Sediu social: Bucuresti, Intrarea Aniversarii, nr. 41
Etaj 3. Modul 504, Sector 3
Registrul Comerţului: J40/16201/2005
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GEOPHYSICAL METHODS

Subsurface utility survey

Several geophysical methods can be used to identify subsurface utilities through non-invasive, non-intrusive geophysical investigations. The applicability of this is closely related both to the conditions of the land on which the identification of the utilities is desired, as well as to the investigation depth.

Geophysical methods vary in their effectiveness because of geology, backfill type and homogeneity, utility material type, methods of joining utility “segments,” utility condition, depth, soil moisture, other nearby buried objects, ground surface type and smoothness, ambient noise, surface conditions, stray and/or interfering energy fields, and equipment manufacturers’ biases.

Equipments:

i. Pipe and Cable Locators

vLocPro2 receiver is a high-precision tracking system, designed to meet the needs of utility companies and those of their suppliers. The receiver is equipped with four antennas, which can be switched through several different configurations (modes) to provide different responses to signals emitted from buried metal pipes and buried active electric line.

vLocPro2 lessor

VLocPro2 offers a wide range of frequencies and functions to solve problems encountered in the field.
Entire range of VLocPro2 devices was designed by a team of engineers with many years of experience in designing such kinds of devices. Such a device has the following characteristics:

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- ✓ Construction of ABS & carbon fiber to provide robustness into easy equipment.
- ✓ Dual core processor and color display for a quick and clear response.
- ✓ An intuitive menu system that allows the user to configure only the necessary functions.
- ✓ Over 65 frequencies offered by receiver for an extensive compatibility with other generators.
- ✓ Maximum, minimum, indication left / right and compass directions for efficient localization.
- ✓ Simultaneous display of depth and current at the press of a single button.
- ✓ Continuous real-time display of depth or current (selectable).
- ✓ Rechargeable batteries with alkaline battery back-up which offers latest power supply for the receiver.

Technical Specifications

Frequency ranges
Radio: 15 kHz … 23 kHz
Power network: 50 Hz … 250 Hz
vLocPro Tx: 512 Hz … 83 kHz
Location depth: 0.3 … 4 m
Transmission power: adjustable up to 10 W

ii. Metal detectors – time domanin electromagnetic induction

The **EM61-MK2** Electromagnetic Induction sensor (Geonics Limited, Mississauga, Ontario, Canada) is the most widely used geophysical sensor for metal objects surveys. Like all time-domain electromagnetic induction sensors, it produces a pulsed magnetic field (primary field) that induces a secondary field in metallic objects in the vicinity of the sensor. The decay of this induced field is sensed by monitoring the current in a wire-loop receiver coil in four-time gates after the turn-off of the primary field. In the EM61-MK2, the main receiver coil is co-located with the transmit coil.

Data acquisition is supported by Allegro CX field computer. This allows graphical display in real time for data analysis and quality control.

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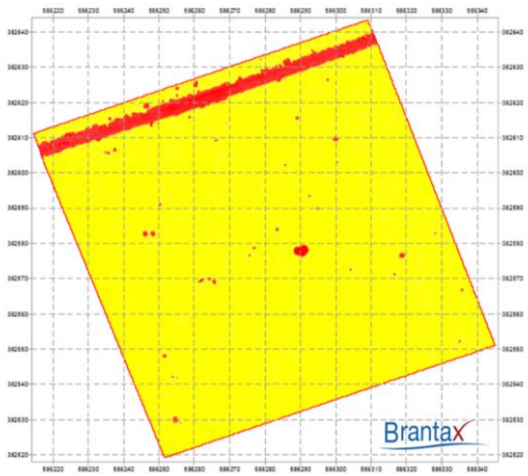
- Electromagnetic equipment EM61-MK2 -

The EM61-MK2 can provide output from four-time gates geometrically spaced in time after the termination of the transmitter pulse. This feature allows discrimination between different types of targets based on the time-decay rate of the response. This discrimination technique works well for simple shaped targets with all three dimensions (x, y and z) being approximately equal, it has also shown to be useful, however, at some military test ranges.

