FS Future Serie®

Future 2005

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 2005 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 sepulchers or buried objects such as pipes, tanks, boxes or suchlike.

The Future 2005 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 2005 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 2005.

2 Important Notes

Please read these operating instructions carefully and closely before using *Future 2005* and its accessories! These instructions give information on how to use the device and point out potential sources of danger.

Future 2005 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 2005* 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 rechargable 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, 32 MHz
Data Memory (internal)	about 65.500 measured values
Operating Temperature	0°C – 50°C
Storage Temperature	-20°C – 60°C
Air Humidity	5% – 75%
Waterproof	No

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)

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	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

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.

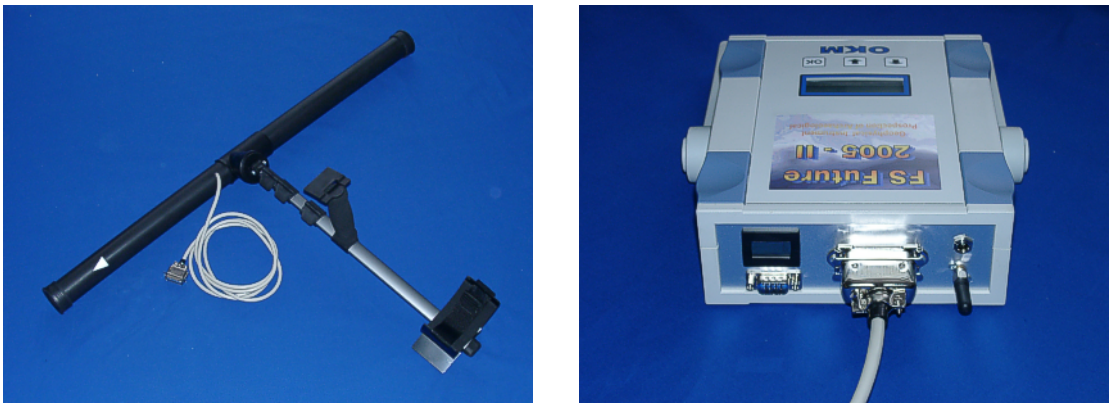

Figure 2: Assembly and Connection of the Probe

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.

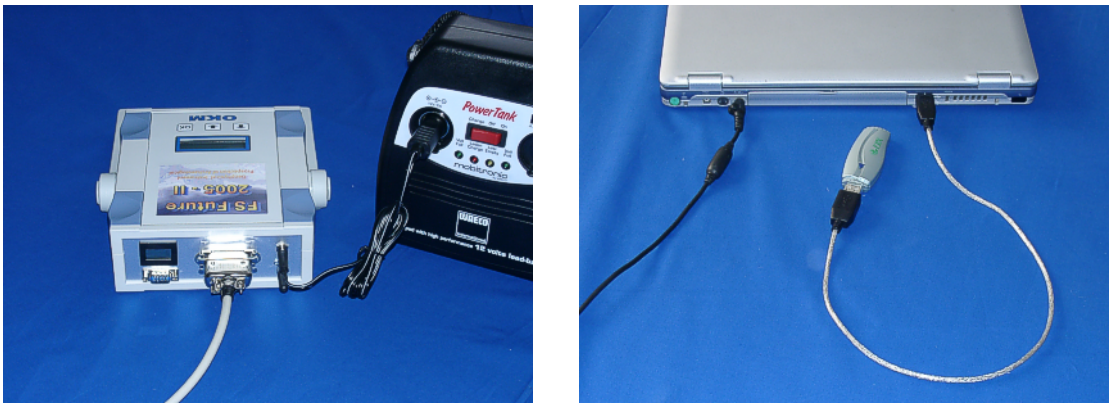

Figure 3: Connection of External Power Supply and USB-Dongle

Figure 3 shows how to connect the external power supply with the control unit. Make sure you use the 12V output for the correct cable connection. The figure also 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 4: Bluetooth-Installation

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

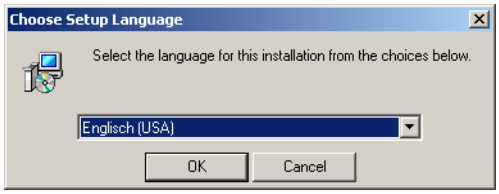

Figure 5: Bluetooth-Installation, Select Language

First there is a possibility to select the language of the installation. Click on *OK*, to change to the installation dialog from figure 6.

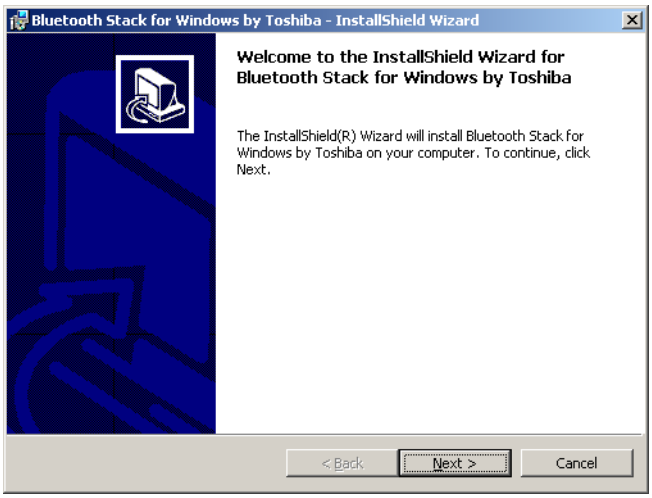

Figure 6: Bluetooth-Installation, Start

Now simply click on *Next*, to continue the installation. A dialog like in figure 7 appears on your screen.

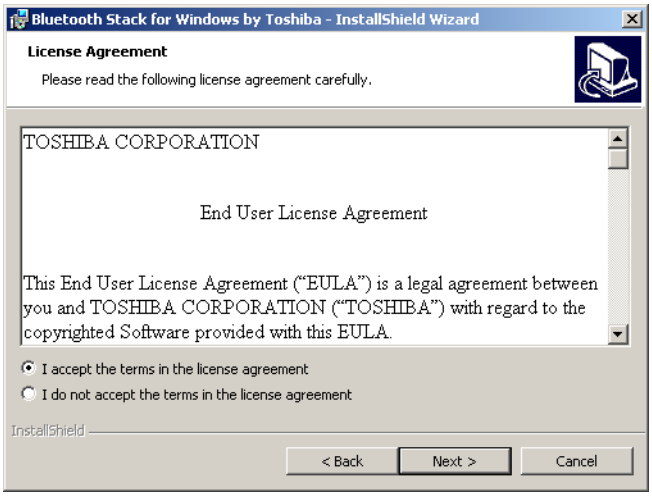

Figure 7: Bluetooth-Installation, Licence Agreement

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

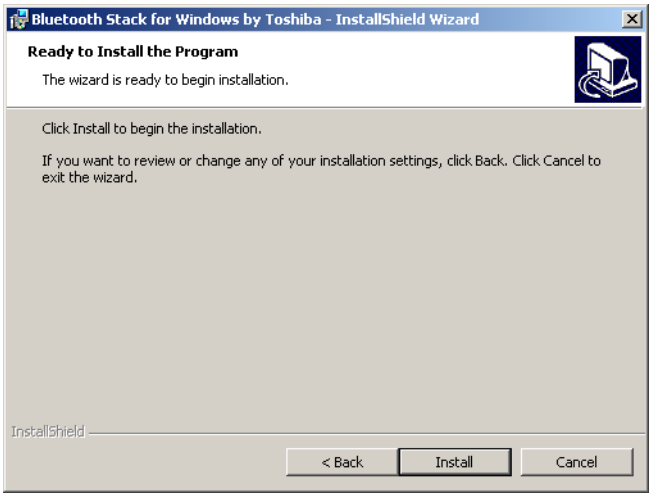

Figure 8: Bluetooth-Installation, Setup

Click now on the button *Install*, to start to copy the files. Afterwards you will be refered 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.

