

Metal Detectors Catalogue

2003



Metal Detectors Catalogue 2003

**Geneva International Centre for
Humanitarian Demining
Centre International de
Démunage Humanitaire - Genève**



The **Geneva International Centre for Humanitarian Demining** (GICHD) supports the efforts of the international community in reducing the impact of mines and unexploded ordnance (UXO). The Centre is active in research, provides operational assistance and supports the implementation of the Anti-Personnel Mine Ban Convention.

At the suggestion of the Geneva International Centre for Humanitarian Demining, the **German Federal Foreign Office** agreed to fund the compilation of a catalogue of mine detection equipment. This is the first edition of what is intended to be an ongoing series of publications aimed at assisting the field users to understand the equipment available to them.

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Metal Detectors Catalogue 2003, GICHD, Geneva, February 2003.

ISBN 2-88487-009-1

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The description of the detectors and the test results expressed in this catalogue are those of the manufacturers. They do not necessarily represent the views of the Geneva International Centre for Humanitarian Demining (GICHD) or the Government of Germany. The views expressed in this publication are otherwise those of the GICHD and do not necessarily represent those of the Government of Germany. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Government of Germany or the GICHD concerning the legal status of any country, territory or area, or of its authorities or armed groups, or concerning the delimitation of its frontiers or boundaries.

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Acknowledgements

This report was researched and written by Lieutenant-Colonel Johannes Dirscherl, Mechanical Studies Specialist, GICHD, with support from the GICHD Study Group. The report was laid out for publication by Françoise Jaffré.

All photographs have been provided by the respective manufacturers.

Foreword

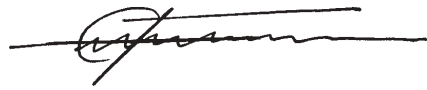
Despite efforts to develop alternative methods and technologies, manual clearance remains the most versatile and widespread technique in humanitarian demining. This is not likely to change in the short and medium term. Worldwide, thousands of metal detectors are used daily in clearance operations. Metal detectors have thus captured a comparatively large segment of the equipment market. This, and a military requirement for metal detectors, has resulted in a variety of models offered by many different manufacturers. Between a myriad of detector models, it is, however, difficult for demining organisations to keep track of models, features, capabilities and empirical experience.

This catalogue includes most of the metal detectors currently in use. The operating functions of each system are explained in general terms and a table of technical specifications is provided. Not all manufacturers have provided information for this catalogue. Some detector models deployed on demining operations are therefore not included in this publication. The GICHD believes that the selection of detectors featured in the catalogue reflects the broad range of detectors available in the market to mine action programmes.

Ground and field conditions vary considerably. Good metal detection capabilities are essential for deminers. Discrimination between landmines and mineralised soil is equally important. Tough field conditions in mine-affected countries — areas where basic infrastructure is typically poor — determine that detectors should be robust and easy to handle and repair. These key issues have all been addressed in this catalogue. The level of information may, however, vary between models, as a result of varying feedback from manufacturers and demining organisations.

The catalogue is also available on CD-ROM and online, on the GICHD website (www.gichd.ch). This edition reflects the detector market in February 2003. Some models may have been upgraded recently and the changes may not be reflected in this edition. Information about detector upgrades and new models will, however, be published on the GICHD webpage.

The GICHD would like to acknowledge and thank the Government of the Federal Republic of Germany for its generous financial support to this project.



Ambassador Martin Dahinden
Director
Geneva International Centre for
Humanitarian Demining

Section 1

Hand-held detectors

CEIA MIL-D1

CEIA, Italy



MIL-D1 in operation



Transport case

Hand-held detectors!

General description

The well proven **MIL-D1** is a portable, high-sensitivity metal detector designed to detect all metals in conductive and non-conductive soils, including laterite. The metal detector consists of a detection head, a telescopic handle, an electronics unit, a canvas carry-bag and a high-impact polypropylene case. The detection head is light, and the wiring is protected from any damage. The electronic unit can be carried over the shoulder, attached to the belt, or as an integral part of the telescopic handle. It is stated by the manufacturer that the MIL-D1 metal detector does not require any daily manual calibration; optimum sensitivity is ensured over all types of terrain due to CEIA's Automated Soil Compensation System. The detector is manufactured in compliance with the ISO-9001 standard, and has been designed to satisfy the most stringent operational requirements for both humanitarian and military demining.

CEIA offers a single, proven state-of-the-art model (MIL-D1) optimised to provide comprehensive detection capability across the entire spectrum of metals and soil types.

A backlit LCD display on the control panel is available as an option.

Hand-held remote programmer allows for MIL-D1 flash memory upgrades under any conditions. MD Scope software for PCs is available for troubleshooting and annual verification of MIL-D1 calibration.

Working methodology

Localisation of metal objects is optimised by a two-tone audible pinpointing system, which allows the position of the detected mass to be identified accurately. When the metal detector approaches a metal mass, the system produces a signal of acoustic intensity proportional to the metal mass. The metal mass is pin-pointed at the position of the centre of the search head at the moment in which the audible signal tone changes.

Audible signal is transmitted either through an internal speaker or external monoaural headphone.

CEIA's Automated Soil Compensation System ensures an above-average sensitivity in all types of soil. The detector, during soil compensation (conducted prior to the search operation), uses digital

processing of the electromagnetic response from the target soil to determine the most effective strategy. The presence of water does not affect the performance of the detector. Soil compensation capability covers all different soils.

Power supply

- 4 x 1.5V alkaline batteries or 4 x 1.2V Ni-MH rechargeable batteries (available on request);
- 65h with alkaline batteries at 20°C;¹
- 50h with alkaline batteries at 5°C;¹
- 35h with Ni-MH rechargeable batteries (7000 mA) at 20°C.

Detectors in use to date

The detectors are in service with various humanitarian aid organisations, commercial mine clearance organisations and armed forces in the following countries: Afghanistan, Croatia, Denmark, Djibouti, Egypt, Ethiopia, Finland, France, Italy, Lebanon, Mozambique, Namibia, Spain, Sudan, Sweden, Switzerland, Thailand, Turkey, the U.S., Venezuela and Yemen.

Factory support

- The proposed spare parts package is arranged in accordance with a life cycle management study and CEIA experience as the original manufacturer;
- An extensive programme is available for both operators and maintenance personnel;
- Factory based training is included in the purchasing package;
- Instruction manuals and documentation are provided in Arabic, English, French, Italian, Portuguese, and Spanish. Other languages available on request;
- The standard warranty is two years. Extended warranty periods can be arranged on request; Comprehensive factory follow-up includes services via Internet contact, mail and personal contact;
- On-site training, supply of training aids, diagnostic software, portable remote programmer. Other services provided by the manufacturer include software upgrading, comprehensive technical assistance, mine simulant study and manufacturing.

Maintenance and support

The detector is considered user-friendly and the customer can completely maintain the equipment. It is not necessary to return the unit to the factory for troubleshooting or verification of calibration. MIL-D1 electronics board is based on full digital technology, which means there is no requirement to trim or refine the performance using laboratory equipment.

Test and evaluation

- The MIL-D1 has been subjected to extensive testing (in terms of reliability and capability of detection) by UNOPS, Departments of Defence and humanitarian demining organisations.
- The detector went through the following comparative trials: UNDP/UNOCHA test Afghanistan September 1999 - March 2000; Gruppe Rüstung (Swiss Army), August 2001; UNOPS test Afghanistan, February - March 2002.

Reported limitations and strengths

Limitations

- The test reports mentioned above do not point to major limitations.

Strengths²

- Far above the average detection rate.
- Ease of operation.
- Ease of maintenance.

1. Gruppe Rüstung, *Technische Erprobung von Minensuchgeräten*, Pieren Jakob, FS 263, Beilage 1, p. 2.

2. UNOPS, *Summary of Metal Detector Trial Report*, February - March 2002

Ebinger EBEX® 420 H-Solar

Ebinger GmbH, Germany



The EBEX® 420 H with its integrated solar panel

General description

The hand-held mine detector **EBEX® 420 H** is an evolution of the well-proven EBEX® 420 and was designed at the request of the HALO Trust to support their One Man One Lane drill in mine clearance. It is a single piece tool without external boxes or cables.

Main characteristics:

- The equipment is designed for easy assembly and operation;
- Highly sensitive to minimum-metal mines like the MAI 75 and R2M2;
- Little user maintenance is required;
- Powered by solar panel.

Working methodology

The EBEX® 420 H applies the very sensitive Ebinger sine wave system and detects metal components including wires by an electromagnetic field of low frequency. A special effort was made to achieve a good resolution of several mines buried at close distance to each other or to other interfering metal. The new EBEX® 420 H metal detector was designed for the location of landmines containing only a minimum amount of metal, or buried UXO. The detector electronics was fully integrated into the handle. EBEX® 420 H can be used in a short mode of approximately 0.6m length for searching in the prone position. For use in the standing position an extension rod takes the detector length to 1.2m. Its simplicity in operation and the absence of cable-linked components make it ideal for the one operator clearance drill.

Detectors in use to date

The EBEX® 420 H is in service in 26 nations including: Afghanistan, Angola, Cambodia, El Salvador, Guatemala, Kuwait, Lebanon, Mozambique, Nicaragua and Somalia.

Since 1998, more than 2,100 units of EBEX® 420 H have been sold. This detector is in use with various humanitarian demining organisations, the United Nations and many other commercial companies.

Power supply

- The EBEX® 420 H is powered by 1 x 9V U9VL LR61 or alternative; rechargeable battery 9V LR61;
- Operational life of battery (1 x 9V alkaline 600mAh): approx. 45h¹ (without solar radiation);
- Operational life of battery pack (9V 110mAh): approximately 20h¹ (without solar radiation).

