle into your computer.

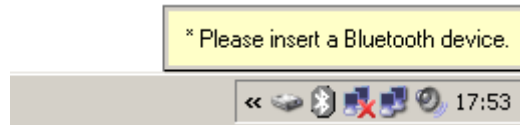


Figure 22: Bluetooth-Installation, Plug in the Bluetooth-Dongle

Now your computer tries to install automatically the Bluetooth-Dongle. Wait until a dialog window like in figure 23 appears on your screen. Click on the button *OK*.



Figure 23: Bluetooth-Installation, Set up Bluetooth-Dongle

After a successful set up of the Bluetooth-Dongle the message from figure 24 appears on your screen.



Figure 24: Bluetooth-Installation, Bluetooth-Dongle has been installed

To find out on which COM-Port the Bluetooth connection has been installed you have to click with the right mouse button on the Bluetooth symbol in the task bar. A dialog window like in figure 25 will appear.

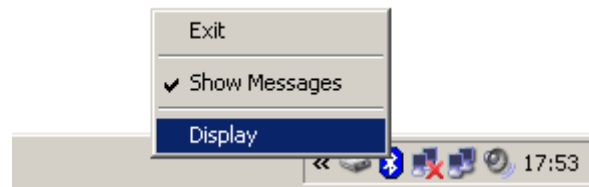


Figure 25: Find out the assigned COM-Port

If you click here on the entry *Display* a window like represented in figure 26 will open. Select in the menu *View* the option *Service Window*.

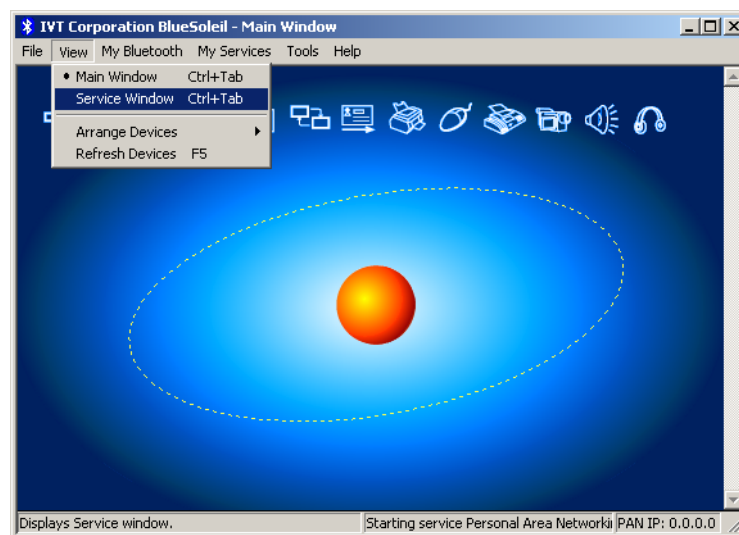


Figure 26: Find out the assigned COM-Port

An image like in figure 27 is represented. Behind the indication *Serial Port A* you can read the number of the assigned COM-Port. In this figure it is *COM7*, this can be different on your computer!

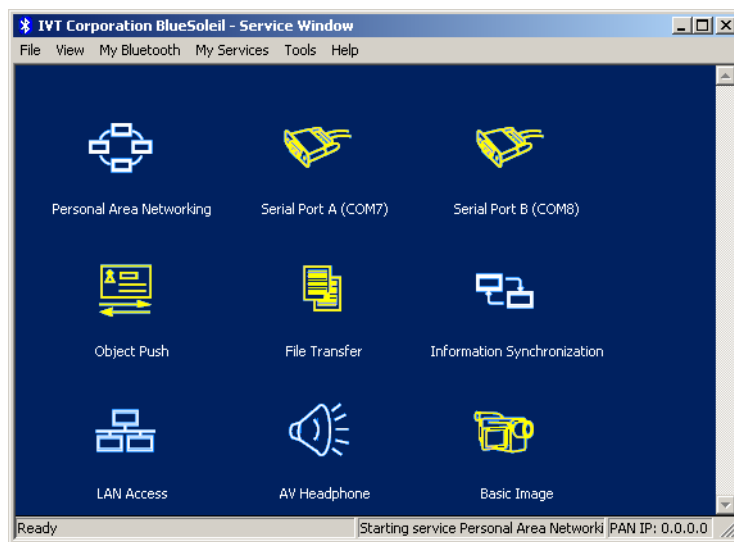


Figure 27: Find out the assigned COM-Port

7.3 Configure connection

After installation and configuration of your Bluetooth connection you should test if the data transmission from your measuring instrument to the computer is working correctly.

