DETECTION & GEOPHYSICS

Making the hidden visible.

FOERSTER

We bring the hidden to light

Worldwide, continents and oceans bear the traces of past civilizations and conflicts: Wars leave their mark in the form of unexploded ordnance and minefields; contaminated sites and industrial wastelands pollute the soil; and sometimes, one even finds the structures of long-ago settlements that can shed light on the societies and cultures of past epochs.

One of FOERSTER's core competencies is the production of ultra-responsive sensor technology that can locate and reveal these relics. The company has developed a wide range of products based on the same principles as those behind Prof. Friedrich Förster's original invention, a highly sensitive fluxgate magnetometer. These innovative instruments meet the exacting quality standards of our customers in the business of detection.

Used as standalone devices or as complete detection systems, these products find application in a wide range of geophysical exploration activities. The measurement data provide you with the foundations for precise localization of contaminated sites or ancient artifacts, and they form the basis for estimating the associated salvage effort. Archaeological treasures can thus be precisely recorded and documented.

Landmine detection

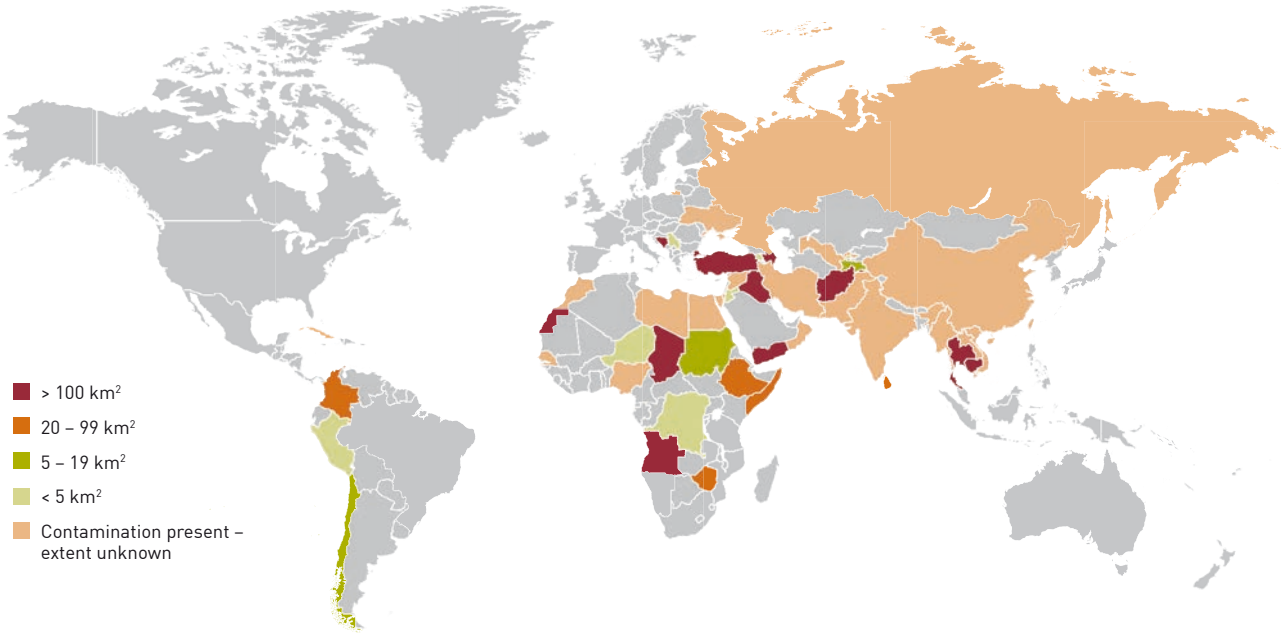
Precisely locate even the smallest metal parts

The "Ottawa Convention," which bans anti-personnel mines, came into force in 1999. It prescribes the destruction of existing stockpiles, a stop to the further production and distribution of landmines, and the clearance of deployed landmines. The treaty obliges the signatory states to support affected countries in mine clearance.

The Convention has since been ratified by 164 states. However, thousands of people – especially children – still die or are critically injured every year as a result of a mine explosion. In Afghanistan, for example, some 10 million mines are said to still be buried.

De-mining is dangerous and demanding work, but FOERSTER devices support you in the search for and detection thereof: The MINEX was developed especially for finding buried ordnance. Even boggy or naturally mineralized, conductive soils can be reliably searched and cleared, allowing contaminated areas to be repopulated and reclaimed for agricultural purposes. Our products are tested and qualified according to international standards, and state-of-the-art microprocessor technology ensures precise analysis of the measurement signals and high detection reliability.