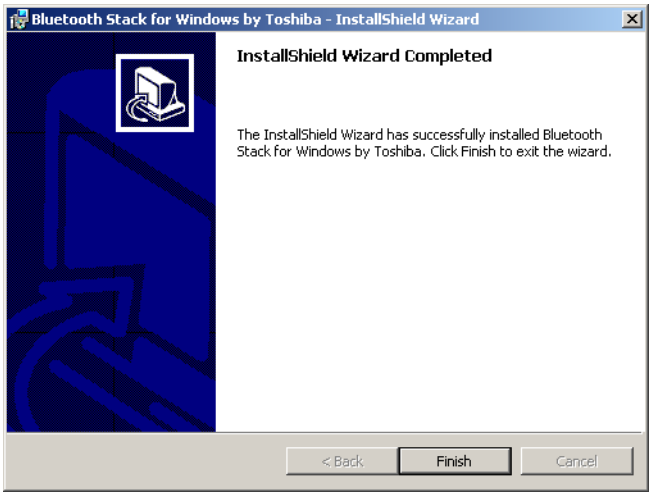

Figure 9: Bluetooth-Installation, Finish

As soon as the installation is finished, a dialog as in figure 9 appears. Click on the button *Finish*.

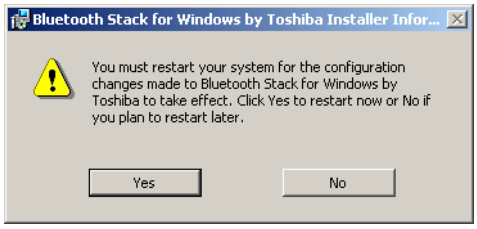

Figure 10: Bluetooth-Installation, Reboot

To terminate the installation you have to reboot your computer. A message like in figure 10 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 11.

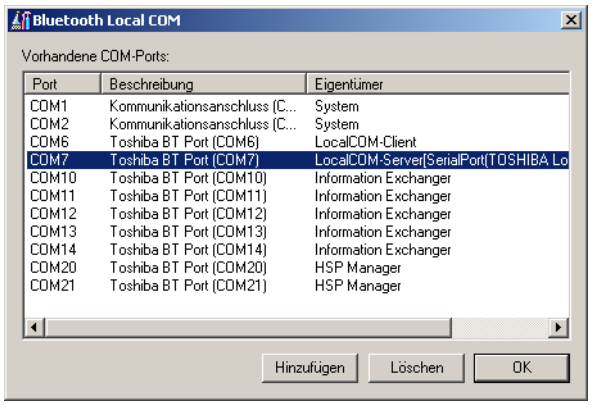

Figure 11: Determining the given COM-Port

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 Configurate 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 36.

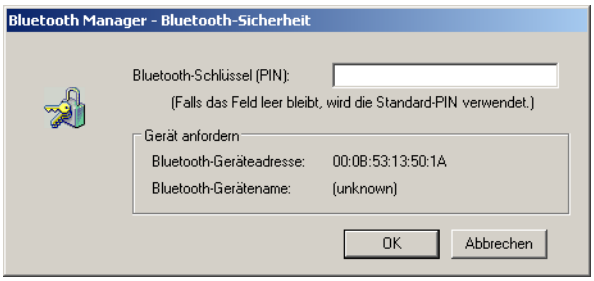

Figure 12:

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 12 appears.

In this dialog you have to enter `OKM`. It is neccessary 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 Windows XP, 2000, ME und 98SE

7.1.1 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.

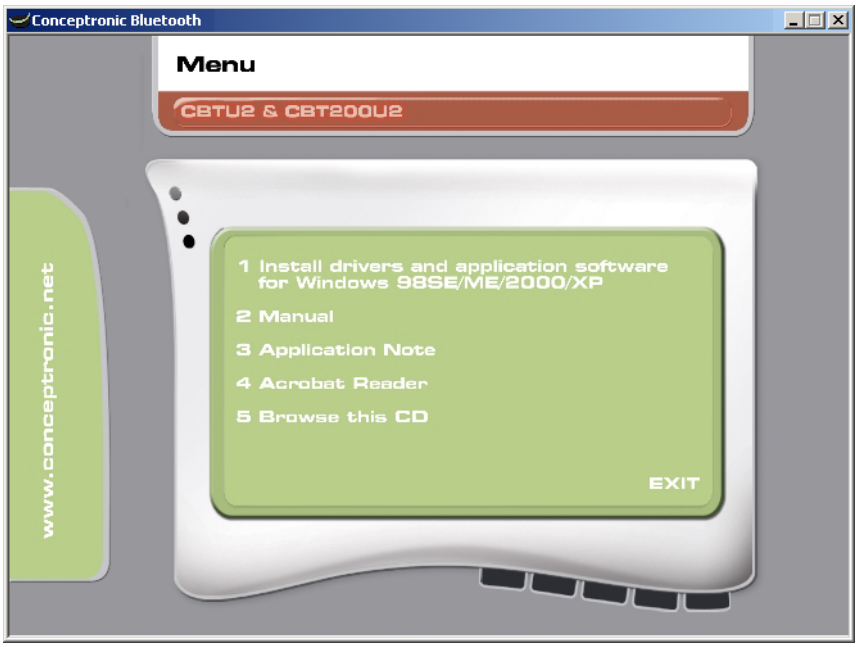

Figure 13: Bluetooth-Installation

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 14: 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 15.

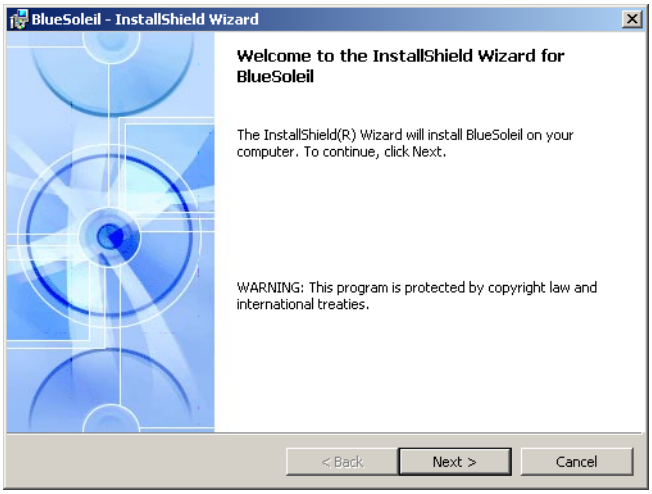

Figure 15: Bluetooth-Installation, Start

Now simply click on *Next*, to continue the installation. A dialog like in figure 16 appears on your screen.