Be sure that the USB Dongle is attached to your computer. Take your measuring instrument and power on the device. Select a operating mode, which includes the direct data transmission to PC. Additional information on direct data transmission to PC you can find in section 9 on page 32.

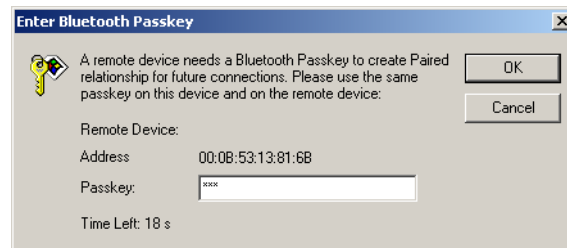


Figure 28: USB-Connection, Enter PIN-Code

As soon as you confirm your selected operating mode the device will try to get a radio connection to the computer. If this connection is successful a message like in figure 28 appears. In this dialog you have to enter OKM. It is necessary to write in capital letters! Confirm this entry by a click on the button *OK*.

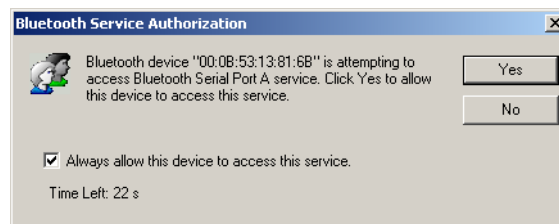


Figure 29: USB-Connection, Confirm Access

Another window will open where you mark the entry *Always allow this device to access this service* and confirm this entry by a click on *Yes*.

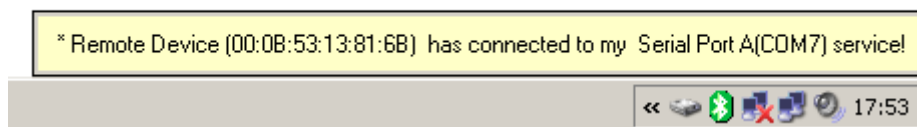


Figure 30: USB-Connection, Connection established

The message from figure 30 indicates that the connection is established. Now you have set up successfully your Bluetooth connection.

8 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.

8.1 Front View

Figure 31 shows the front side of the control unit.

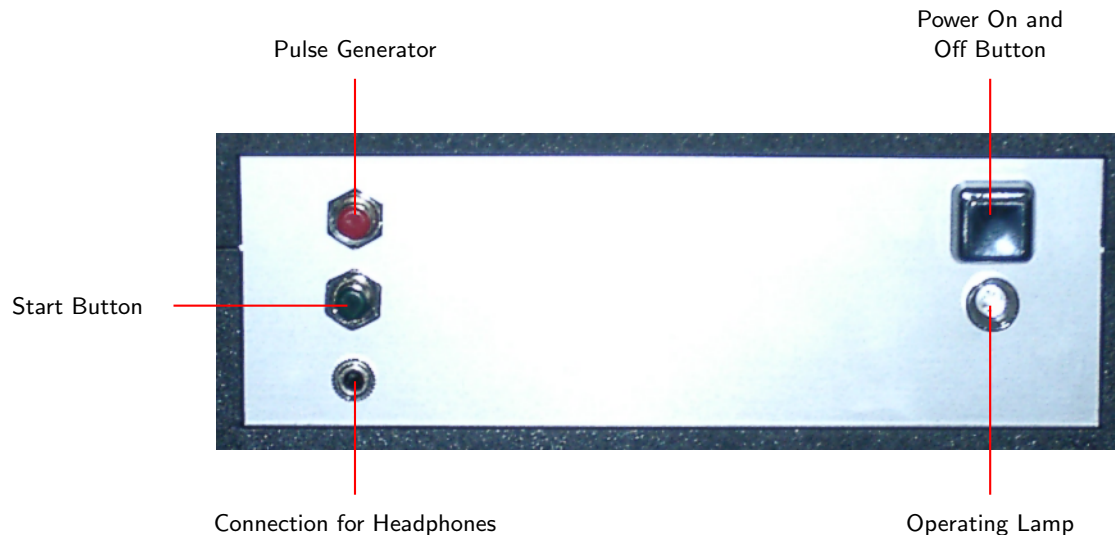


Figure 31: Front View

The **Power On and Off Button** is used to switch on and off the control unit. Before operating with your device you have to connect your external power supply and power it on.