Factory support

- All detectors are covered by a 24-month warranty. The worldwide service network ensures permanent availability of spare parts;
- Operation and maintenance training is provided at Ebinger facilities or on site;
- Additional factory support by specially trained staff is provided on request;
- Instruction and maintenance manuals are available in Arabic, English, French, German, Italian, Russian and other languages available on request.

Maintenance and support

- There are no special requirements for the technicians or the workshop facilities. Most repairs can be carried out by Ebinger-trained staff on site.
- The step by step explanation of the manuals ensure easy maintenance of the system.

Test and evaluation

The detector went through comprehensive internal tests. Reports displaying the performance can be provided by the manufacturer on request.



EBEX® 420 H in operation

Reported limitations and strengths

The system is in service for several years, however it has not been tested in comparative trials. Therefore, no statement regarding known limitations and strengths can be given.

1. According to the manufacturer.

Ebinger EBEX® 420 PBD

Ebinger GmbH, Germany



General description

The **EBEX® 420 PBD** is a modular, easy to use equipment, which is in daily use in Afghanistan, Angola, Bosnia and Herzegovina, Cambodia, Georgia, Mozambique, San Salvador, Viet Nam and Zimbabwe, and other heavily-mined countries. The detector design eases logistics and maintenance, allowing fault identification and cure without tools and advanced training.

Main characteristics:

- The equipment is designed for easy assembly and operation;
- High sensitivity enables to detect low metal content mines;
- Good adaption to conductive soil, good pinpointing and fast work progress;
- The equipment's large dynamics in the audio alarm system helps operators to discriminate small from large metal items;
- The equipment's audio control pulses indicate the battery condition. Audible confidence clicks inform operators that equipment is functioning correctly;
- The equipment operates on a dynamic search mode;
- The equipment widely filters interference from conductive ground or salt water;
- Little user maintenance is required, saving time and expense.

Working methodology

The hand-held mine detector EBEX® 420 PBD is the pulse induction version of the well-proven EB 420. It was developed in cooperation with military personnel serving in the United Nations and humanitarian mine clearance operations around the world, to suit large scale mine- and battle area clearance in adverse conditions requiring only minimal training and logistic support.

The detector operates with the dynamic Ebinger pulse induction system. Its search head sends out short magnetic pulses which cause conductive targets to respond with an electromagnetic echo field which is detected and transduced into an audible signal. These signals depend in intensity and characteristics on the size and distance of the detected target. The dynamic search mode adapts the detector to homogeneous soil interference and provides a good resolution between several targets buried at close distance.

The EBEX® 420 PBD metal detector was designed for the location of low metal content mines and for the detection of UXO buried in undergrowth or underground. Its simplicity of use by one adjuster makes it ideal for use in adverse conditions or in difficult operations. It is lightweight with the electronics integrated into the handle.

This negates the need for cables and additional control boxes or a battery compartment and the detector can even be operated with a loudspeaker. The EBEX® 420 PBD can be operated in a short mode of approximately 1m for search in the prone position or in the extended version of 1.6m when used in the standing position. Its large dynamics and wide adjustability will facilitate the suppression of interference from conductive ground.

Detectors in use to date

Since 1995, more than 5,000 units of EBEX® 420 PBD have been sold. This detector is in use with various humanitarian demining organisations, the United Nations and many other commercial companies.

Power supply

- The EBEX® 420 PBD is powered by 6 x 1.5V C-cell or alternative; rechargeable battery pack 3,8 Ah/12V;
- Operational life of battery (6 x 1.5V alkaline 8Ah): approx. 50h¹,
- Operational life of battery pack (12V 3.8Ah): approx. 35h.¹

Factory support

- All detectors are covered by a 24-month warranty. The worldwide service network ensures permanent availability of spare parts;
- Operation and maintenance training is provided at Ebinger facilities or on site;
- Additional factory support by specially trained staff is provided on request;
- Instruction and maintenance manuals are available in Arabic, English, French, German, Italian, Russian, and other languages on request.

Maintenance and support

- There are no special requirements for the technicians or the workshop facilities. Most repairs can be carried out by Ebinger-trained staff on site;
- The step by step explanation of the manuals ensure easy maintenance of the system.

Test and evaluation

The detector passed several tests: UNAVEM III Demining School – Commander (Memorandum) 1996; International Detector Test UNADP Mozambique, December 2000; European Commission Directorate General JRC², March 2001.

Reported limitations and strengths

The detector went through various trials, however there is no general scientific evidence regarding its detection performance under different soil conditions or other key qualities.

It showed the capability to detect a VPROM1 with a sufficient safety margin at all angles.²

1. According to the manufacturer.

2. M. Fernandez, A. Lewis, F. Littmann, *PROM 1 Anti-personnel landmines - Probability of activation by physical contact with a metal detector*, Special publication No. I.01.29, European Commission Directorate General JRC Joint Research Centre Institute for Systems, Informatics & Safety, Ispra, March 2001.

