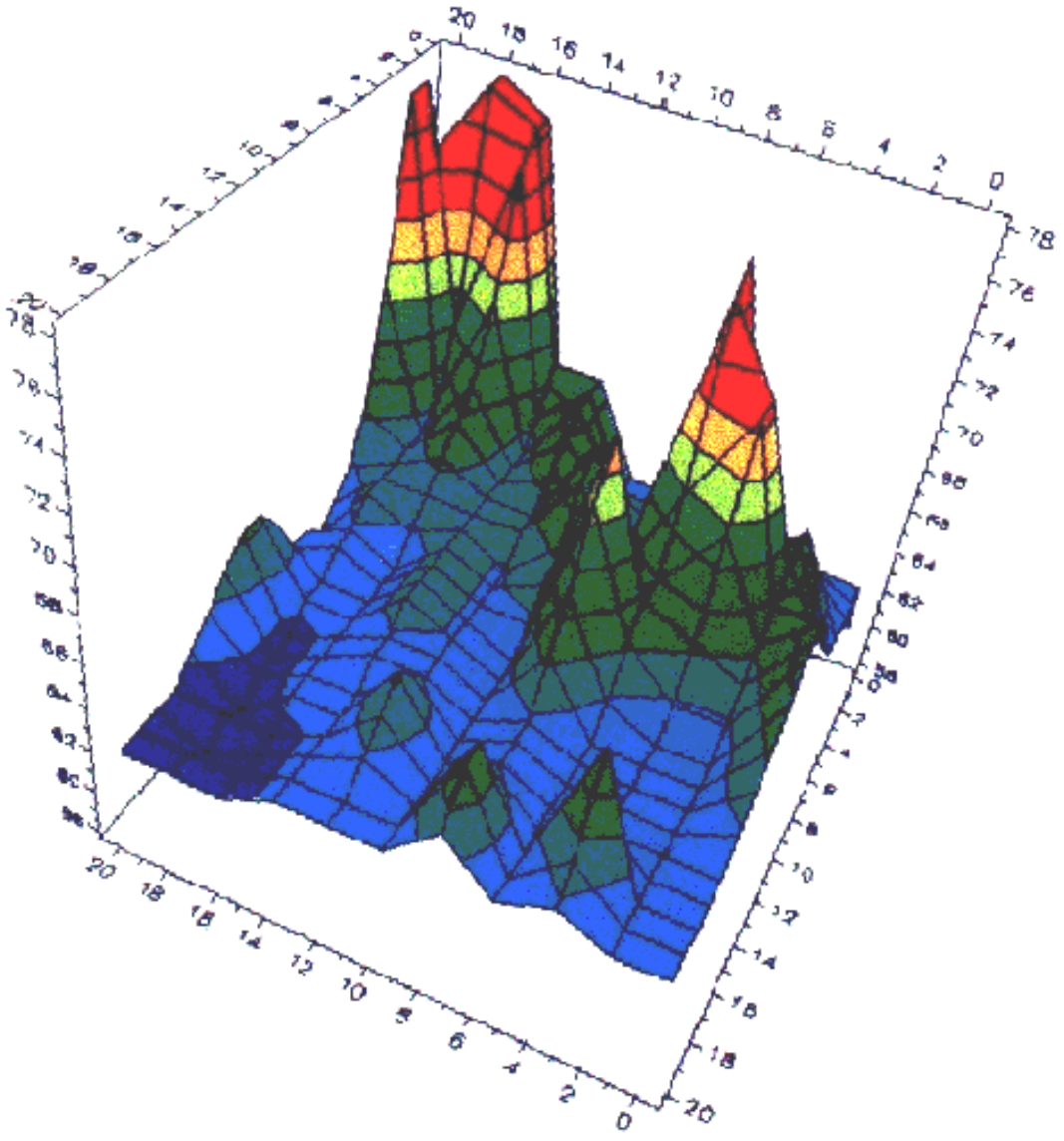
The Geophysical Exploration System

EMFAD UG 12



Introduction

With this documentation we are presenting the UG 12 System, developed by EMFAD® GmbH, for measuring abnormal changes of conductivity in the ground.

The anomalies which can be measured by the UG 12 method are mainly caused by: conductive metal materials, like pipes, cables, barrels, metal waste, reinforced concrete etc., irregularities in the subsoil, caused by cavities, graves, faults, shafts, groundfills, deposits, electrolytic effluents from landfills etc.