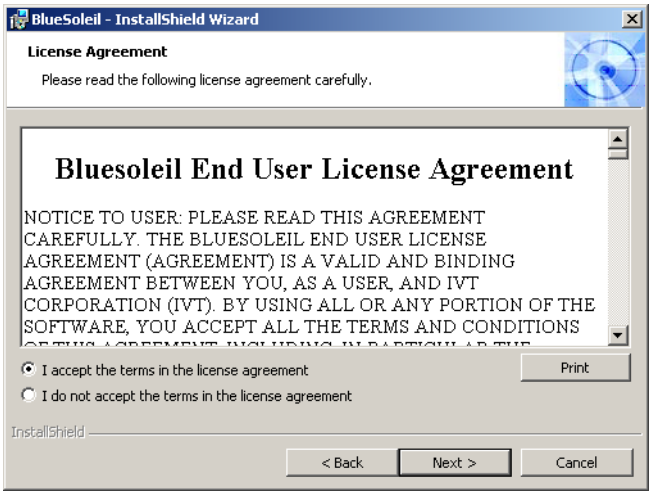

Figure 16: Bluetooth-Installation, Licence Agreement

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

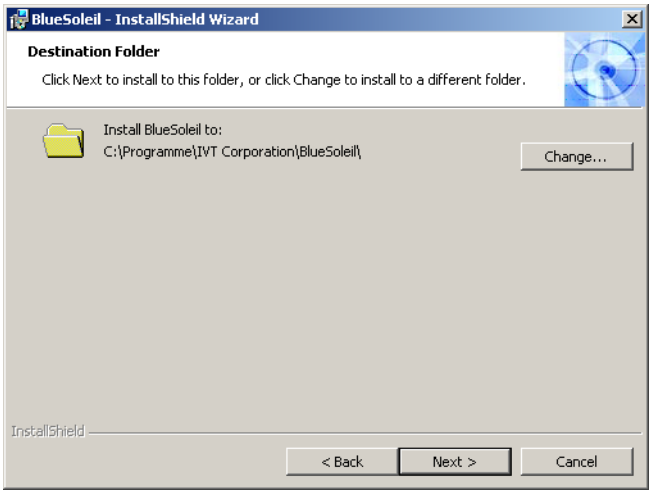

Figure 17: Bluetooth-Installation, Destination Folder

Inside the dialog from figure 17 you have the possibility to select another destination folder. Normally there is no changing necessary. Click only on the button *Next*.

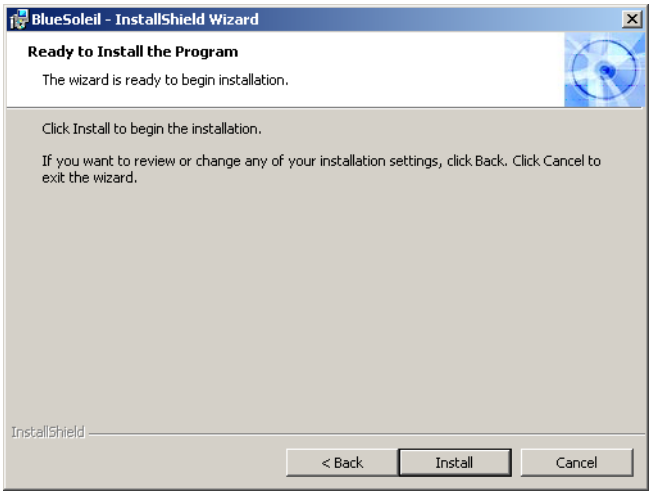

Figure 18: Bluetooth-Installation, Setup

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.

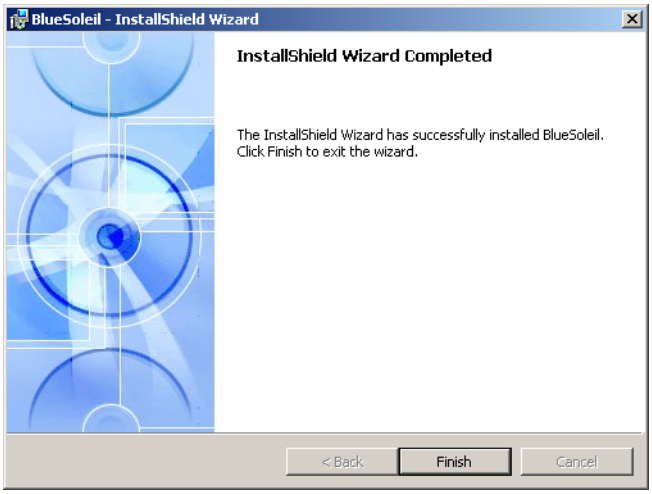

Figure 19: Bluetooth-Installation, Finish

As soon as the installation is finished, a dialog as in figure 19 appears. Click on the button *Finish*.

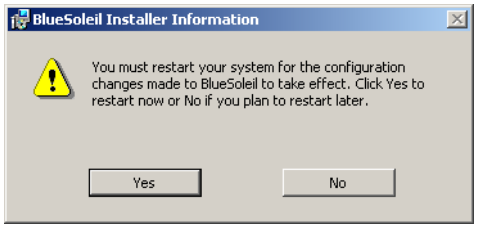

Figure 20: Bluetooth-Installation, Reboot

To terminate the installation you have to reboot your computer. A message like in figure 20 will appear. Confirm it with a click on the button *Yes*.

7.1.2 Install Bluetooth-Dongle

After you have reboot the computer the message from figure 21 appears on your screen. Now you have to plug in the Bluetooth-Dongle into your computer.

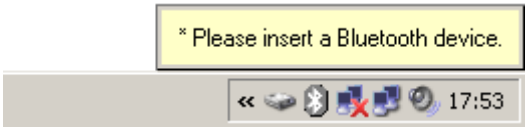

Figure 21: Bluetooth-Installation, Plug in the Bluetooth-Dongle

Now your computer tries to install automatically the Bluetooth-Dongle. Wait until a dialog window like in figure 22 appears on your screen. Click on the button *OK*.

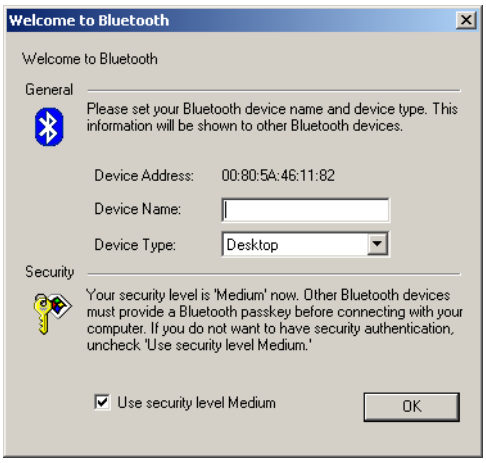

Figure 22: Bluetooth-Installation, Set up Bluetooth-Dongle

After a successful set up of the Bluetooth-Dongle the message from figure 23 appears on your screen.

Figure 23: 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 24 will appear.

Figure 24: Find out the assigned COM-Port

If you click here on the entry *Display* a window like represented in figure 25 will open. Select in the menu *View* the option *Service Window*.

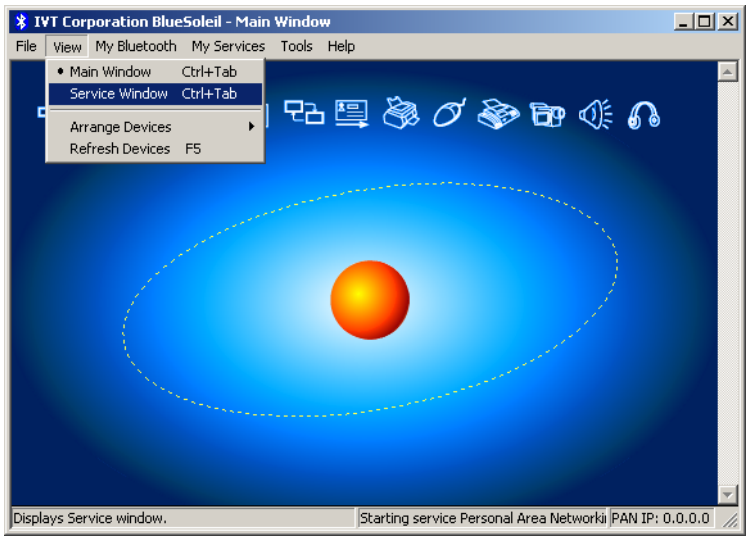

Figure 25: Find out the assigned COM-Port

An image like in figure 26 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!

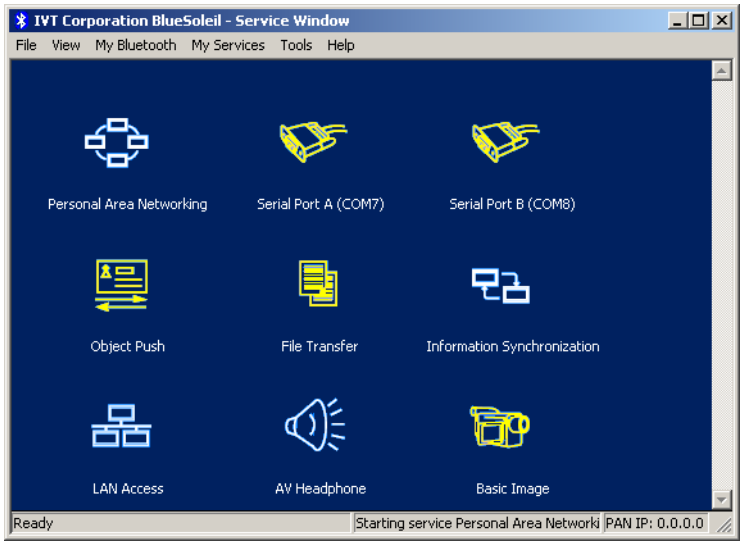

Figure 26: Find out the assigned COM-Port

7.1.3 Configurate 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 36.

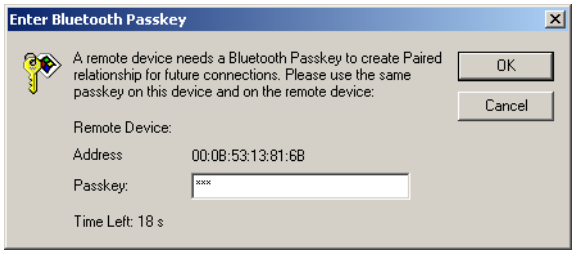

Figure 27: USB-Connection, Enter PIN-Code

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 27 appears. In this dialog you have to enter `OKM`. It is neccessary to write in capital letters! Confirm this entry by a click on the button *OK*.

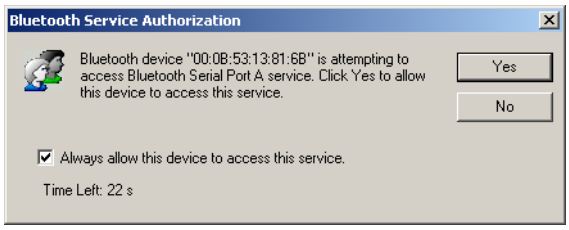

Figure 28: USB-Connection, Confirm Access

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

Figure 29: USB-Connection, Connection established

The message from figure 29 indicates that the connection is established. Now you have set up successfully your Bluetooth connection.

7.2 Windows Vista

For Windows Vista there are no additional drivers necessary. The basic functions are already provided by the operating system. To install the Bluetooth-Dongle on your Windows Vista system, please read the instructions in the following subsection!

7.2.1 Install Bluetooth-Dongle

Power on your computer and wait until Windows Vista is completely booted. After you signed up for your Windows Vista system plug in the Bluetooth-Dongle into a free USB slot. The message from figure 30 appears on your screen.

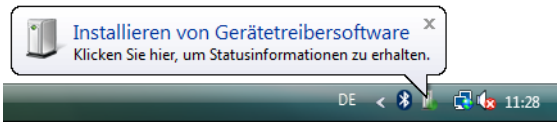

Figure 30: Windows Vista, Install Bluetooth-Dongle

Wait a little moment until the installation of the Bluetooth-Dongle is completed successfully and the message from figure 31 appears on your computer screen.

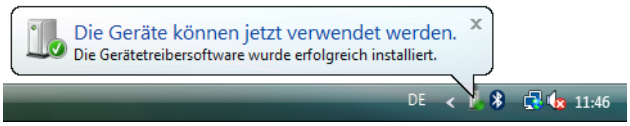

Figure 31: Windows Vista, Set up Bluetooth-Dongle

To use the Bluetooth-Dongle with your device, you have to apply a serial COM-Port. Therefore please click with the right mouse buttom on the Bluetooth symbol on the down right side of your computer screen! A dialog similiar to figure 32 will open. Click with the left mouse button on the entry *Open Bluetooth settings*.

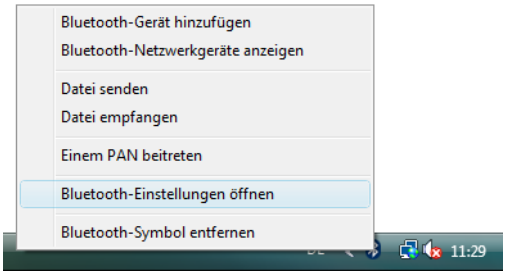

Figure 32: Windows Vista, Configurate Bluetooth-Dongle

The dialog window from figure 33 will open. Click with the left mouse button on the tab *Options* and compare the settings of your computer with those from the figure. After that please click on the tab *COM-Ports*.
To transfer the measured data from your device to the computer, you have to establish now the serial COM-Port. The figure 33 (right side) shows the relevant dialog window. Click with the

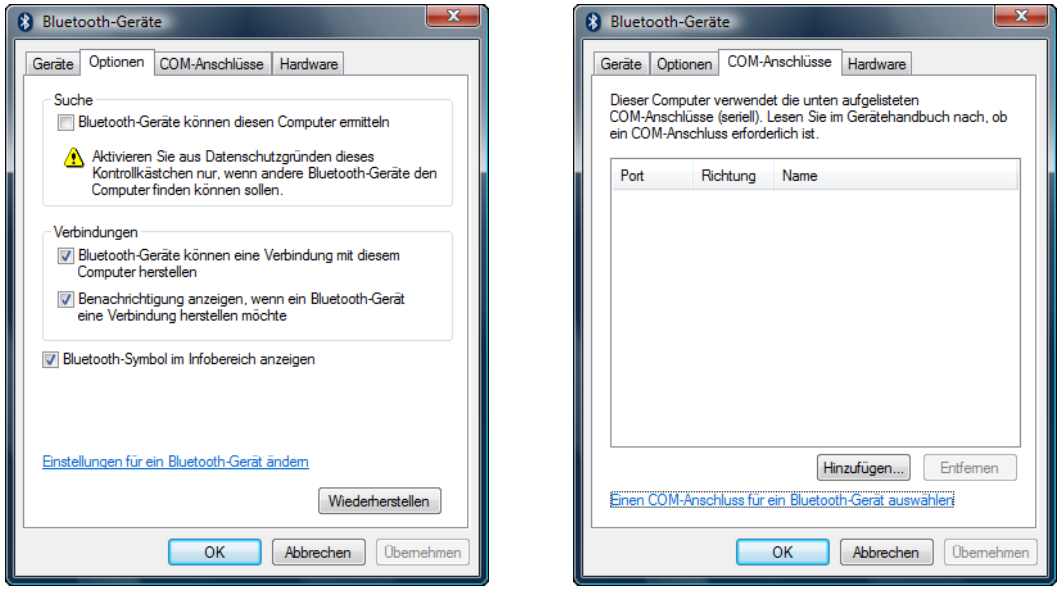

Figure 33: Windows Vista, Verify Bluetooth settings

left mouse button on the button *Add*. Another dialog window like represented in figure 34 will open.

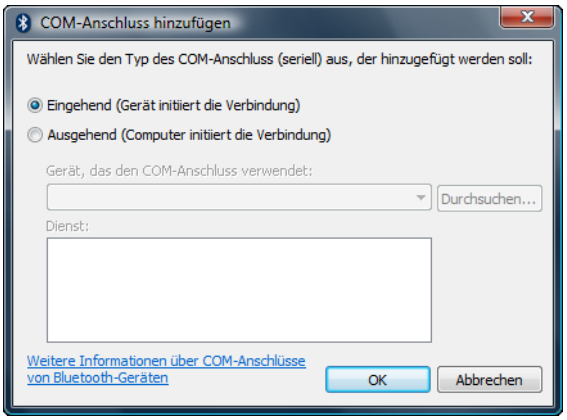

Figure 34: Windows Vista, Configurate serial COM-Port

In this dialog you only have to select option *Incoming (Device initiate connection)* and confirm your selection by a click on the button *OK*. Automatically a serial COM-Port will be created and a Port refered. In this tutorial the Port *COM3* has been refered. This Port *COM3* has to be entered later in the software, to transfer measured data to your computer.

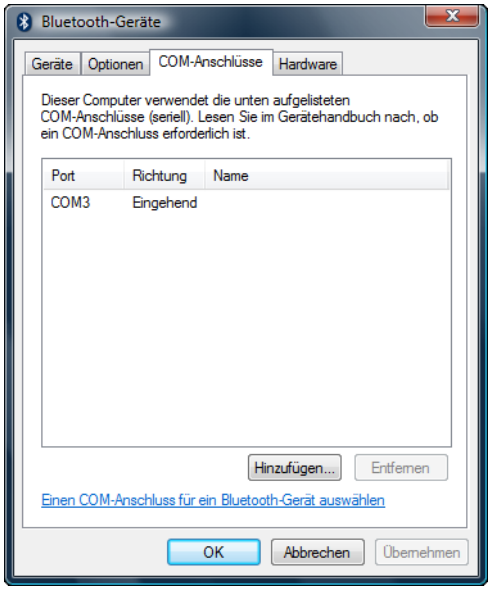

Figure 35: Windows Vista, Configurate serial COM-Port

Again, in figure 35 the allocation of the serial COM-Port *COM3* is represented. The installation of the Bluetooth-Dongle is now completed. The next step is to establish a test connection, to control the connectivity.

7.2.2 Establish connection

Be sure that the Bluetooth-Dongle is plugged into your computer. Now take your measuring instrument and power it on. Select an operating mode which supports the direct data transfer to your PC. Detailed information you can find in section 9 on page 36. As soon as you confirmed this function on your device, a radio connection to your pc will be established. If it is successfull the dialog from figure 36 appears.

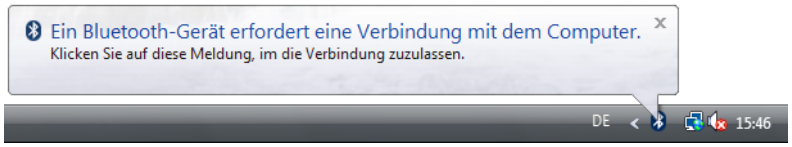

Figure 36: Windows Vista, Allow access

Click with the left mouse button inside this message to enter the PIN-Code. A dialog like in figure 37 appears on your computer screen.

Figure 37: Windows Vista, Set up Bluetooth-Dongle

There please enter the PIN-Code `OKM`. Take care to use capital letters! Confirm the entry by aclick on the button *Next*.

Figure 38: Windows Vista, Finish connection assistant

After a connection has been established the dialog from figure 38 appears. Just click on the button *Finish* to finish the connection assistant.