Data resulted from acquisition will be processed with EM61 software. It uses the ratio of the responses of the two receivers to determine the "depth-to-target" approximate, with a high precision for objects with a width of less than one meter. EM61 successful applications include locating underground storage tank, buried metal/metal inserted pipies, hazardous metal waste and unexploded munitions. With its unrivaled resolution, noise rejection outside, depth of exploration and ease of operation and interpretation EM61 is the best choice for detecting buried metal.



Technical Specifications

Measured Quantities: Four time gates of secondary response in mV.
EM Source: Air-cored coil, 1 x 0.5 m size
Current Waveform: Uni-polar rectangular current with 25% duty cycle.
EM Sensors: Air-cored coil, 1 x 0.5 m in size, coincident with EM source.

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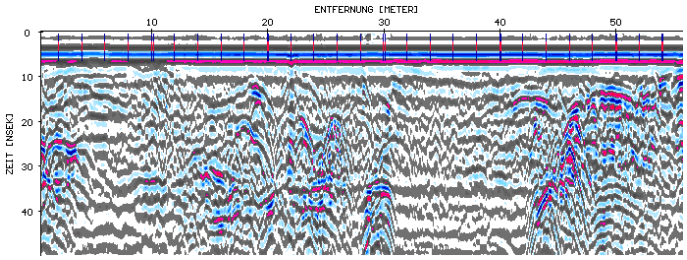
Measuring Ranges: 10,000 mV
Dynamic Range: 18 bit
Data Output: Bluetooth or RS-232 Serial
Power Supply: 12 V rechargeable battery for 4-hour continuous use
Data Storage: 8 GB internal Flash Memory and SD external memory

iii. Ground Penetrating Radar (GPR)

The georadar prospecting method (Ground Penetrating Radar-GPR) is a modern non-destructive, fast and quasi-continuous investigation technology. The domains of applicability of this method are very different: engineering geology, hydrogeology and hydrology, construction and civil engineering, archaeological and environmental protection.

The GPR principle uses electromagnetic wave propagation and image dispersion, identifying changes of the electric and magnetic properties of the soil. Measurements can be made by probing the soil surface. Thus, an image resolution is provided, which is better than those offered by any other geophysical methods, reaching accuracies of the order of centimeters, in proper working conditions. Depth of investigation varies from less than 1 m to 30 m depending on the soil properties on which measurement are performed.

Detectability depends on underground electric and magnetic properties of the subsoil and the used antenna. The quantitative interpretation through GPR modeling can generate data and information such as depth, orientation, measure, forms of buried objects.



As they propagate into environment, the waves are reflected or diffracted by the interface which limit the electromagnetic structures with contrasting characteristics and are delivered to the surface where they are captured by the antenna, then recorded versus time. Measurements

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are made continuously or point by point along the profile. Measurement result is represented as a radargram.

This method has an increased application in industrial environments where the surface is covered with concrete. The georadar signal can be shielded via clay areas and groundwater. The ideal soils are sandy soils and bedrock.

For detecting utilities on large surfaces we use 3D georadar scanning. This method has a high efficency and the data analysis is able to highligt subtle variations. The data processing programs used allow for direct export of results in to AutoCAD, which makes much easier data management.

Note: *The method is applicable if the surfaces to be investigated allow the measuring equipment use and ensures permanent contact between ground and geo-radar antenna. Presence of boulders, vegetation, ponds etc slows data acquisition and distorts the measurements, or makes it impossible to apply.*

The described geophysical measurements are subject to the standards:

- ✓ ASTM: D7046- 11 Standard Guide for Use of the Metal Detection Method for Subsurface Exploration
- ✓ ASTM: D6820-02(2007) Standard Guide for Use of the Time Domain Electromagnetic Method for Subsurface Investigation
- ✓ ASTM: D6639-01(2008) Standard Guide for Using the Frequency Domain Electromagnetic Method for Subsurface Investigations
- ✓ ASTM: D6432-11_Standard Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation