

FS Future Serie®

FS-Thermoscan

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 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 high 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 FS-Thermoscan.

2 Technical Specifications

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

2.1 Control Unit

Dimensions (L x W x H)	35 x 12 x 22 cm
Weight	about 0,9 kg
Voltage	12 VDC
Operating Temperature	0 °C – 50 °C
Storage Temperature	-20 °C – 60 °C
Air Humidity	5% – 75%
Waterproof	No

Table 1: Technical Specification (Control Unit)

2.2 Laser Pointer

Laser Class	2 (according to EN 60 825-1)
Range	up to 50 m
Wave Length	630 – 680 nm
Maximum Output	< 1 mW

Table 2: Technical Specification (Laser Pointer)

2.3 Measurement Readings

Optimal Surface Temperature	10 °C – 25 °C
Distance / Spot Size Ratio	8 : 1
Field Of View (Flare Angle)	7 °
Resolution	0,01 °C
Temperature Difference (min. amplification)	9 °C
Temperature Difference (max. amplification)	1 °C

Table 3: Technical Specification (Measurement Readings)

3 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 FS-Thermoscan (Control Unit)
- 1 External Power Supply
- 1 Charger For External Power Supply
- 1 Adapter For External Power Supply
- 1 User Manual
- 1 Carrying Case

Table 4: Scope Of Delivery

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



Figure 1: Scope Of Delivery

4 Controls

4.1 Complete View

In figure 2 FS-Thermoscan is shown with all its components.



Figure 2: Complete View

The Handhold is used to hold the device during the measurement.

On the Analog Display all measured values are visible.

The Laser Pointer marks the position of the recording of the measured value, if activated.

With the Connecting Plug to External Power Supply Or eXp 4000 you can connect the device to an eXp 4000 or via the Adapter Cable to an external battery. You have the possibility to use the device as a stand-alone unit without any additional devices.

4.2 Front View

The figure 3 shows the front side of the device with all available operating elements.



Figure 3: Front View

The Power On And Off Button For Laser Pointer is used to switch off and on the laser pointer, which is situated on the upper side of the control unit. With its help it is possible to do accurate measurements.

Via the Analog Display the current measure value is represented. The deflection of this display depends on the adjustment of the calibration and the sensitivity. Further information about the calibration of the FS-Thermoscan you can find in section 5.1 on page 11.

By using the Regulator Of Calibration you can adjust the indicator of the analog display to the center.

By using the Regulator Of Sensibility you can adjust the range of values of the measurement. So the device can be aligned to the current temperature differences.

5 Usage

The FS-Thermoscan is a measuring instrument to recognize differences in temperature in the surrounding area. So it is possible to identify objects and structures of different temperature. Possible applications are

- detection of voids (caves, tunnels, rooms, chests, ...),
- visualization of the heat distribution and
- measurement of differences in temperature.

The capacity for the thermal absorption of different materials is an important parameter for the detection of buried voids. The inspected area heats up itself during the day because of the solar irradiation evenly. On the areas where no voids are situated under the surface more heat can be absorbed than in areas where a void is situated under the surface. During the night the ground emits the saved heat to the environment. During this process areas with subterranean caves, tunnels or boxes achieve faster the balance of temperature with the surrounding atmosphere. Thereby a cold zone arises on the surface of the ground on this position where the cavity is situated under the ground.



Figure 4: Schema of the thermal distribution of cavities

In thermographs (graphical representation of the thermal distribution), which has been done during the night cold zones can indicate the possible existence of voids.

The FS-Thermoscan can be used as a stand-alone unit or connected as an optionally accessory to eXp 4000. To receive the optimal deflection of the temperature values you have to calibrate the FS-Thermoscan before starting the measurement to the current measured field.

5.1 Calibration

To adjust the FS-Thermoscan to the researchable measure field please use the Regulator Of Sensibility and the Regulator Of Calibration. The Regulator Of Sensibility regulate the amplification and change the

maximal temperature range. The Regulator Of Calibration moves the indicator of the Analog Display to the center of the scale (green zone) to indicate positive and negative fluctuations of temperatures.

Point the FS-Thermoscan to the area you like to examine and turn the Regulator Of Sensibility on the highest position. After that turn the Regulator Of Calibration in this way to the left or right so that the indicator of the Analog Display is situated in the center of the scale. Now move the FS-Thermoscan constantly over the area and control the deflection of the indicator. If the indicator deflect completely to the left or right you have to turn back the sensibility regulator. Therefore you have to rotate the Regulator Of Sensibility a little bit to the left and repeat the described procedure. The calibration is finished when the indicator deflects without reaching the limit on the left or right side.