By this extensive mapping, zones or individual objects are clearly shown as abnormal changes. EMFAD technology has been used successfully under the most different climatic and geological environmental conditions when carrying out measuring work on order. Fields of application have been mainly archaeology, exploration of buried dangerous waste, soil investigation, geology and professional treasure hunting.

Technical information

Microprocessor-controlled measuring process, recording of measurements, measurement carried out at normal walking speed, continuous storage of measured values, high density of measurements, individual measurements very close to each other, very high productivity by measuring up to 50,000 sq. metres per day, depth of localisation up to 12 metres, extensive storage capacity, various software-based options for filtering and presentation, fixing of position and approximate depth of measured anomaly, measured results can be documented, interpretation of measured values possible on site by means of analog indicating instrument.

Probe recording

Accuracy of measurement: 1 measured value per second;
max. number of measured values: 15.000 per area investigated
(measured values remain intact even when unit is switched off)
Range of dynamics: 80 dB (1:10.000)
Power: 2 x 9 V block or rechargable batteries

Data processing

A comfortable Data-processing software for 2D and 3D presentation, interpretation,

modelling, documentation and printing is included.

Interface to standard interpretation software is included (data export).

Questions & Answers

In order to be able to give as many answers as possible to questions of potential users in this various fields of application, we have ased Dipl.-Geophysiker Rüdiger Brede, Technical Director at EMFAD® GmbH.

DTI: Please explain to us the measuring method of the UG 12 system in simple words.

R. B.: The method developed by us of detecting field anomalies can recognise abnormal "unusual" changes in earth by measuring the conductivity of the ground. These anomalies have been caused either because metal meterials like pipes, power lines, barrels, metal waste, but also graves, tunnels, or bunkers had been buried in the ground and, due to this, the normal homogeneous substance of the ground has been changed. Also fill-up of waste dumps emitting electrolytic effluents due to chemical processes in the soil is recognised as an anomaly. Or the anomalies are natural cavities, rock crevices, faults, caves, graves or underground water reservoirs.

The UG 12 system is working without its own transmitter. We are using the electromagnetic spectrum of the long-wave range, which penetrates deeply into the ground with high energy. When these waves meet conductive material in the ground, they produce a so-called secondary field, which is recognised by the UG 12 unit as a "positive anomaly". The very contrary is the case with regard to caves, tunnels, and other cavities in the ground; these are producing a much weaker secondary field than the surrounding ground, so that these changes are recorded as "negative anomalies".

Field strenth of the long-wave transmitters is not the same everywhere on earth; therefore the unit has a band-range scanner for setting the transmitter ranges which are strongest in the area of investigation, in order to make use of their high energy level allowing to obtain maximum possible search efficiency and unambiguous measuring results.

The measured data, stored by the unit, are automatically transferred to the computer or to the display screen respectively after start of the programm, when a cable connection is made between the unit and a PC. The interfaces are prepared to an extent that the data can be read also into other programs. I have in mind 'Excel' or 'Word', so that data can be processed further or can be used for writing reports.

DTI: How is the unit being operated?

R. B.: The UG 12 unit measures 36 * 10 * 10 cm and weighs only about 1,5 kilograms. It works with 2 normal 9V batteries affording continuous operation for about 24 hours. It is also possible to use 9V rechargeable batteries, which, however, are supplying power for about 15 hours only. The unit is switched on by using button 1. By means of scale button 2 the unit is then adjusted for the strongest transmitter range, which can be read from the indicating instrument 7.

The operator than takes position at starting point S1, presses button 3 and walks immediately forward on the search line previously fixed. Each second, an automatic measurement is made. At the end of the search line button 3 is pressed again; the small LED lamps 5 and 6 indicate that the operator has now compleated the search operation and carries out the next search operation in opposite direction S2. Button 4 is pressed when the search operation has to be interrupted, for a pause or to walk around an object in the search path, for inst. a tree. The connection 9 is intended for an external indicating instrument, on which the positive or negative measured values can be read continuously.

DTI: How are the measurements carried out?