Landmine contamination



Detection of unexploded ordnance & contaminated sites

Identify deeply buried hazards

Even decades after a military conflict has ended, explosive materials are often still found in the ground. Disposing of unexploded ordnance (UXO) entails locating, recovering and destroying these duds. Precise location is essential to safe and effective removal. FOERSTER supports you in this task with a broad product portfolio developed expressly for the detection of bombs.

The “active” metal detectors of the METEX product family and the “passive” magnetometers of the FEREX product family reliably detect buried ordnance at great depths. Data acquisition systems and software for visualizing the signals let you depict and comprehensively analyze contaminated areas and war zones.

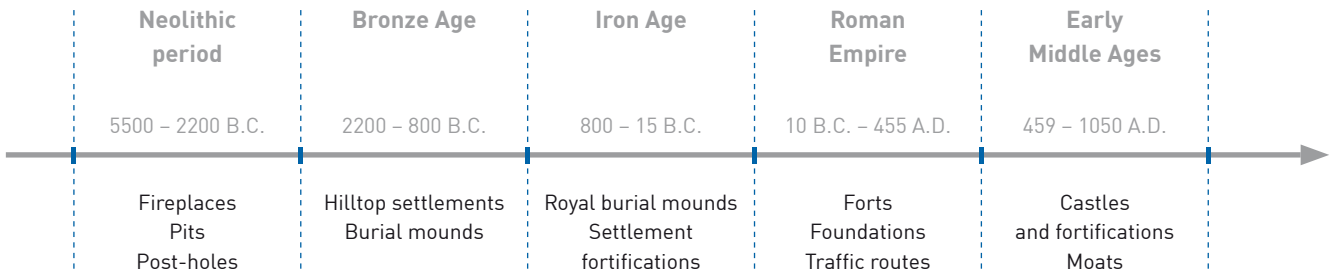
The devices are controlled via optimized and intuitively designed user interfaces, which facilitate the fast and sustainable training of future operators.