The smaller the differences in temperature on the measured area, the larger the sensibility should be. Only in this way small variations in temperature can be visible.

If you are using the FS-Thermoscan out of the advised temperature of the surface it can happen that the indicator of the Analog Display cannot be calibrated to the center of the display.

5.2 Usage as stand-alone device

Connect the FS-Thermoscan via the Adapter Cable with the 12V plug socket of the External Power Supply and power on the External Power Supply. Calibrate the device before starting the measurement and then move the FS-Thermoscan slowly and evenly over the complete area you like to measure.



Figure 5: Measurement with FS-Thermoscan

The view of the differences of temperature is only represented on the Analog Display, where the indicator moves to the right (red zone) if the temperatures increase or move to the left (blue zone) when the temperatures decrease. Observe exactly the deflection of the Analog Display, to recognize specific changes in temperature. In this way cold and warm zones can be identified and conclusions to possible inclusions can be made. The quality of the measurement depends mostly on the calibration which has been done.

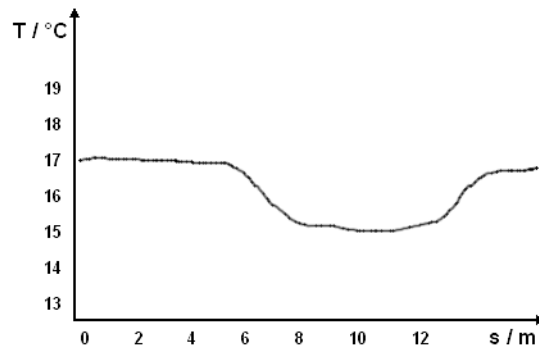


Figure 6: Temperature sequence of a measurement on the hillside

Like explained above cold zones can indicate possible cavities. The diagram in figure 6 shows the temperature sequence of a test measurement. The FS-Thermoscan has been pointed horizontally to the hillside and then moved slowly from the left to the right. In the area between 6 and 14 meters a clear decrease of temperature can be recognized – a possible indication for a subterranean void.

5.3 Usage as optional equipment to eXp 4000

Besides using the FS-Thermoscan as a stand-alone unit it can also be used as an optional equipment to the eXp 4000. If the FS-Thermoscan is used together with the eXp 4000, there are additional possibilities of graphical analysis besides the *Analog Display*. So a more accurate survey of the area is possible.

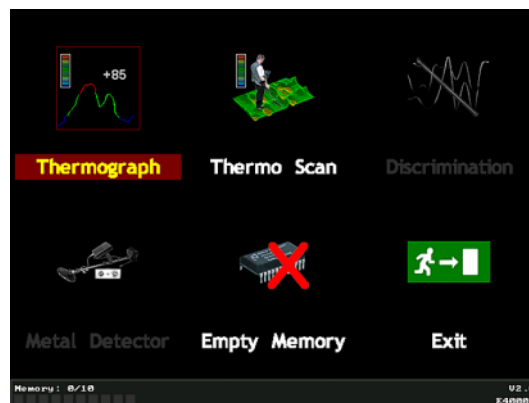


Figure 7: The operating modes Thermograph and Thermo Scan of eXp 4000

As soon as you connect the FS-Thermoscan to the eXp 4000 the optional accessory will be recognized automatically by the device and two following operating modes are available:

- **Thermograph**

The operating mode *Thermograph* offers additional graphical representations to analyse the measured values of the FS-Thermoscan.

- **Thermo Scan**

In operating mode *Thermo Scan* you have the possibility to scan a complete area and create a Thermo Scan (graphical representation).

In the next sections these two operating modes are explained in detail.

5.3.1 Thermograph

The operating mode *Thermograph* offers a more detailed display of the measured results of FS-Thermoscan. As soon as the FS-Thermoscan is connected to the eXp 4000 this operating mode will be available for you.

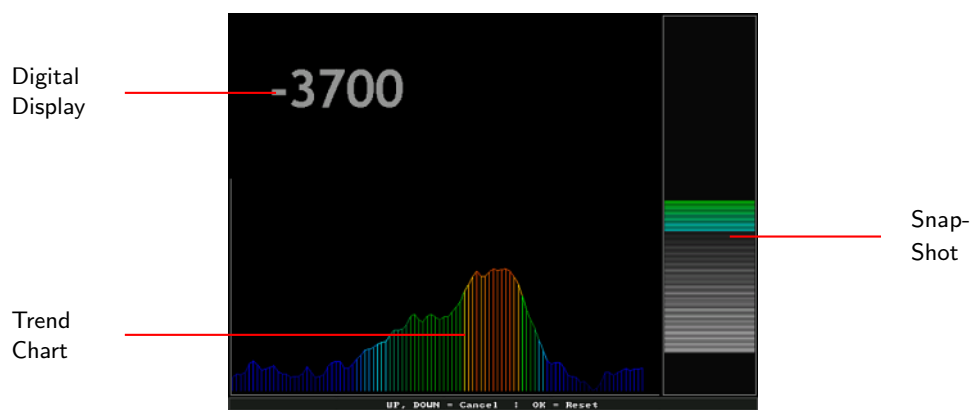


Figure 8: The Operating Mode Thermograph On The eXp 4000

In figure 8 you can see a typical display if you are working in the operating mode *Thermograph*. The monitor is subdivided in 3 parts.

- **Digital Display**

In the Digital display on the upper left part of the monitor the analog measuring values of the FS-Thermoscan are represented in a digital form. Because of the higher resolution of this display also smallest variations of the temperature becomes visible.

- **Snap-Shot**

The snap-shot on the right side of the monitor shows the current increasing or decreasing measured values. During the *Ground Balance* the zero point will be determined and all following measured values will be indicated as a deflection to the top (increasing temperature) or a deflection down (decreasing temperature).

- **Trend Chart**

The trend chart on the lower part of the monitor show differences in temperature also in a date back period of about 10 seconds. In this way differences in temperature can be represented visually.

The operating mode *Thermograph* can also be used for the Calibration. Do not take attention to the position of the indicator of the *Analog Display*, instead of that please take attention to the deflection of the *Snap-Shot*.

5.3.2 Thermo Scan

In operating mode *Thermo Scan* you have the possibility to create a graphical representation of the distribution of temperatures. Also this operating mode is only available when the FS-Thermoscan is connected to the eXp 4000.

The scanning of the measured area is generally similiar to the operating mode *Ground Scan*, with the only difference that instead of an antenna the FS-Thermoscan is connected to the device.

As soon as you confirmed the operating mode and adjusted all necessary parameters (adjustment of the parameters is explained in the user manual of eXp 4000, operating mode *Ground Scan*), you will be asked if you like to do a calibration. If you confirm this question by *Yes* you will enter into the operating mode *Thermograph*. There you have the possibility to calibrate the FS-Thermoscan via the *Analog Display* or the digital display of the eXp 4000. After you finished the calibration of the device, press the button *Previous Operating Mode* (Arrow-Up) or the button *Next Operating Mode* (Arrow-Down) to go back to the operating mode *Thermo Scan*.



Figure 9: Measurement with eXp 4000 and connected FS-Thermoscan

Now you have to start to scan the field. Therefore you have two possibilities:

- **Scan the area as usual**

In this method the FS-Thermoscan has to be used like a conventional antenna. Hold the FS-Thermoscan in your hand and point the *Temperature Sensor* towards the surface of the ground. According to your adjustments of the scan mode move the device over the area while walking next to it, in the parallel or zig-zag mode.

- **Scan an area from the distance**

Stand in front of the area you like to inspect, hold the FS-Thermoscan in your hand and

point the Temperature Sensor to the start point of your field. Now you can scan the area by moving the Temperature Sensor continuously over the measure field. You don't have to stand directly over the measure point, it is enough if you orientate the FS-Thermoscan with the Temperature Sensor to this point. So the area can be measured from distance. Switch on the Laser Pointer, to focus on every single measure point. This scanning method is especially interesting in areas with difficult access. So it is possible to inspect rock faces, hillside situations or similiar structures.

After proceeding the measurement the graphic can be stored, transfered onto a computer and analysed in the software. All functions of the software are usable but please note that a depth measurement is not possible in this operating mode. The differences in temperature are only measured on the surface of the ground and do not allow any indications about the depth.

Warm areas are represented in red color and cold area are shown in blue color. If you are searching for cavities and are using the above explained measurement principle you have to inspect especially the blue color parts inside your graphic.

6 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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