The **Operating Lamp** shines, when the device is powered on and indicates the operating readiness of the control unit.

The **Pulse Generator** is used to release every impulse manually in the appropriate operating mode. He is also used to activate the headphones.

The **Start Button** is used to start a measurement.

Through the **Connection for Headphones** the delivered headphones can be connected with the control unit.

8.2 Back View

Figure 32 shows the back side of the control unit and their connections.

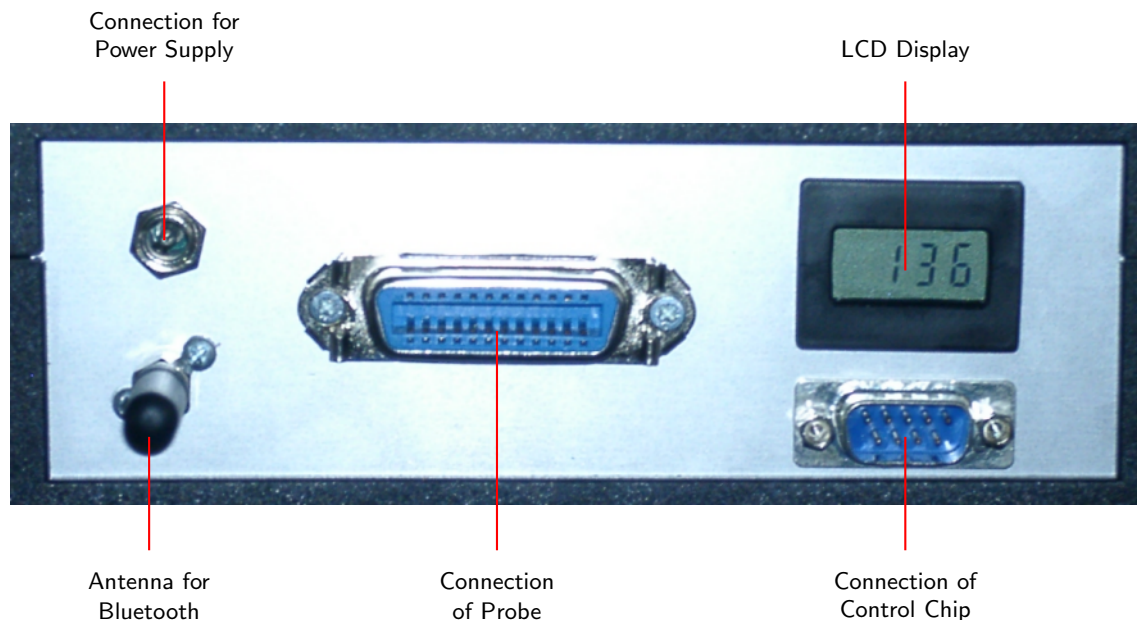


Figure 32: Back View

The Connection for Power Supply is used to connect the battery. Here the external power supply (Power Tank) has to be connected to the device.

The LCD Display indicates how often the device was powered on. This display is only of interest for the repair and maintenance service.

The Antenna for Bluetooth is used for data transmission to PC.

In the Connection of Probe the probe cable has to be plugged in.

The Connection for Control Chip is used for the connection of the delivered control chip. The control chip is absolutely necessary to operate with the device.

8.3 Touchpad for Menu Navigation

The top of the device is including a touchpad like in figure 33. With this touchpad you can navigate to the different operating modes in the menu.

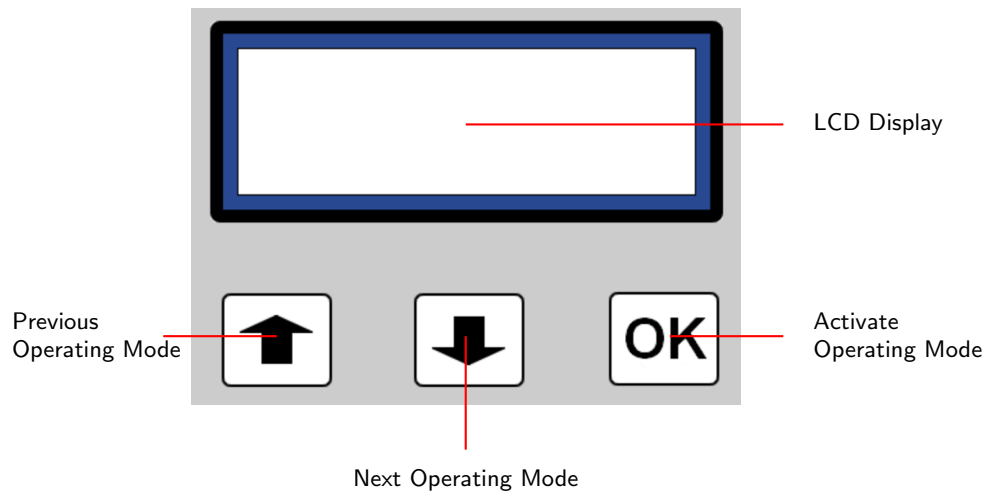





Figure 33: Touchpad

With keys  and  you can select every operating mode. To confirm your selection press .