Ebinger EBEX® 421 GC

Ebinger GmbH, Germany



General description

The **EBEX® 421 GC** is a modular, compact, lightweight, battery operated, hand-held metal detector which is suitable for all kinds of demining operations. The modular design allows for each component to be interchangeable with other detectors of the same “family” and each component can be ordered individually. The EBEX® 421 GC is the enhanced version of the well-known EBEX® 420 GC. The system is able to detect mines with minimum metal content with high reliability and can be used in both shallow fresh or salt water.

The rugged design qualifies the detector to be used under all climatic conditions.

Main characteristics:

- The equipment is simple to set up and easy to operate;
- The equipment can compensate unhomogeneous laterite or mineralisation maintaining high detection sensitivity;
- The equipment’s large dynamics in the audio alarm system helps operators to discriminate small from large metal items;
- The equipment’s audio control pulses indicate the battery condition. Available confidence clicks inform operators that equipment is functioning correctly;
- The equipment operates on a dynamic search mode;
- The equipment widely filters interference from conductive ground or salt water;
- Little user maintenance is required; thus saving time and expense.

Working technology

The EBEX 421 GC uses bipolar pulse induction for detection and is designed to operate in high metallic soils by including a soil compensation feature.

No further detailed information is given by the manufacturer.

Detectors in use to date

Since 1998, more than 2,500 units of EBEX® 420 GC have been purchased. This detector is in use with various humanitarian demining organisations, the United Nations and many other commercial mine clearance organisations.

Hand-held detectors

Power supply

- The EBEX® 421 GC is powered by 8 x 1.5V C-cell or alternative; rechargeable battery pack 3,8 Ah/12V;
- Operational life of battery (8 x 1.5V alkaline 8Ah): approx. 20h;¹
- Operational life of battery pack (12V 3,8Ah): approx. 10h.¹

Factory support

- All detectors are covered by a 24-month warranty. The worldwide service network ensures permanent availability of spare parts;
- Operation and maintenance training is provided at Ebinger facilities or on site;
- Additional factory support by specially trained staff is provided on request;
- Instruction and maintenance manuals are available in Arabic, English, French, German, Italian, Russian, and other languages on request.

Maintenance and support

There are no special requirements for the technicians or the workshop facilities. Most repairs can be carried out by Ebinger-trained staff on site.

The step by step explanation of the manuals ensure easy maintenance of the system.



Workshop in Mozambique, local demining personnel repairing mine detectors

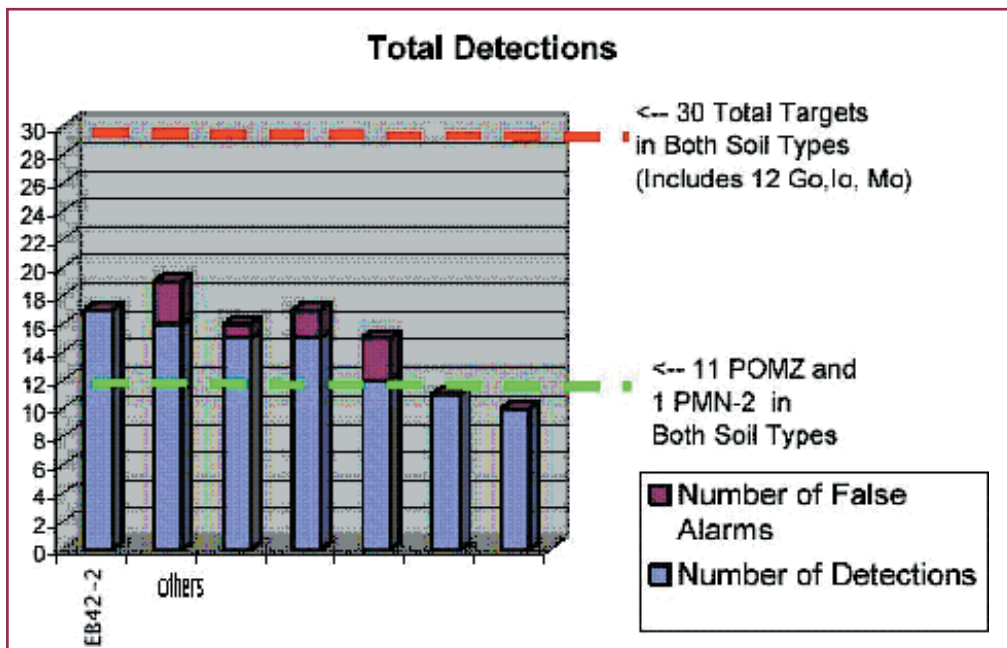
Test and evaluation

The detector went through comprehensive internal and comparative tests (in terms of reliability and capability of detection).

Due to the identical working methodology and technical specifications the EBEX 420 and 421 GC do not differ from each other in terms of capability of detection.