R. B.: Firstly, the search task should be clearly defined, then the landscape is to be examined and it is to be determined at which time the area can be searched. Of course, the user of the unit will have made previously many test measurements in order to become acquainted with the working method and, in particular, with the display evaluation of the measurements made.
Making the actual measurement is quite simple - one switches on the unit, looks for the highest strength of field, i. e. the strongest transmitter range, and takes position on the starting point for the area to be examined. Start button 3 is then pressed an one walks forward right away on the first search line (S1), already fixed before, at normal walking speed to the end of the search area as earlier determined. A seconds clock generator in the unit helps to maintain constant walking speed. Now, at the latest, one has to decide, whether one wishes to search the area very accurately or, for the time being, only roughly for anomalies. For accurate measurement, measurements are made at distances of 1 metre (S2), for rough determination measurements can be made at a distance of 5 metres. If the rough measurement indicates that thera are anomalies in the ground, the area can then be searched by making an accurate measurement. The only important precaution is, that the measurements from beginning to the end are made at a consant waling speed. At a later time, the length and width of the searched area are fed into the program. The computer then processes the data automatically and will show the area with real distances on the display screen.

In this connection one more information: It can happen that one wishes to know immediately on the place of search whether there is an assumed anomaly, i. e. perhaps a cave, or a pipeline, or a buried metal object. In that case, one will observe only the measured values, as they appear on the display instrument, measuring this area grid-like wighout specific walking speed.

DTI: How large does the anomaly has to be, that it can be measured and can be recognised on the display instrument or later on the display screen?

R. B.: Firstly, this depends on the strength of the primary fields which exist in the search area. Particularly strong positive secondary fields occur due to agglomerations of metal objects or with individual large metal objects, as, for inst., barrels, cans, ammunition depots, negative fields are caused by medium-large or large caves, passages, and shafts.

With positive anomalies which are caused by metal objects, clear measured values are obtained when the volume in total is at least 60 x 80 cm. On principle, vertical or inclined surfaces produce a much larger secondary field - which is also recorded more clearly - that horizontal surfaces. But also single or several objects of medium size which had been buried can well be measured to be anomalies because of the fact that the ground is more loosely packed, of less density, and also the structure had been altered.

Caves of medium to large size can be recognised very clearly; electric power lines are shown with particular intensity. This shows that small to medium large metal objects and non-metal pipelines of small diameter are not recognised by the unit as an anomany.
At this point I should say something about the illustrations on the measured values which are shown here:

Natural soil is normally homogeneous, it does show hardly any changes and also practically no anomalies. It may be that now and then small rock crevices or caves are recorded, but not more. When measured values of this kind occur, as shown here, these are, indeed, very outspoken changes, very extreme anomalies.

DTI: How can one measure the depth of anomalies?

R. B.: Only in cases, where there is a very significant, i. e. a very substantial changes in the ground, the measured values between 'normal' ground an the anomaly are so different that they are shown later on the display by a clearly visible curve with extrme differences of measured values. The approximate depth is determined from this using a formula which is explained in the operating instructions.

DTI: Does the unit also work when there are metal or concrete slabs on top of the ground?

R. B.: When this involves small areas of a few square metres it does not matter, only with large reinforced concrete surfaces one must expect supression, i. e. attenuation of the measurd values so that possibly no measurement of anomalies is possible below these surfaces.

DTI: What do the different colours mean in the graphs of the search areas recordet?

R. B.: Very pronounced positive anomalies are shown in colours between orange and red, negative anomalies are identified by areas ranging from blue to grey, which areas are also typical for dug-up loose earth, also for graves.

DTI: Which is the maximum depth of exploration for the UG 12 unit?

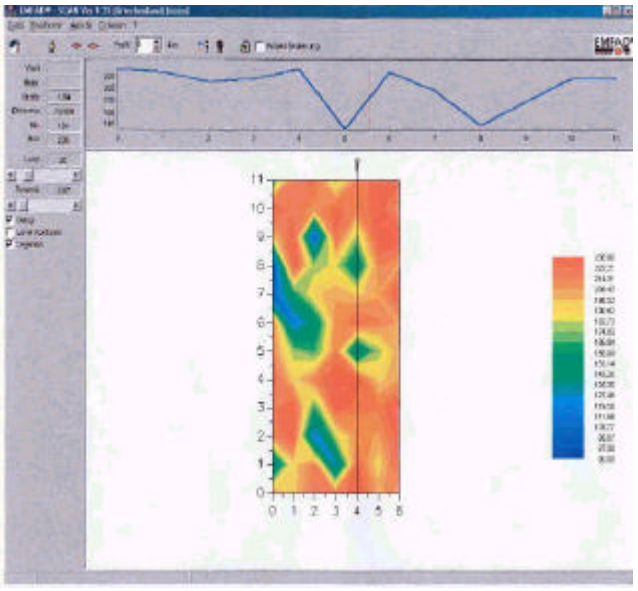
R. B.: We have named the unit UG 12 because we have had so far reliable measured data down to a depth of 12 metres. Theoretically, we could also detect anomalies in greater depth. This depends, as I said before, on the primary fields and the size of the anomaly.