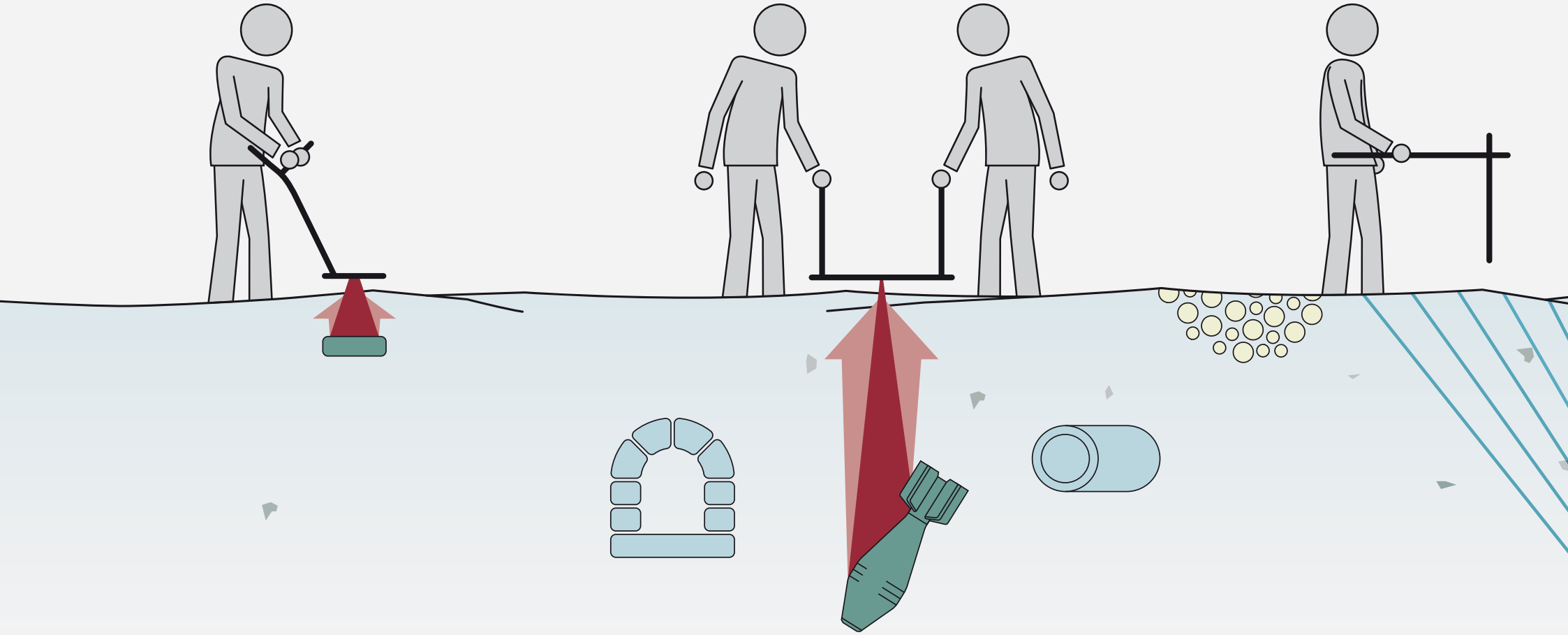
Archaeological exploration

Making historical structures visible

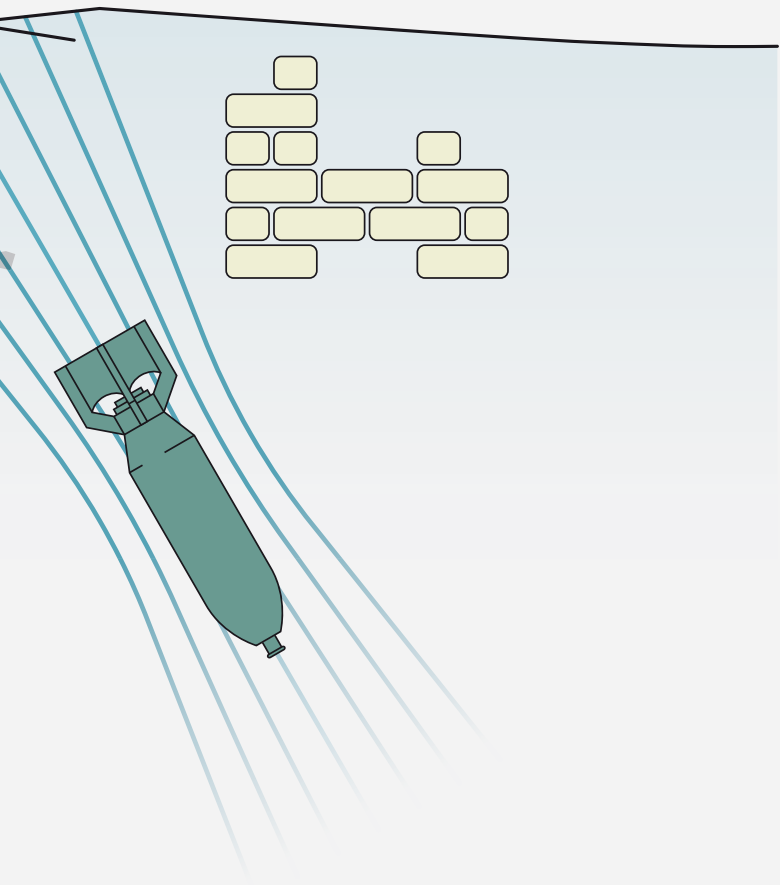
Our ancestors left their mark. Today's soil strata still bear the traces of former settlements, traffic routes and civic life. A geomagnetic survey can bring these alterations in soil structure to light. For just this purpose, FOERSTER supplies ultra-sensitive fluxgate magnetometers and mapping software.

The magnetometers of the FEREX product family are distinguished by their exquisite sensitivity and resolution. They enable the reliable measurement of foundations, trench structures or even prehistoric post-holes. A data logger with high sampling rate can record a network of measuring points with high spatial resolution. Exact positioning via GPS or odometer allows you to display even the smallest anomalies with high resolution. And standardized interfaces make it simple to integrate supplementary sensors into the FEREX system.





Locating objects at different depths



The right detector for the object and its depth

Contaminated sites and unexploded ordnance can usually be assigned typical depths. As a rule, mines are located close to the surface. Over the course of time, however, these can be covered over through environmental effects. The same applies to unexploded cluster munitions and relics from ground battles. Mortar and artillery grenades are usually found in deeper zones, and – depending on their size – bombs dropped from airplanes mostly below that. But later events such as flooding and soil deposition can increase the depth of any of these things.