Tests passed by the detector (EBEX 420 GC) include:

- Nicaraguan Field Test Report, 2001 (EBEX 420 GC);
- International Pilot Project for Technology Cooperation (IPPTC), 2001 (EBEX 420 GC);
- International Detector Test, UNDP Yemen, 2002;
- UN Mine Action Programme Afghanistan, February - March 2002 (EBEX 420GC);
- U.S. Department of Defense Humanitarian Demining Research and Development Program, Nicaraguan Field Test Report, October 2001, p. 15.



Nicaraguan Field Test Report, October 2001.³

Reported limitations and strengths (related to EBEX 420)²

Limitations

- Poor range of length adjustment.
- Front heavy in long configuration.
- Soil compensation adjustment screw is unlabelled and difficult to use.

Strengths

- Good auditory output devices – volume control on headset and external speaker (optional).
- Easy set up and operation.
- Rugged and waterproof.

1. According to the manufacturer.

2. Y. Das, J.T. Dean, D. Lewis, J.H.J. Roosenboom, G. Zahaczewsky (eds), *A multi-national technical evaluation of performances of commercial off the shelf metal detectors in the context of humanitarian demining*, International Pilot Project for Technology Co-operation, Final report, European Commission, Joint Research Centre, Ispra, Italy, 2001, p. 64.

3. DoD Humanitarian Demining Research and Development Program, *Handheld Metal Detectors - Nicaraguan Field Test Report*, October 2001, p. 15.

Foerster MINEX 2FD 4.500

Institut Dr. Foerster, Germany



General description

The **MINEX 2FD 4.500** is a metal detector working on the continuous-wave EMI principle with two parallel frequencies. Production started in early 2000 and the detector is being used in a variety of demining scenarios with army and police forces, NGOs and commercial companies. One of the MINEX's most obvious features is its one-piece design. The manufacturer claims that this provides speed of operationalisation, very low and precisely-balanced weight, high mechanical durability, and a minimum of potential mechanical "weak points" such as cables or plugs.

A drill-safe telescopic bar with fast-lock clips keeps the search head in its chosen position.

The MINEX 2FD 4.500 is equipped with a push-button for a ground-learn procedure to ensure adaptability to all soil conditions. Under special circumstances, the internal electronics can be adapted and optimised for search in a particular area over longer periods. The detector adapts itself to the consistency of the soil upon which the system is operating.

Safety considerations strongly influenced the MINEX development. An audible alarm informs the operator of any malfunction. Low battery level is indicated by a red LED, guaranteeing hours of safe work without any loss of sensitivity. When remaining battery life reaches a critical point, an additional audible alarm is activated. Double safety is ensured by a steady ticking sound during operation. The search head does not need to be moved in order to get a signal — keeping the head motionless over an object will not result in a drop of the signal level.

A number of other, less obvious, features are included to optimise user safety. As the detector covers a variety of different frequencies, all metals can be found with approximately the same sensitivity. Further, the preset sensitivity will be maintained, even if the soil is compensated. The electronics are programmed not to modify the sensitivity level without the user's knowledge.

Working methodology

The MINEX 2FD 4.500 provides three possible sensitivity settings, which are placed on the back of the detector, allowing a supervisor located behind the user to identify the chosen setting. Working on a non-dynamic principle, there is no minimum speed for coil movement.

The gradiometric arrangement of the search coil indicates metallic objects with a switching sound when the centre of the coil passes over them. As a direct result, it is possible to pinpoint objects exactly, to distinguish objects located very closely together and to work beside large metallic objects, such as fences, railways and gates.

As an example, minimum metal mines located in a horizontal distance of about 10-15cm from each other can still be separated and localised. The only steady background noise is an unobtrusive control tick.

Water, both salt and fresh, does not influence the MINEX's detection capabilities. Different soil types can be "learned" on-site with a simple push button. This ensures that the detector is adapted to the specific soil without choosing and using preset soil types.

Power supply

The MINEX 2FD 4.500 is powered by three 1.5V D-cells. Rechargeable batteries can be used, indicated operating times varying depending on their quality and age. Under all circumstances, the sensitivity and detection quality is not influenced by the battery conditions.

Battery consumption depends on a couple of factors. At 20°C, the detector can be operated continuously for some 30h. At a normal operating rhythm (two four-hour sessions per day) total operating time is around 50h. Under most circumstances, a single set of batteries ensures sufficient supply for a working week.

Detectors in use to date

- In service since early 2000, the MINEX 2FD 4.500 is mainly in use in the following countries: Afghanistan, Australia, Austria, Croatia, Denmark, Egypt, France, Guinea-Bissau, India, Mozambique, Oman, Portugal, Spain, Switzerland, Tunisia, the U.S., and Viet Nam.
- The previous version MINEX 2FD 4.400 with identical technological features has been in field use since 1991.



2FD 4.500 in operation

Factory support

Spare parts are available exclusively from Foerster. The rechargeable batteries used for the MINEX can be purchased on the open market.