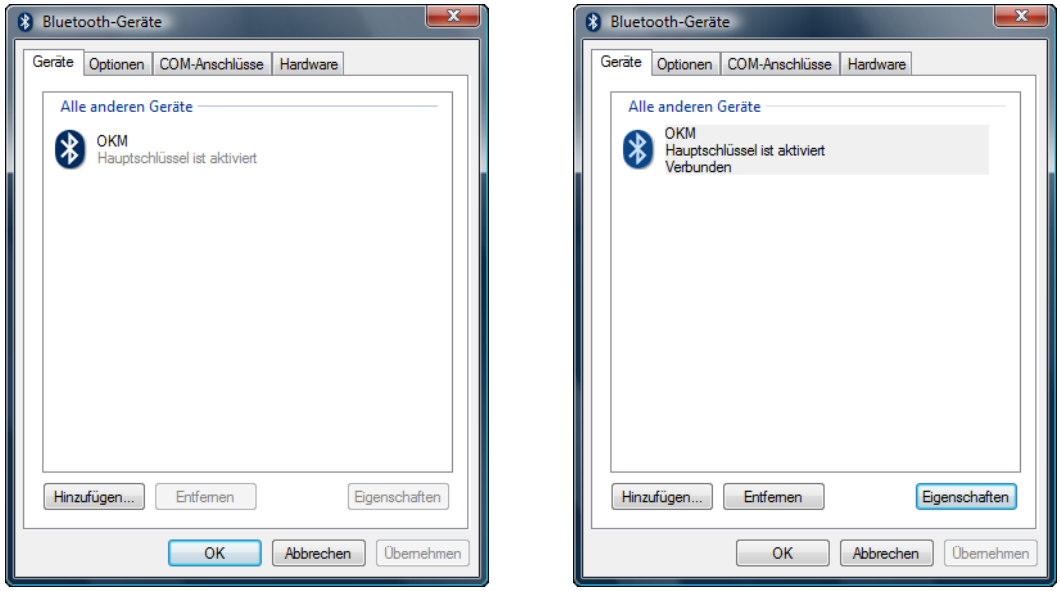

Figure 39: Windows Vista, List of Bluetooth devices

To find out the current status of your Bluetooth-Dongle click with the right mouse button on the Bluetooth symbol inside the down right corner of your screen. In the following menu (see figure 32 on page 28) please click with the left mouse button on the entry *Open Bluetooth settings*. A dialog like in figure 39 shows all existing devices. As soon as one of these devices has established a connection it will be indicated by the supplement *Connected*.

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 40 shows the front side of the control unit.

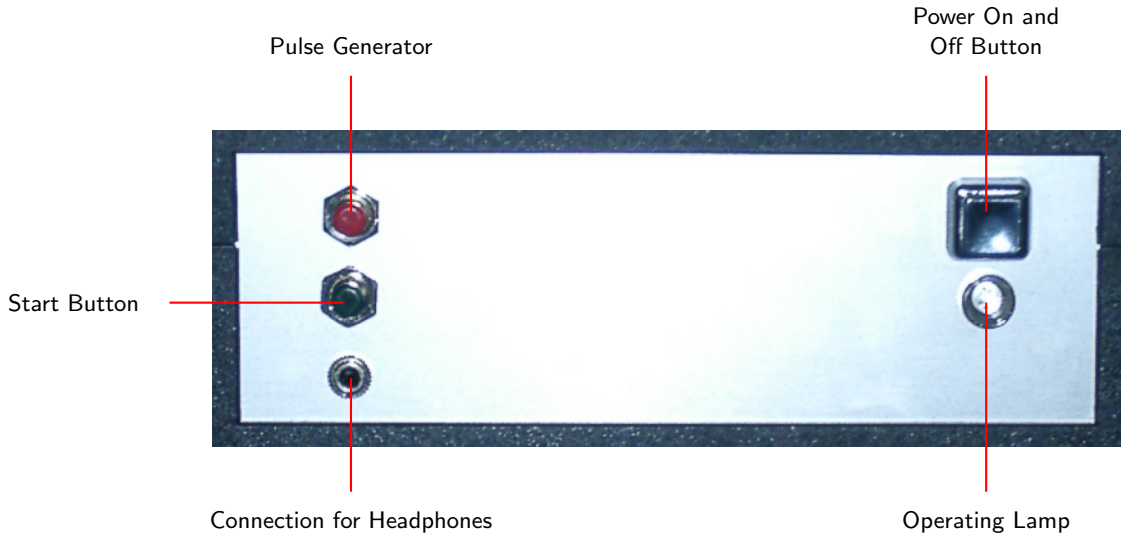

Figure 40: Front View

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 41 shows the back side of the control unit and their connections.

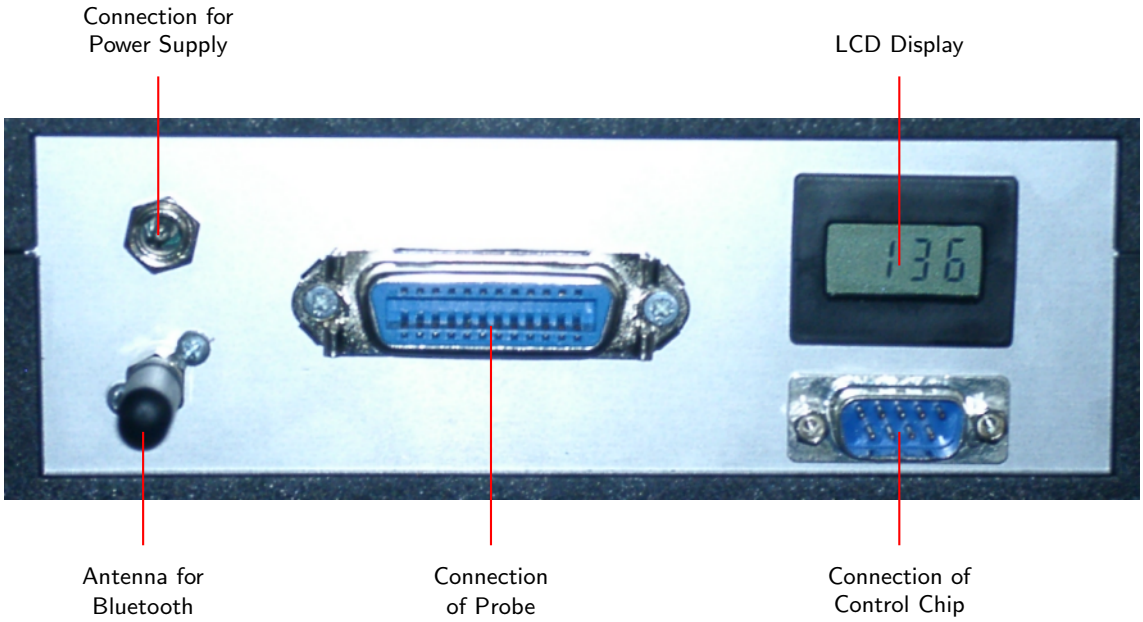

Figure 41: Back View

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 42. With this touchpad you can navigate to the different operating modes in the menu.

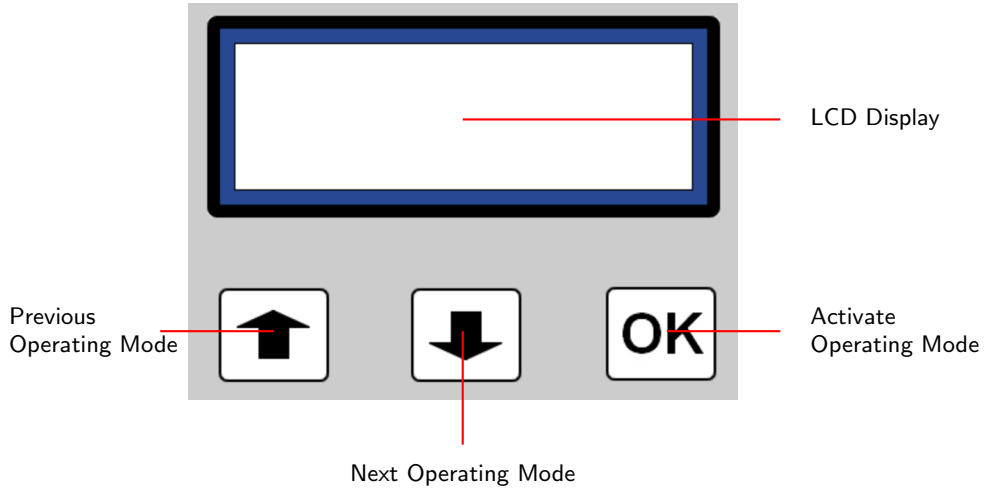

Figure 42: Touchpad

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

9 Operating Modes

In this section you will learn more about the different operating modes of the device. Every function is been explained in particulary 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 prossesses the following operating modes:

- **Magnetometer, Sound Mode**
  Measurement with acoustical signals. No graphical representation.
- **Ground Scan**
  Automatic scanning mode. Measured values will be stored into internal memory or sent directly to a PC.
- **Live Scan**
- **Transfer Memory To Computer**
  Transfer the stored measure values from internal memory to a connected computer.

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

9.1 Magnetometer, Sound Mode

With the operating mode „*Magnetometer, Sound Mode*“ the device is moved in the magnetometer mode. This mode allows you to detect acoustically the existing field strength.

The higher the field strength, the higher will be the audible signal. In this operating mode it is easily possible to find metallic objects (specially iron objects) right under the surface.

After you confirmed function„*Magnetometer, Sound Mode*“ by pressing the key *OK* you have to select if you want to work with one sensor (1 Ping) or with all sensors.

9.2 Ground Scan

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

Before you can use this operating mode you have to navigate some submenus. First you have to decide which of the following mode you want to use:

- **Automatic Mode**
  Measure values will be taken continously.

- **Manual Mode**
  Measure values will be taken only if the user pushes the Pulse Generator.

After this you have to select the number of impulses (10, 20, ..., 200). How to determine the right number of impulses you can read in section 10.3 on page 44!

The last step is to specify the transfer mode of your measure values:

- **Transfer To Computer**
  Measure values will be sent directly to a connected computer.
- **Transfer To Memory**
  Measure values will be stored into the internal memory.

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 43 shows this in a pattern.

Figure 43: 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 continiously the first measure line (left representation in figure 43).

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 similiar to figure 44.

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

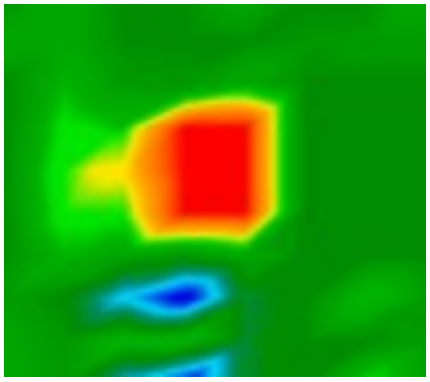

Figure 44: Graphical Representation of a Measurement with Horizontal Probe

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 41 or in your software manual.

Please read also section 10.2 on page 43 where the principle procedure of a graphical measurement is explained in detail.

9.3 Live Scan

This operating mode allows you to see the determined 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. All measured values are sent directly to a connected pc.

The device recognize automatically which antenna is connected to the control unit. Only in the software program you have to select which antenna you are using currently. 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.

The graphical representation on your computer depends on the software program you are using. Figure 45 shows a representation of the horizontal probe in the *Future Series – Standardsoftware*.

The usage of the verticale probe is similiar to the usage of the horizontal probe. Pay attention to the reduced penetration depth of about 3 meter while using the verticale probe!

Figure 46 shows a graphical representation of the verticale probe in the *Future Series – Standardsoftware*.

In this operating mode measure values are recorded continuously and sent to the computer.

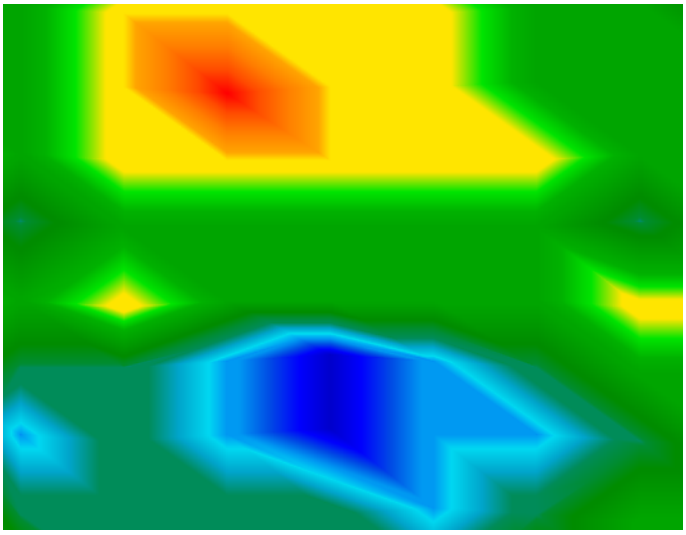

Figure 45: Live Mode with Horizontal Probe

Even if you stand still on the same place, the graphical representation will keep on moving. In this case there should be no relevant changes visible.

9.4 Transfer Memory To Computer

With operating mode „*Transfer Memory To Computer*“ measured values can be transmitted from the internal memory of the device to a computer. Therefore it is necessary that the software has to be prepared before starting the transmission. Only if all preparations of the software are made correctly and the software program is ready to receive the measured data you can confirm this function. Further information about a correct preparation of the software program you can find in the manual of your software product.

Immediately after confirming the operating mode by pressing the key Activate operating mode, the message *Connecting with Computer ...* will appear on the display of your device. This procedure can take a few seconds. Further information about the connection establishment via Bluetooth you can find in section **??** on page **??**. Afterwards you will be asked to press the Start button.

The measured data will now be transmitted to your computer at one time.

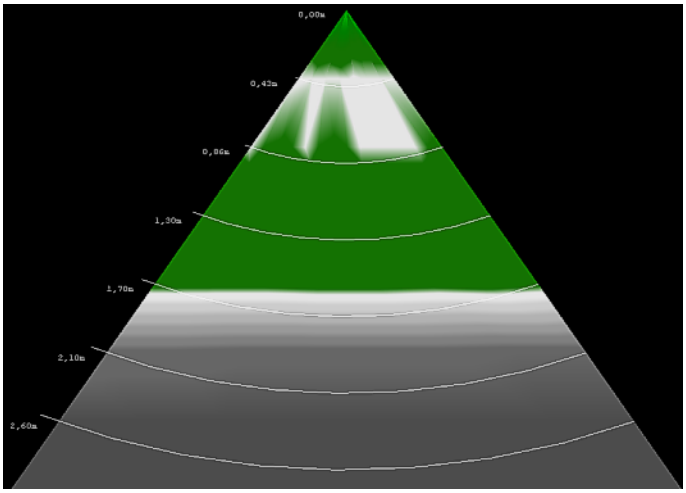

Figure 46: Live Mode with Verticale Probe

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 44).
- Inform yourself about the area you select for measurement. Is it usefull 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 41).

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

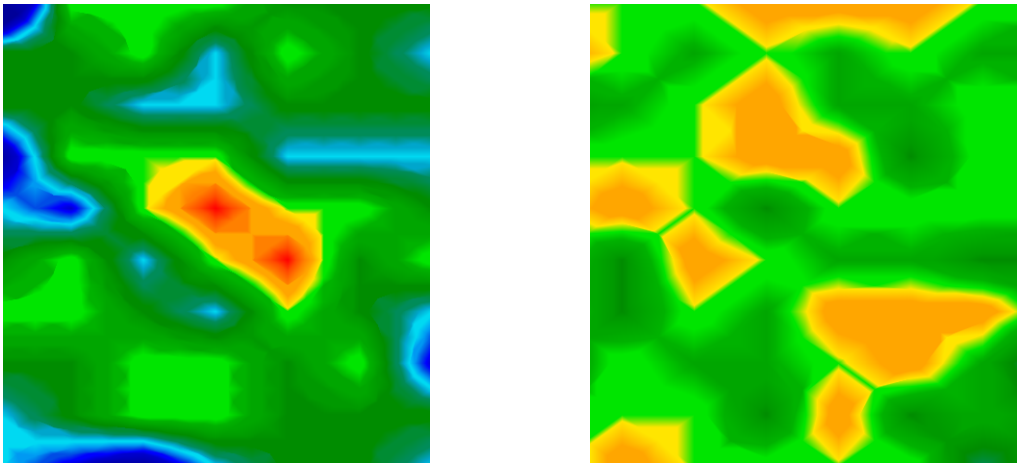

Figure 47: Comparison of object and mineral

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

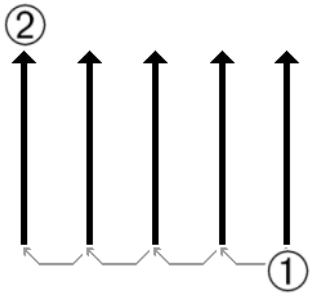

Figure 48: Given manner

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 49 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 50 and 51 shows two possible measurements.

It is easy to recognize that the control scan in figure 50 is totally different from the first measurement in figure 49. This means only a mineralisation of the ground, not a concrete metalic object.

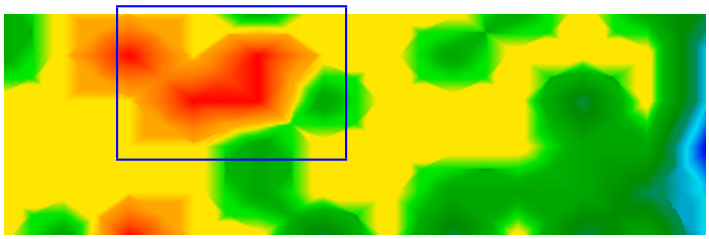

Figure 49: First measurement of an area

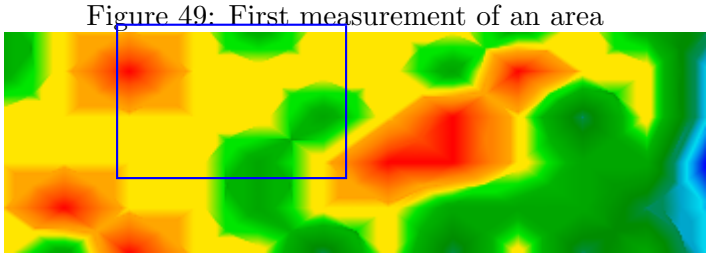

Figure 50: Control scan, Variant A

Even if the control scan in figure 51 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.

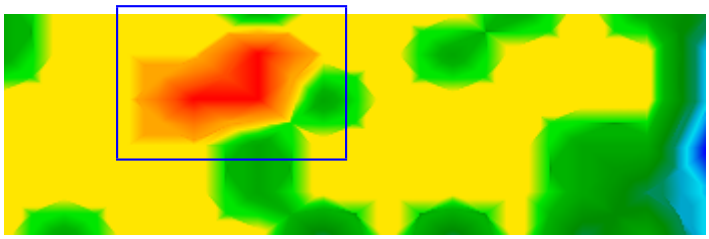

Figure 51: Control scan, Variant B

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

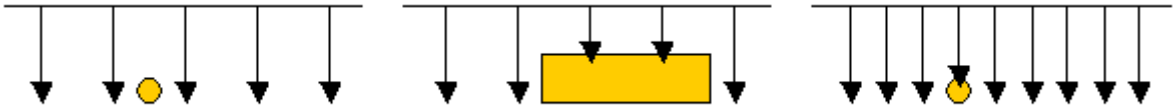

Figure 52: Effect of number of impulses and their distance

Figure 53 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.

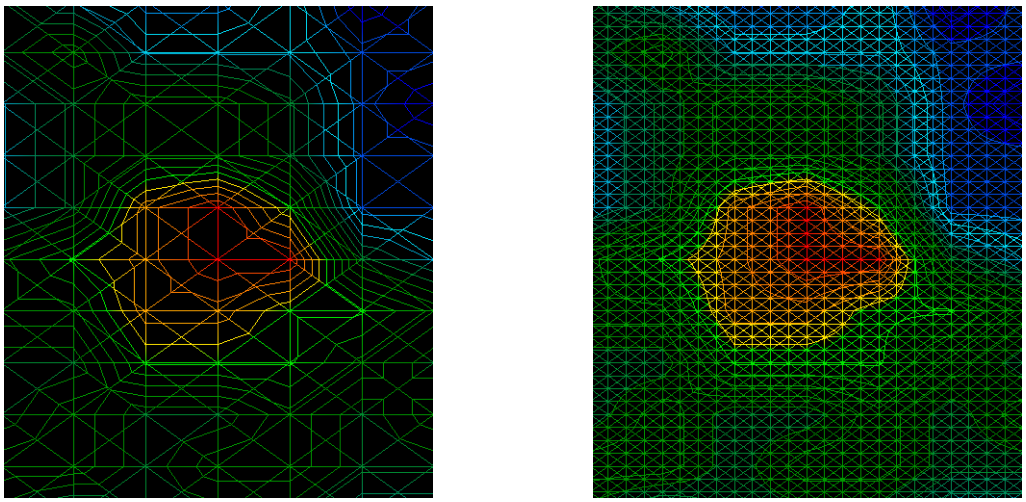

Figure 53: Comparison of small and high number of impulses

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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