Archaeological artifacts can be found at even greater depths. Magnetic measuring techniques typically detect anomalies in the upper to middle soil layers, depending on the magnitude of the magnetic contrast between the different material zones. Detection systems contribute greatly to the localization effort, as the position of an article is displayed directly and unambiguously by the detection signal - which is then visualized using appropriate software.

In the field of near-surface detection, active metal detectors based on the electromagnetic induction method (EMI) have proven valuable and effective. The electromagnetic fields emitted by the device induce eddy currents in the metal parts of buried **mines / ammunition**; this generates a secondary field, which in turn is evaluated by the metal detector. Acoustic and optical alerts provide an accurate prospect of the object's position and allow for precise localization. The detection range is affected by the transmitting power, the shape of the antenna, and ground conditions, as well as the type and volume of metal in the target object. Depending on the desired emitted signals, the devices employ either pulse or sinusoidal (continuous wave) technology.

For **items at greater depths**, large loops based on pulse technology are the most suitable. Systems carried by hand or moved by vehicles have a typical range of 3-4 m maximum depth. For things up to 7-8 m deep, passive magnetometers that can sound out ferromagnetic material are better. In general, the objects are detected using an analysis of the Earth's normally homogenous magnetic field; ferromagnetic bodies cause a distortion of the magnetic field. It is this disturbance that is recorded, evaluated and displayed. As with the metal detector, beeps and lights alert the user where the thing lies. Recording systems make it possible to display magnetic anomalies across large areas, and, with the use of appropriate algorithms, to calculate detailed object lists that provide information about the position, size, depth and orientation of the items in question.

MINEX 4.600 – Detection of near-surface objects

The MINEX 4.600 was developed to detect very small, near-surface metal objects. These are mainly the so-called minimum metal or 'plastic' mines. The MINEX is characterized by its robustness and reliability even under tough environmental conditions. A ground learning function for use on uncooperative soils and a military mode that switches off the LED indicators for safe night operation are just two of the useful features.

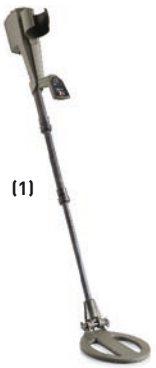
The Double D shaped search coil provides the best pinpointing and detection, even near large metal structures. The MINEX detection device is supplied in a sturdy carrying case and can be further outfitted with customer-specific accessories.

METEX – Large loop metal detectors for medium depths

METEX is an active metal detector for objects at medium depths. The large search coil finds all conductive metals, both on land and in shallow water. Due to its high power output, METEX can locate objects that would not be discovered by conventional mine detectors due to their depth.

The special flexible-coil design of the METEX 4.251 makes it superior to other large-diameter coils. The dismountable coil allows for easy transport in difficult

(1) MINEX 4.600
(2) METEX 4.251



terrain. The coil and control unit are supplied in a sturdy carrying case. The connecting elements are stowed in a specially made backpack.

And the METEX 4.250 also comes ready to use in a robust transport case. The device's rigid coil is designed for safe use in harsh environments. An optional wheel set allows for easy and fast handling by just one operator.

FEREX 4.035 – Detection made simple, even at depth

The FEREX 4.035 is the basic unit of the FEREX product family. Ideal for the location of unexploded ordnance and contaminated sites in any terrain, it can be adapted to your immediate working conditions via different filter modes and sensitivity levels.

The FEREX 4.035 fluxgate magnetometer detects disturbances in the Earth's magnetic field caused by ferromagnetic objects. Due to its higher detection depth compared to EMI detectors, it's also suitable for a wide variety of other applications.

The MG-10-550 probe is characterized by its high sensitivity and minimal noise. Surveying even under high-voltage lines or along fences, pipelines and railway tracks is no obstacle for FEREX: Special filters ensure this.

(3)

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(3) METEX 4.250
(4) FEREX 4.035

Efficient surveying of large areas

Multi-channel data recording, supported by vehicles

The efficient surveying of large areas for objects of interest, either on land or offshore, poses challenges for both the organization of the effort and the equipment required. FOERSTER supplies you with products that can be optimally combined to execute large projects time- and cost-effectively. The principle behind this is the linking together of multiple FEREX detectors to form a multi-channel data acquisition system. The probe carrier systems are available in various designs – from manually moved to vehicle-towed. They can be adapted to the topography of the terrain and thus ensure high productivity with optimum sensor performance.