9 Operating Modes

In this section you will learn more about the different operating modes of the device. Every function is been explained in particularity in its proper subsection. The right selection of an operating mode depends primarily of your planned measurement. So for example there are some special functions which have to be used for a first measurement in a unknown area to get a general overview, against which others are more suitable for a detailed search and analysis with a special processing software program.

The device posseses the following operating modes:

- **Automatic Mode, 10 Impulses**
Automatic scanning mode with 10 impulses per measured line. Measured values will be sent directly to a PC. Possibility to activate headphones.
- **Automatic Mode, 20 Impulses**
Automatic scanning mode with 20 impulses per measured line. Measured values will be sent directly to a PC.
- **Automatic Mode, 30 Impulses**
Automatic scanning mode with 30 impulses per measured line. Measured values will be sent directly to a PC.
- **Automatic Mode, 40 Impulses**
Automatic scanning mode with 40 impulses per measured line. Measured values will be sent directly to a PC.
- **Automatic Mode, 50 Impulses**
Automatic scanning mode with 50 impulses per measured line. Measured values will be sent directly to a PC.
- **Manual Mode, 30 Impulses**
Scan manually with 30 impulses per measured line. Measured values will be sent directly to a PC.
- **Live Mode, Vertical**
Measurement with Live representation. No data record is possible in this mode.
- **Live Mode, Horizontal**
Measurement with Live representation. No data record is possible in this mode.
- **Sound Mode, 1 Ping**
Measurement with acoustical signals (1 sensor activated). No graphical representation.
- **Sound Mode, 16 Ping**
Measurement with acoustical signals (16 sensors activated). No graphical representation.

Via a touchpad on the top of your device you can select and confirm your appropriate operating mode.

9.1 Automatic Mode, 10 Impulses

This operating mode allows you to record a graphical measurement whereby the measured data will be sent directly to a connected PC. Additional information about the preparation of your software program you can find in the appropriate manual for software.

To measure in this operating mode you have to connect the horizontal probe. Also you have to keep a certain manner and direction to scan your area, that the data can be recorded in a correct way. Figure 34 shows this in a pattern.

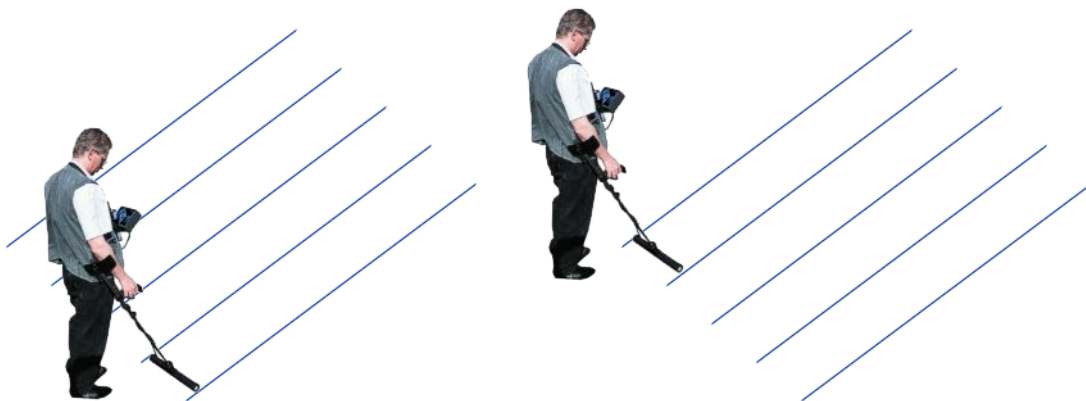


Figure 34: Measurement with Horizontal Probe

Go to your starting position and power on the device. Take care that the arrow on the upper side of your probe shows to the left. Confirm your operating mode by pressing **Activate operating mode**. The message *Connecting with computer ...* will show you that the data transmission to PC is activated. Then please press the **Start Button**. The device will now send out the impulses and you have to walk continuously the first measure line (left representation in figure 34).

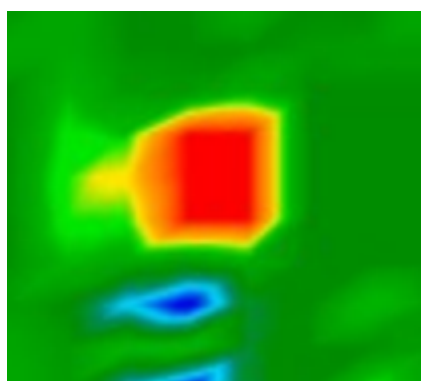


Figure 35: Graphical Representation of a Measurement with Horizontal Probe

If all impulses of the first measured line were sent out, the device will stop automatically. Now go on to the starting point of your second measured line, which should always be on the left side of the line before and press again the **Start Button**. Repeat this procedure until you scanned

the complete area. Now in your software program there should be a graphical representation of this scanned area which can be similar to figure 35.

The graphical representation should mainly include green color values which represent normal ground. In this graphic could be included red or blue objects. Normally metallic objects are represented in red color and cavities, water deposits and diggings always in blue color. Beware that mineralisations in the ground also could be in red color. How to recognize minerals from „real“ metals, you can read in section 10.1 on page 37 or in your software manual.

Please read also section 10.2 on page 39 where the principle procedure of a graphical measurement is explained in detail.

9.2 Automatic Mode, 20 Impulses

This operating mode is nearly similar to menu option *Automatic Mode, 10 Impulses*. IN this mode 20 impulses per measured line will be sent.

Please read section 9.1, where the principle procedure of a graphical measurement is explained in detail.

9.3 Automatic Mode, 30 Impulses

This operating mode is nearly identically to menu option *Automatic Mode, 10 Impulses*. The only difference is that 30 impulses per measured line are sent out.

Please read attentively section 9.1, where you can find information on the principle procedure for a graphical measurement.

9.4 Automatic Mode, 40 Impulses

This operating mode is nearly identically to *Automatic Mode, 10 Impulses*. The only difference is that 40 impulses per measured line were sent.

Please read attentively section 9.1, where the principle procedure of a graphical measurement is explained in detail.

9.5 Automatic Mode, 50 Impulses

This operating mode is nearly identically to function *Automatic Mode, 10 Impulses*. The only difference is that 50 impulses per measured line were send out.

Please read section 9.1, to make you familiar with the principle procedure for a graphical measurement recording.

9.6 Manual Mode, 30 Impulses

This operating mode is nearly identically to *Automatic Mode, 10 Impulses*. The only difference is that 30 impulses per measured line were send and every single impulse has to be activated

manually. Therefore please use the pulse generator (red button). Every time when a measure value should be recorded than press one time the pulse generator.

Please read section 9.1, to make you familiar with the principle procedure for a graphical measurement recording.

9.7 Live Mode, Horizontal

This operating mode allows you to see the ground in a real time live mode. You don't have to scan in a given manner, you can walk in every direction and see what is situated in the ground under the horizontal probe.

In this operating mode you have to connect the horizontal probe to the control unit. The recorded measure values will be sent directly to a connected PC. Additional information about the preparation of your software program you can find in the appropriate manual for the software.

Go to your starting position and power on the device. Take care that the arrow on the upper side of your probe shows to the left. Confirm your operating mode by pressing Activate operating mode. The message *Connecting with computer ...* will show you that the data transmission to PC is activated. Then please press the Start Button. Now you can walk as desired in your measured area.

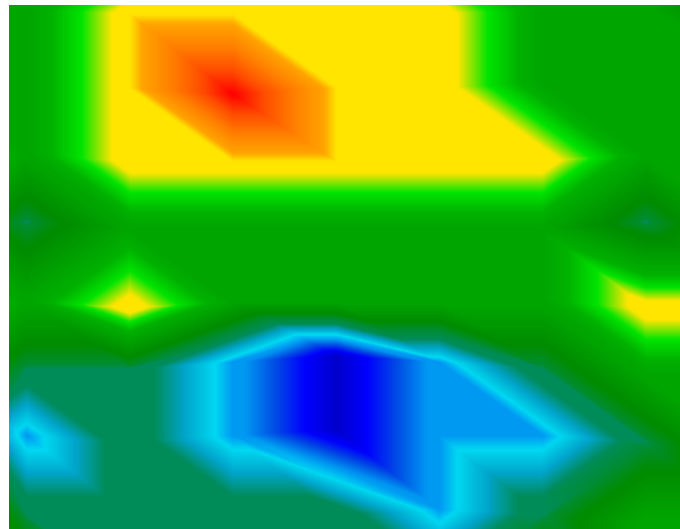


Figure 36: Live Mode with Horizontal Probe

The graphical representation on your computer depends on the software program you are using. Figure 36 shows a representation through *Future Series – Standardsoftware*.

In this mode measure values will be recorded continuously and transferred to a connected PC. Even if you keep staying in one position the graphical representation will go on continuously. But in this case it should not show you large changes.

9.8 Live Mode, Vertical

This operating mode is nearly identically to mode *Live Mode, Horizontal*. You simply have to connect the vertical probe. Please note that the penetration depth in this mode is reduced to about 3 meters!

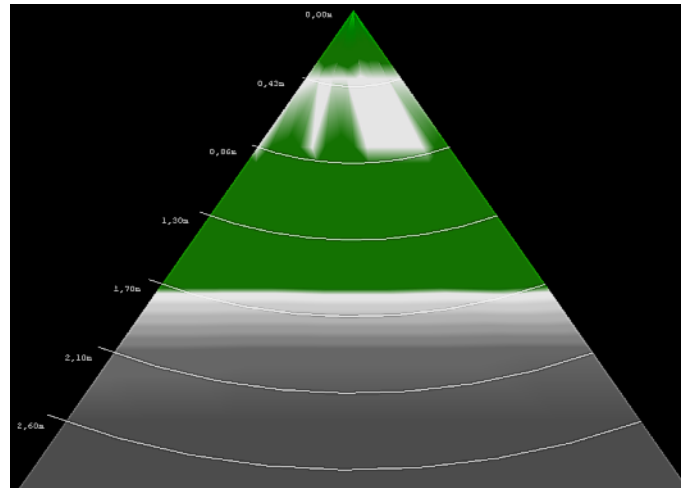


Figure 37: Live-Mode with Vertical Probe

Figure 37 shows the graphical representation in the *Future Series – Standardsoftware*.

9.9 Sound Mode, 1 Ping

In this operating mode the Magnetometer mode of the device will be activated. This mode allows you to notice acoustically the current field strength.

The higher the field strength the higher will be the acoustic signal. In this mode it is easily possible to find metallic objects (in particular iron objects) which are placed close to the surface.

During this measurement only one of the sensors in the middle of the probe is activated. So an exact point detection is possible.

9.10 Sound Mode, 16 Ping

This operating mode is nearly identically to function *Sound Mode, 1 Ping*. During the measurement all sensors are activated. This is an advantage for scanning large areas.

10 Analysis and Evaluation of Measurements

Before measurement you have to know what kind of objects or cavities you are looking for and if the area you choose is suitable for this. Measurement without a plan will not give you the results you would like. For this reason please consider the following indications:

- What are you looking for (graves, tunnels, buried objects, ...)? This question has its effects on your concrete manner to measure an area. If you are looking for big objects you can enlarge your distance between the measure points (impulses), for small objects use small distances (see section 10.3 on page 40).
- Inform yourself about the area you select for measurement. Is it useful to search at this place? Are there historical indications, which confirm your speculations? What type of soil is on this area? Are there good conditions for data recording?
- Your first measurement in a unknown area has to be large enough to get representative values (f. ex. 20 impulses, 20 search lines).
- 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 exact values concerning the depth measurement, the object has to be in the centre 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 a correct depth measurement is not possible.
- There should not be more than one object in a graphic. This will influence the exactness of depth measurement.
- You should do at least two control scans to get sure about your results. So you also can recognize and isolate mineralized ground (see section 10.1 on page 37).

10.1 Metal or Mineralisation

At the beginning it is not always easy to make a difference between real objects and mineralized ground. In principle metals are represented in red color, but mineralized accumulations can also include red signals.

Here some advice how you can differentiate between a real object and a mineralisation:

- **Form**
If the object represented in your graphic has a special form (f. ex. rectangle, circle, ...), you can conclude of a possible real found.
- **Color**
If there are many yellow and orange color values around the object, it will be probably a mineralisation.
- **Depth**
With a small depth of about 0,10m or 0,40m there is a high possibility that there is only a mineralisation of the ground.

- **Color Filter**

If position and form of the object are changing with the use of the color filter it is probably a mineralisation.