Besides the direct support from Foerster, Germany, the company provides a worldwide network of representatives in over 40 countries, most of them offering comprehensive after-sales service. Besides offering training on the customer's site, Foerster provides test and training areas at their facilities in Reutlingen, Germany. These places are equipped to offer training conditions for UXO- as well as mine-search under a variety of scenarios. A full training programme for trainers including lessons on background knowledge with various training material is available in English and German.

On request, training forms part of a purchasing package. Standard manuals and service documentation are available in English, French, German and Spanish — other languages can be provided on request.

Foerster addressed different soil scenarios by offering a modification of the electronics for the exclusive search in a particular area over longer periods. Furthermore, programmes for soil compensation are in preparation.



MINEX 2FD 4.500 in transport case

Maintenance and support

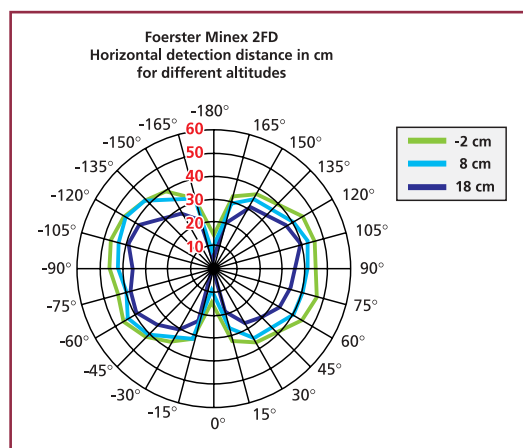
The MINEX maintenance system is organised on two levels: level one, basic field maintenance, and level two, workshop maintenance.

Workshop personnel must have a basic knowledge of mechanic and electronic repairs, such as experience with soldering. Foerster can supply complete toolsets and testing equipment as well as service training. Fully-equipped workshops with trained personnel are able to handle all repairs down to the level of the factory's own final assembly.

Test and evaluation

Foerster performs tests within its own facilities, mainly for research and quality control. For the most part, the tests are performed as far as possible under "real" conditions. This includes the targets (mines and UXO) as well as the circumstances (soil, disturbing influences, etc.). The results, which form an important part of the current research, are not available publicly. Nevertheless, the Foerster training site offers the possibility for interested customers to see the equipment working under these conditions.

The MINEX 2FD 4.500 formed part of various independent tests — the results are partly available from open sources as well as directly from Foerster. For example: Test UNDP (UN Accelerated Demining Programme) Mozambique, 2000; Test International Pilot Project for Technology Cooperation (IPPTC), 2000/2001; United Nations, Afghanistan, 1999/2000; Gruppe Rüstung (Swiss Army), 2001. As a result of these tests, the detector was recommended by the Swiss Army for humanitarian demining.



Horizontal detection distance of MINEX 2 FD 4.500 (see JRC test, March 2001).

Known limitations and strengths:

Limitations

- The detector showed regions of reduced sensitivity in front and behind the search head (see figure above).²

Strengths

- Dual tone assists target pinpointing.¹
- Good harness.¹
- Good transit and field case.¹
- One-piece design.

1. These test results are derived from the International Pilot Project for Technology Cooperation (IPPTC) test where the previous model MINEX 2 FD 4.400 was tested (March 1999-June 2000, Annex A, p. 72). The design has changed but the technical specifications are identical.

2. M. Fernandez, A. Lewis, F. Littmann, *PROM 1 Anti-personnel landmines - Probability of activation by physical contact with a metal detector*, Special publication No. I.01.29, European Commission Directorate General JRC Joint Research Centre Institute for Systems, Informatics & Safety, Ispra, March 2001, see p. 16.

Geophex GEM-3

Geophex, USA



General description

Geophex introduced the **GEM-3** in 1997 mainly as a broadband electromagnetic metal detector and discriminator for buried UXO. The sensor has been commercially available since 2001.

The GEM-3 was originally a product of a research project sponsored by the U.S. government. It was initially developed for detecting and discriminating UXO in military ranges. Its application to landmines is new and still evolving.

One of the major goals for the GEM-3 is to shift the burden of mine detection and discrimination to the greatest extent possible, from the operator to the sensor itself. The manufacturer's emphasis has been to simplify the process of the audio detection and automatic target classification by internalizing the decision-making process to the sensor and its computer. Therefore, the sensor has been designed and is continuously upgraded to minimize the training requirement for the operators.

Working methodology

The GEM-3 sensor contains a pair of concentric transmitter coils and a small receiver coil at the center. This concentric coil geometry is called a "monostatic" configuration because all coils are essentially co-located. All coils are molded into a single, light, circular disk in a fixed geometry, making it a very portable package. The sensor head is scalable to almost any size. Attached to the other end of the boom is a removable electronic console. The sensor design is based on U.S. Patent No. 5,557,206 entitled *Apparatus and Method for Creating a Magnetic Cavity*, dated 1996 and owned by Geophex.

The GEM-3 uses multiple frequencies (typically 10) spanning from about 300Hz to 50kHz for detection and discrimination. Local geologic conditions and mine types may affect the frequency selection. Prior to a survey, the GEM-3 prompts for a set of desired transmitter frequencies — the operator may choose from default options. Built-in software converts these frequencies into a digital "bit-stream," which is used to construct the desired transmitter waveform for a particular survey. This bit-stream represents the instruction on how to control a set of digital switches connected across the transmitter coil, and generates a complex waveform that contains all frequencies specified by the operator.

The GEM-3 measures two quantities at each frequency, called inphase (I) and quadrature (Q) components. For a 10-frequency operation, for instance, the sensor produces 10 each I- and Q-components at each location. The sampling rate is 30 times per second, or 30Hz.

Hand-held detectors

To facilitate the detection process, the GEM-3 generates a variable-pitch, variable-amplitude audio that is generated by an internal computer using the digital data collected by the sensor. The data stream used for the audio may depend on local geology; for instance over magnetic soil, the audio is based on a digital sum of quadrature responses of all frequencies.

Once a target is detected, the GEM-3 may be used in a classification mode based on a new technology known as Electromagnetic Induction Spectroscopy, or EMIS (U.S. Patent No. 5,963,035 by Geophex, 1999). By measuring the broadband spectral response of an object, the sensor obtains a distinct spectral signature that may uniquely identify a landmine. Based on the response spectrum, it is possible to “fingerprint” the object; this is the basic concept of EMIS. Figure 1 on next page shows example of GEM-3 EMIS spectra for some common landmines.

Power supply

The GEM-3 has an internal rechargeable battery that can be charged from a common 12VDC outlet in cars or household 110-220V AC sources. The internal battery, powering the entire sensor, lasts about 8h in a typical continuous operation.

Detectors in use to date

The GEM-3 is a relatively new sensor entering into the field of landmine detection and classification. The sensor has been used extensively for detecting UXO for environmental cleanup projects at military ranges.

About 30 units have been sold since early 2001 when the sensor became first commercially available. These units are more or less equally divided among the US government, universities, and EOD companies. The U.S. government users have included: the Naval EOD Technical Division in Indian Head, Maryland; the Corps of Engineers in Huntsville (Alabama) and Fort Ord (California); Fort Belvoir Countermine Division in Virginia; the Army Engineering R&D Center of Vicksburg (Mississippi); and the Cold Region Research Laboratory in New Hampshire.¹

Factory support

No further information is provided by the manufacturer.

Maintenance and support

Despite its internal sophistication, the GEM-3 is built for easy operation and maintenance. Three push buttons control the entire sensor operation based on menu displayed on a small LCD screen that provides continuous prompts to the operator.

One of the major goals for the GEM-3 is to shift the burden of mine detection and discrimination, to the greatest extent possible, from the operator to the sensor itself. The manufacturer’s emphasis has been to simplify the process of the audio detection and automatic target classification by internalizing the decision-making process to the sensor and its computer. Therefore, the sensor has been designed and is continuously upgraded to minimize the training requirement for the operators.

Both the operator’s manual and the sensor software may be downloaded from the Geophex website.

Test and evaluation

Internal test reports can be provided by the manufacturer on request.