The hardware, sensor technology and data acquisition are all modular and can be installed on your own carrier system. GPS-referenced data acquisition and precise navigation tools assist you, displaying the exploration results in georeferenced databases and cadasters.

With DATA2LINE, the GIS tool developed by FOERSTER, you can carry out comprehensive, highly detailed work on large-area projects. The work is divided logically into the phases 'project layout & preparation,' 'data acquisition,' 'data analysis & object calculation' and 'documentation.' Your experts can edit the data as required, and it can also be transferred to a common project database. Since DATA2LINE offers various data interfaces, you can also import, display and document data collected via third-party systems.

DATAMONITOR 3 handles the project's framework data and serves as a precise navigation tool for the efficient collection of data in the field. This allows you to divide up complex projects and assign the parts to different data acquisition systems for processing.

FEREX 4.034 – Precisely detect geomagnetic anomalies

With the FEREX 4.034 you can detect geomagnetic anomalies with precision and ease. To cover large areas quickly and reliably, up to four probes can be attached to a single probe holder – optionally with a set of wheels.

GPS support assists you in defining the exploration area and the tracks. A built-in navigation system provides you with valuable information during data acquisition, including current position, deviation from the ideal track and measurement data quality. Initial results are displayed directly on the color screen. The system's significantly improved signal-to-noise ratio and extensive application software also help make your job easier – not to mention its relatively low weight.

FOERSTER MULTICAT 4.850 – Fast screening of large areas

The FOERSTER MULTICAT 4.850 is a robust, non-magnetic trailer for fast and precise probing of large areas. It can accommodate up to eight FEREX probes. The **DATAMONITOR 3** navigation software's open design, which accepts GPS systems of various brands, makes the FOERSTER MULTICAT 4.850 an ideal solution for surveying large swaths of land: You can cover up to 25 hectares of terrain per day at speeds of up to 36 km/h.

(1) FEREX 4.034
(2) FEREX 4.034 with wheel set and GPS system

This leads to a considerable increase in the daily output in terms of the area surveyed. High detection rates can be achieved even under adverse ground conditions, and the trailer's robust build ensures that sensors and cables are always protected from harm.

FEREX PNC – Magnetometer network for large areas

The FEREX PNC probe network controller allows you to build a network of up to 16 FEREX probes. This greatly facilitates the surveying of large areas – both on land and on/under water. The open design, which accepts GPS systems of different brands, in connection with the DATAMONITOR 3 navigation software makes the FEREX PNC probe network an ideal solution for almost any kind of large-scale surveying and detection.

Courtesy of RPS Energy Ltd.

Drone (UAV)

This drone design, qualified by FOERSTER, accommodates up to five absolute magnetometers to detect UXO. The data are acquired with a variant of the DATAMONITOR 3 software built into the UAV's computer. Flight control and measurement data acquisition are both supplied with high-precision position data by an RTK-DGPS. The flight control system uses high-precision sensors for position control, altitude measurement and obstacle recognition – with the necessary redundancies. After use, the measurement data is transferred via USB and can be evaluated and documented using DATA2LINE.

(3) FOERSTER MULTICAT 4.850
(4) FEREX PNC
(5) Drone (UAV)

(3)

(4)

(5)

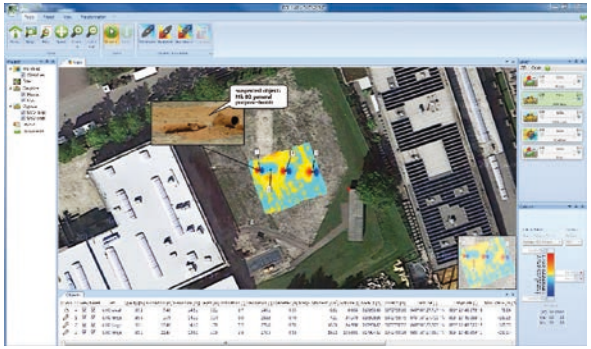
DATA2LINE 4.810 – Bringing the invisible to light

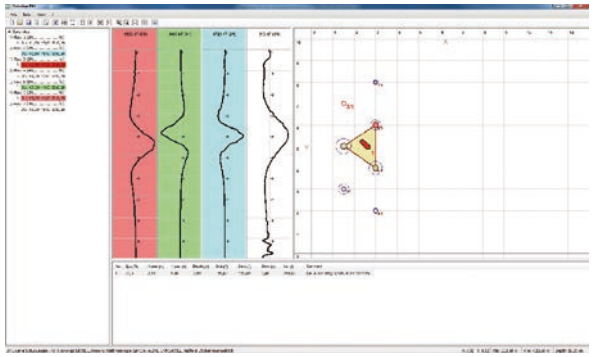
After recording large amounts of data with a FEREX or FOERSTER MULTICAT, the DATA2LINE data evaluation software comes into play. DATA2LINE is a complete solution for the administration, visualization, analysis and documentation of site-specific magnetic measurement data. In addition, you can import documents into the project file and edit them there, so that all critical data is stored together.

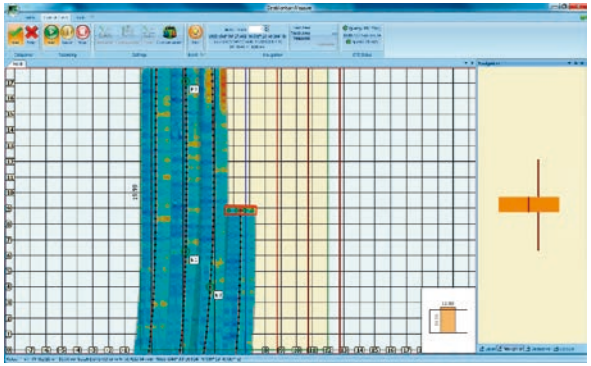
- The **DATA2LINE BASIC** module already contains all the essential functionalities of a GIS system. It enables the user to fully manage and document complex projects. Data import and export, the merging of multiple data sets, geo-referencing, integration of graphical elements, and report generation are the fundamental tasks performed by the software.
- The **DATA2LINE UXO** evaluation module features a very accurate object calculation to determine the position, depth and size of anomalies. This, combined with its ability to manage object lists and to filter measurement data, turns the software into a powerful tool for the investigation of contaminated sites.
- The **DATA2LINE GEO** module extends the program with additional graphic filters for data processing. Originally intended for archaeologists, the module is also a valuable tool for data evaluation in difficult UXO-search situations.
- The **DATA2LINE BM** module evaluates the geomagnetic data recorded in boreholes. This allows you to precisely determine the position, depth and size of magnetic anomalies.

DATAMONITOR 3 – Powerful software for sounding large areas

DATAMONITOR 3 is a high-performance program for navigation, data acquisition and georeferencing of large areas. The software controls all the FOERSTER components during exploration, whether on water or on land. Automatic field division and coordinate export capabilities assist you with project preparations. The software also displays the magnetic field map directly. Navigation takes place along optimized tracks or freely in the field, so you can easily examine large, irregular tracts of land.







Active magnetic inductive methods (EMIs)

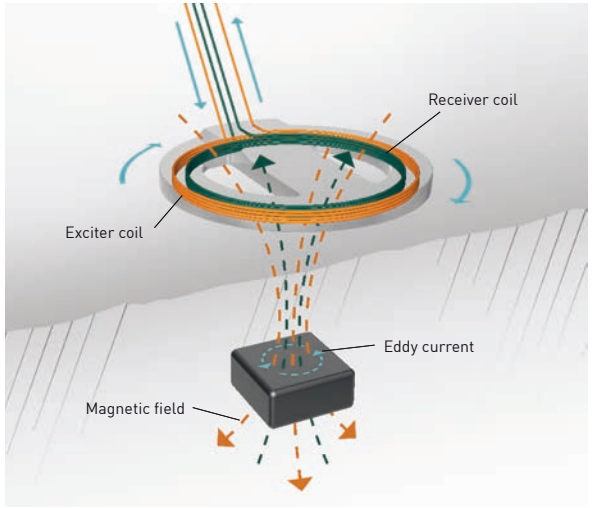
These methods are well suited to the detection of metals. Detection performance depends on the transmission and reception parameters, as well as on the type of metal and the local soil conditions, since the method relies on conductivity and the magnetic permeability properties of the metal. A search coil generates magnetic fields that propagate through the soil, either as single pulses or continuously at one or more frequencies. When metal parts are struck by this magnetic field, eddy currents form, which in turn causes them to emit a secondary magnetic field. The effects of this field are detected and evaluated by the receiving coil of the metal detector. At the same time, interference signals generated in the ground must be compensated for.

The received signals are evaluated and set off acoustic or optical alerts, thus allowing for pinpointing of the metal part. Or, the received signals can be stored for later evaluation using appropriate algorithms. FOERSTER supplies detection systems in both pulse and continuous wave technologies.

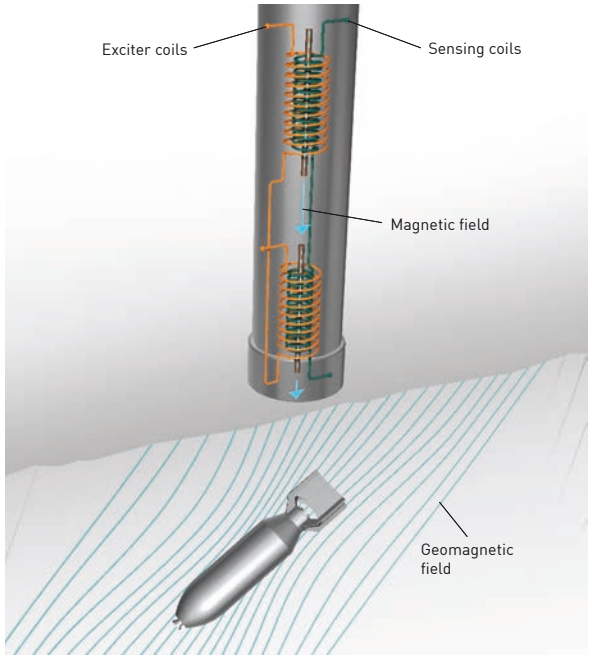
Passive magnetometer methods

These methods are ideal for detecting ferromagnetic metals. Highly responsive passive sensors measure the Earth's homogeneous magnetic field and accurately recognize any disturbances in this field caused by nearby ferromagnetic components. The position, orientation and mass of the metal object are determined by analyzing the anomalies in the magnetic field. These can be recorded or sent as acoustic or optical alerts to the operator, who then uses them to locate the object.

Since soils and infrastructure elements also carry their own magnetic signatures, highly sensitive magnetometers can be used in the context of archaeological and geological surveys. A distinction is made between absolute probes, which display the Earth's magnetic field including possible anomalies, and differential probes, which neutralize the Earth's magnetic field and display only the effect of the magnetic anomaly. FOERSTER supplies highly sensitive (fluxgate) magnetometer probes in both absolute and differential arrangements.



Active magnetic inductive methods



Passive magnetometer methods

Tailor-made detection systems

On land

The extensive range of FOERSTER detection products – the different sensors, network components, positioning systems and software for data acquisition and navigation – can be installed on vehicle-based carrier systems and adapted to the operating conditions at hand. Multi-channel sensor networks and the higher vehicle speeds associated with them can significantly increase productivity without reducing detection effectiveness. A wide range of accessories enables integration with a variety of customer-specific carrier systems.

On water

FOERSTER sensors are supplied in several protection classes, including watertight versions – of course with correspondingly qualified cable and connection technology. Also on water: Multi-channel sensor networks and higher vehicle speeds can significantly increase productivity without reducing detection performance. The data acquisition software can be implemented on the vehicle's own computer and the sensors connected via standard interfaces.

In the air

Weight-reduced magnetometer sensors with low power consumption form the basis for drone-based detection systems. The modest payload allows for long operating times and thus high productivity. Absolute magnetometers offer excellent measurement sensitivity, making it possible to reliably detect smaller ammunition objects even from low-to-medium flight altitudes. These systems are very advantageous in areas that are otherwise difficult to access or when operating under extreme weather conditions.

Courtesy of RPS Energy Ltd.

Product training – theory & practice

Detection training field – Putting what you've learned into practice

So that you can try out the detection devices in an environment as close to real life as possible, we've set up a special training field about a hectare in size. This is perfectly suited for practicing the theoretical and device-specific learnings in realistic exercises. Using an underground tube system, detection objects are placed in defined positions in the ground; these must then be located with the appropriate search device. Different soil conditions simulate various usage sites around the world, so that handling the detectors feels as real as possible. All terrain points and positions are georeferenced.

At FOERSTER, not only do we integrate the terrain training into our seminars, we also offer use of the field to other companies and organizations. It provides unique test possibilities: You can even devise your own scenarios. Thusly trained under expert guidance, specialists can immediately apply their new knowledge to anchor it in practice.

Tailor-made training courses

We offer many types of training – from standard courses for operators to training for trainers through to seminars for the maintenance and repair of your FOERSTER products. Naturally, the courses can be adapted to your specific needs and coordinated thematically; they take place either at the FOERSTER headquarters in Reutlingen, Germany, or (on request) directly on your premises. Trainers who are either FOERSTER experts or certified by FOERSTER ensure optimal knowledge transfer. Plus, we offer training in several languages, so you get the most benefit from the courses and are ready for immediate use of your FOERSTER products.