- **Control Scan**

If position, depth and form of the object stay nearly the same, also in further control scans you can conclude of a real object. Also if some graphics look similiar you always have to compare all indications.

Figure 38 shows a real object (left side) and a mineralized accumulation (right).

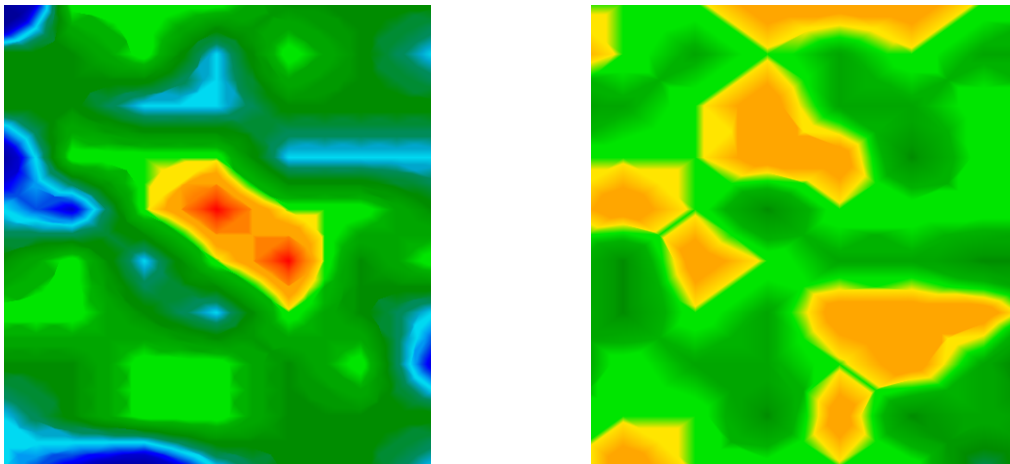


Figure 38: Comparison of object and mineral

10.2 General Procedure

The main rule for scanning an area is:

**The more exactly you scan an area
the better will be your graphical evaluation.**

You have to scan in a given manner that the software can calculate the measured values in the right way. Your device has following possibilities:

- **Parallel**

Figure 39 shows all different ways of scanning in a scheme. The measurement starts at your starting point ① and ends at point ②.

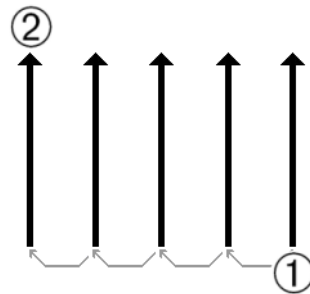


Figure 39: Given manner

If you have finished one scan line, the next line has to be on the *left* side. Do not change the direction of your probe.

The more you repeat your scanning above a possible object (control scans), the better you can decide afterwards if it is a real object or not. Temperature, other radio transmission, sun energy, mineralisation of the ground, loam, salt, water, etc. can influence negatively the measure results.

Before you start to dig, take your time to do some control scans. Repeat exactly the same scan about 3 - 5 times, to be sure about your results. Only if all these graphics have almost the same values you can be sure about your results.

Figure 40 is a graphical representation of a measured area. The blue rectangle marks a possible object in the ground.

To be absolutely sure that there is an object in the ground you have to do a control scan. Measure exactly the same area, same starting point and the same number of impulses and lines. Take also the same distance between the measure points. Figure 41 and 42 shows two possible measurements.

It is easy to recognize that the control scan in figure 41 is totally different from the first measurement in figure 40. This means only a mineralisation of the ground, not a concrete metallic object.

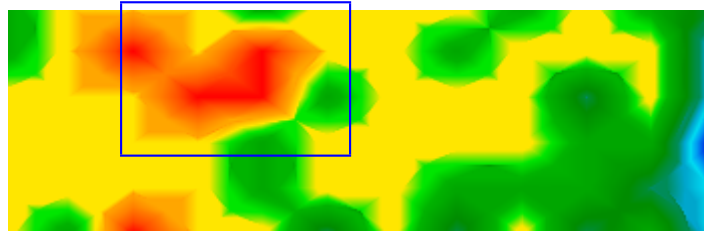


Figure 40: First measurement of an area

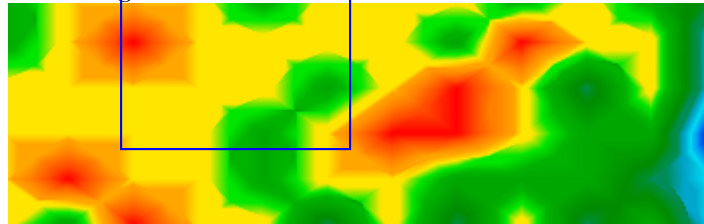


Figure 41: Control scan, Variant A

Even if the control scan in figure 42 is not exactly the same to the first one, you can see that the blue marked parts show nearly the same values. This is a reference for the existence of an object.