DTI: What additional equipment would be needed for the professional use of the unit?

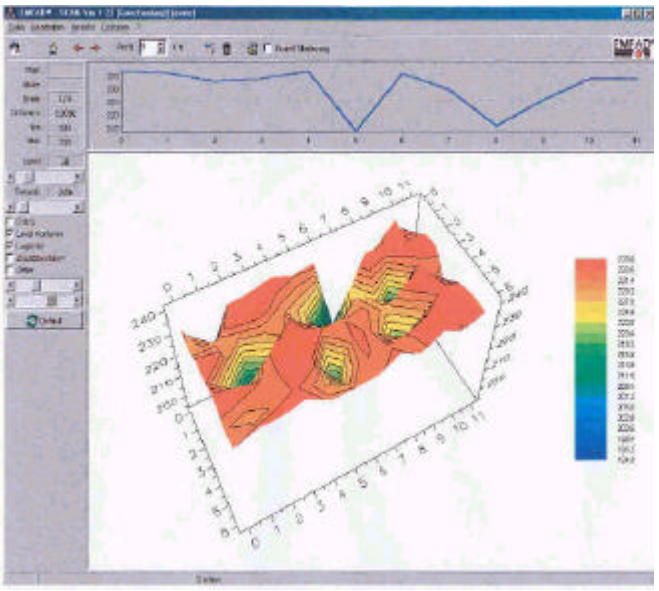
R. B.: In order to display the measured data, which are stored by the unit automatically, a notebook or a PC using operating system Windows 95/98/NT/2000 is required. A simple machine is sufficient, but it should have a disk drive for data transfer. Of course, the unit is supplied with operating instructions and software with instructions in the German or in the English language. The user should know how to operate a computer. When the search is for metal objects, a additional use of a strong detector with a double-antenna system or large coils is recommended.

DTI: Thank you, Mr Brede. This information will certainly help many interested parties to understand the UG 12 system and the new possibilities for exploring the ground below our feet.

Example: Graves in Greece



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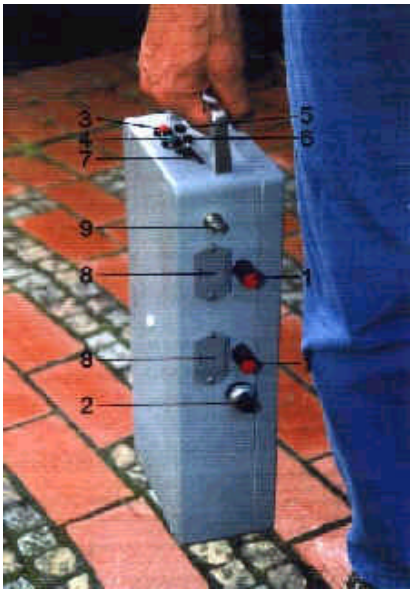
Example: Graves in Greece in 3D

The EMFAD UG12 is small and light. It weighs is only 1,5 kg and dosn't need an antenna.

After measuring, the stored data on the UG 12 must be transferd to a laptop, a notebook or a PC at home. In the computer the data is prepared by a special software und shown as a graphic on the screen.

This photo shows how the operator walks from starting point S1 to the end of the search area and then moves on 2 meters to point S2 and continous back on line 2 in order to take the second measurement. The complete search area is being examined using this 'rectagle' method.





1 - Switches for "On/Off"

2 - Receiver adjustments

3 - "Start/Stop" – button

4 - Button for "delay"

5 - Kontrol - LED for walk direction S1

6 - Kontrol - LED for walk direction S2

7 - Display for transmitter power and batterie status
8 – Batterie

9 - External analog output

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