FOERSTER

Institut Dr. Foerster GmbH & Co. KG
In Laisen 70 | 72766 Reutlingen | Germany
+49 7121 140 312 | sales.ds.de@foerstergroup.com

foerstergroup.com

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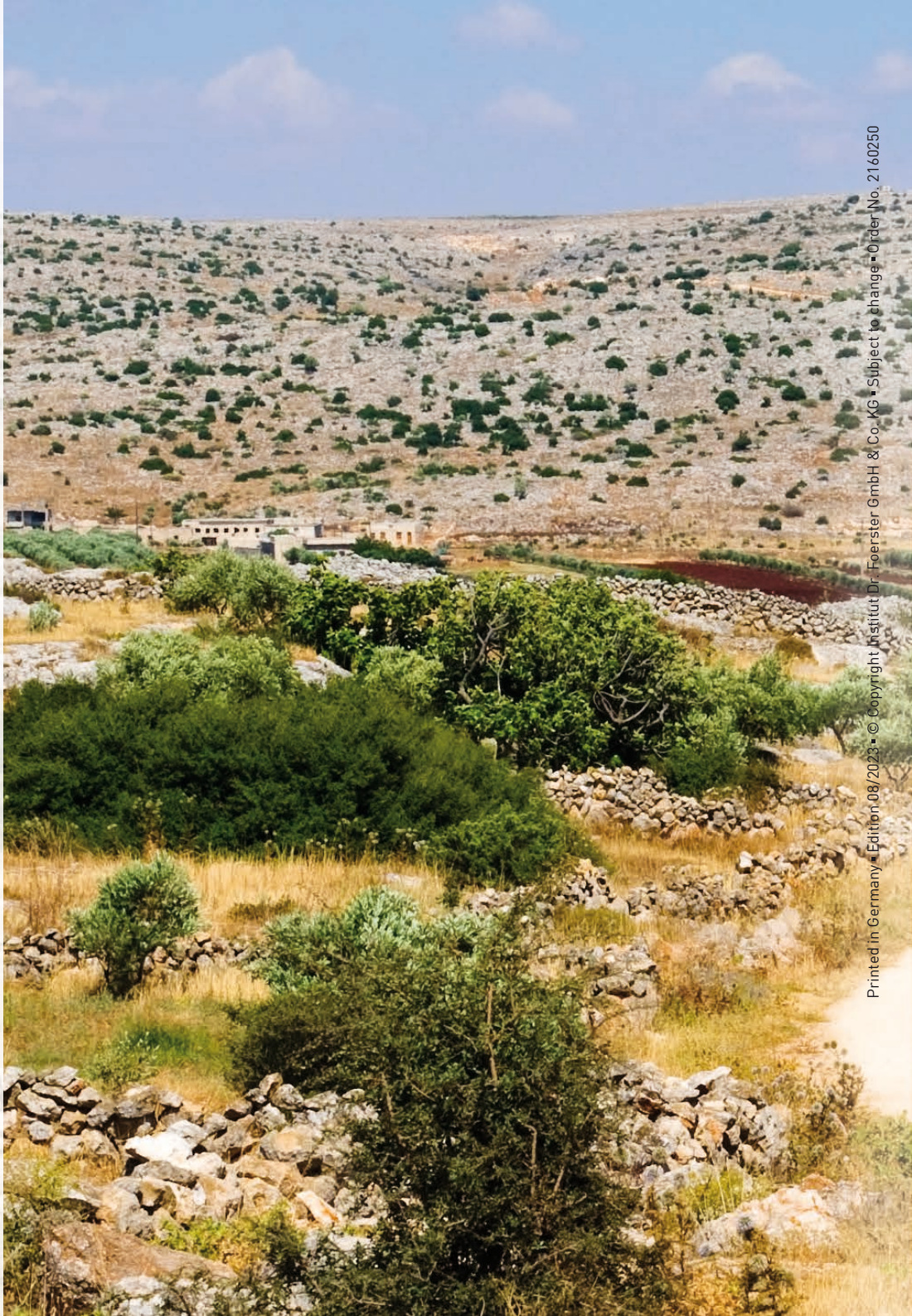

Printed in Germany ▪ Edition 08/2023 ▪ Order No. 2160250