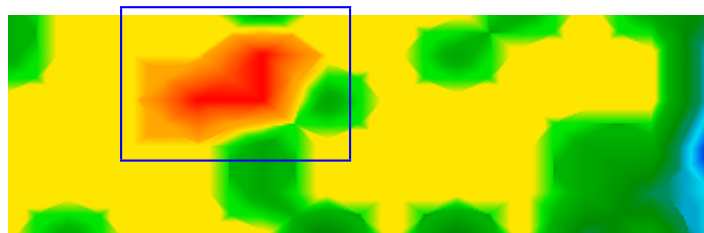


Figure 42: Control scan, Variant B

Before you can determine the depth of the detected object you have to scan a further image. It only should cover the blue marked area. All other metals and mineralized ground should be ignored because it would disturb the measurement. After this you can determine the correct depth.

10.3 Regulation of the Number of Impulses

There is no special rule for the number of impulses. But there are different aspects which has to be considered. These are for example

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

The optimal distance between two impulses is about 20cm until 30cm. The smaller the distance between two impulses is the more exactly will be the graphical representation. If you are looking

for small objects you have to select a small distance, for big objects you can increase the distance between each impulse.

Figure 43 shows the effects of the distance and the number of impulses per scan line for some objects.

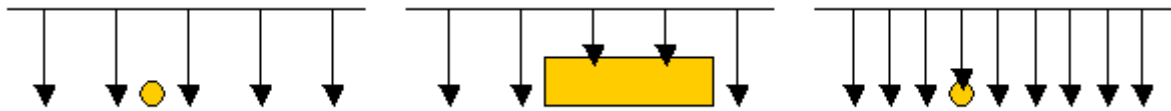


Figure 43: Effect of number of impulses and their distance

Figure 44 shows the difference between very few impulses (left side) and much more impulses on the same scan line length (right side). The second record (right side) shows much more details and also smaller objects can be seen.

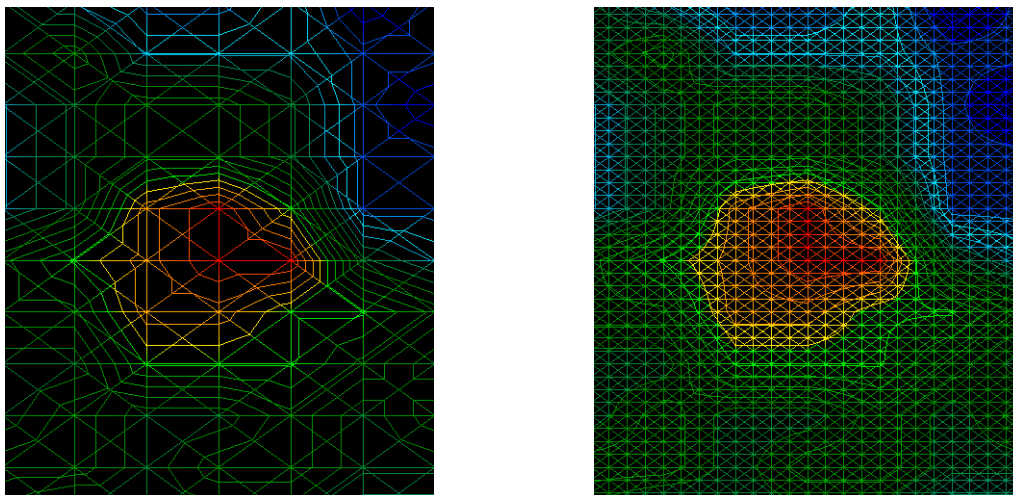


Figure 44: Comparison of small and high number of impulses

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 for the search of bigger objects you can proceed like this. With this manner you can measure relatively fast a large area and afterwards you can record the interesting subsection.

Further information about the graphical analysis you can find in the appropriate software manual.

11 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 colour 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 or children.

12 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

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

Beware that all batteries and accumulators are always charged fully while operating with your system. You should only load the batteries when they are completely discharged no matter if you are working with the external power supply or with the internal accumulators. In this way a long durability of the used batteries is guaranteed.

To load the external and internal batteries you have to use only chargers which are part of our scope of delivery.

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