1. According to the manufacturer.

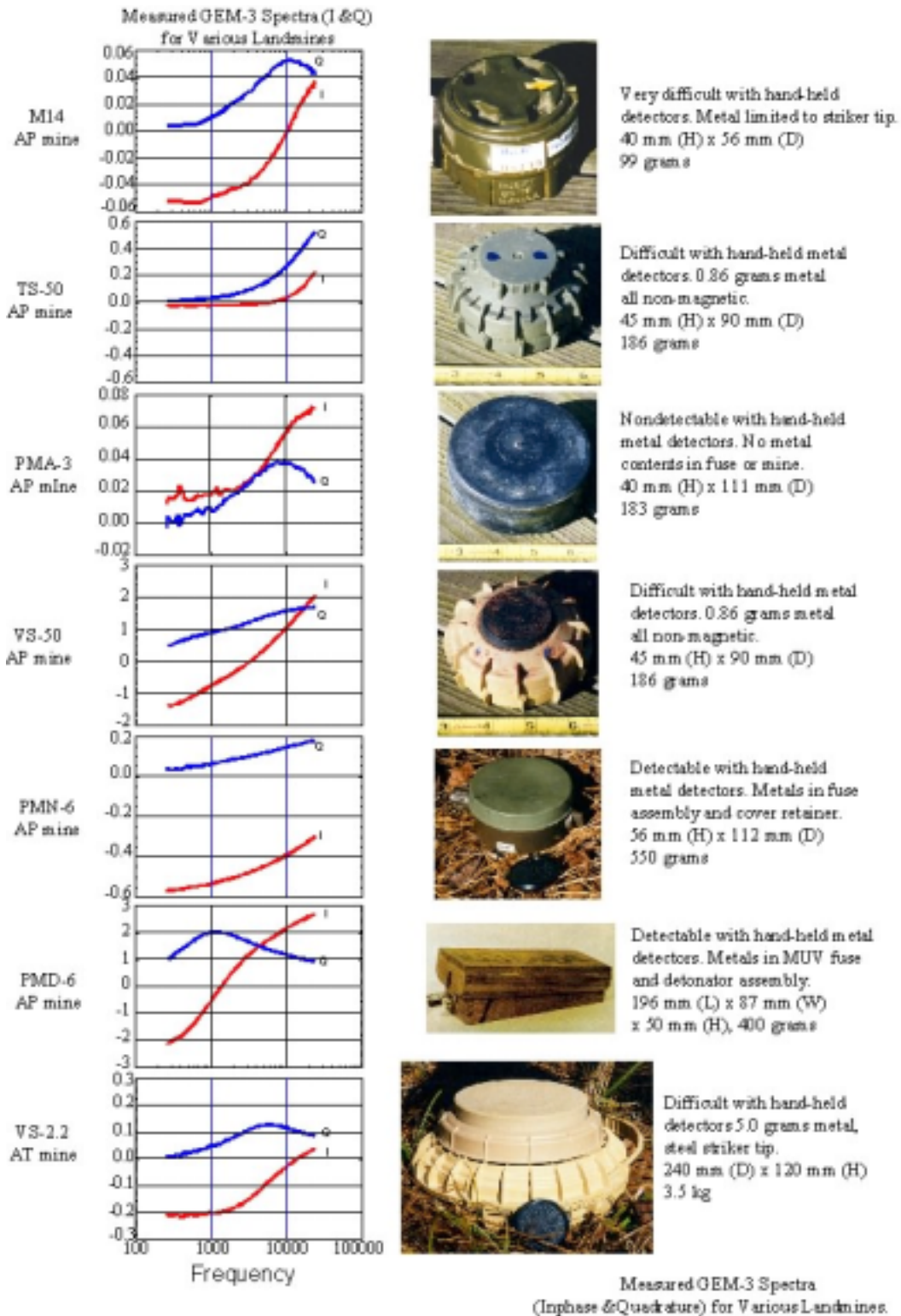


Figure 1
 Measured GEM-3 spectra, inphase (red) and quadrature (blue) for seven common landmines. The vertical scale indicates the GEM-3 response in parts-per-million (ppm) and relative amplitude, which is proportional to the target metal content. Such EMIS data can be used to identify particular mines by name.¹



Geophex GEM-3 in operation

Reported limitations and strengths

No information available at this time.

Minelab F1A4

Minelab Electronics Pty Ltd., Australia



General description

The **Minelab F1A4** metal mine detector was launched onto the demining market in 1997 and is now used in more than 40 countries worldwide. It began with an invitation to attend trials being conducted by the Cambodian Mine Action Centre (CMAC), which was looking for its next generation detector. In comparing the F1A4 to other manufacturers' equipment, CMAC reported that the F1A4 has a larger detection pattern, a deeper detection capability, particularly in mineralized soil conditions, and is more effective in the wet. It was also noted that the F1A4 has superior ground balance capability, enabling it to detect all types of metal and minimum-metal mines in all soil conditions. The design enhances operator safety while remaining simple to use.

Since this initial success Minelab have maintained the F1A4's competitive edge with mechanical and technical improvements.

The detector has proved its effectiveness in Afghanistan, Cambodia, Iraq, Lebanon and Mozambique, and has demonstrated a far-above-average performance in finding low-metal-content mines.¹ The F1 family includes detectors designed for minimum-metal mines, anti-tank mines, UXO and an enhanced deep target detector with data logging and mapping capability.

Working methodology

The F1A4 uses a technology system called multi-period sensing to reduce background interference caused by heavily-mineralized soils. The background noise caused by soil often masks a detector's ability to detect accurately the small metal firing pin used in the millions of plastic landmines that have been laid around the world. The F1A4 transmits pulses of electromagnetic energy into the ground below its coil. These pulses of magnetic energy cause metal objects in the ground, through induction, to produce a changing magnetic field of their own. The F1A4 receives the signals from the metal targets between its transmitted pulses and is able to negate the interference caused by mineralized soils while still responding to metal targets. This is achieved by transmitting a continuous train of alternating long and short magnetic field pulses. The decay relationships from signals received from metal and iron oxide are known. In the absence of metal, iron oxide will return a predicted signal that the detector can identify. If metal exists in the soil, the return signals result in a different relationship that alerts the operator to the presence of metal. Target indication is provided by a constant threshold tone which excites and increases in volume when a target is found.

Hand-held detectors

Power supply

The F1A4's power system:

- operates with commercially-available alkaline and rechargeable batteries;
- operates for at least five days normal operation before requiring battery change;
- makes maximum use of simplified start-up and "test and adjustment" procedures;
- has been designed to meet both military and civilian demining requirements and incorporates safety features such as "low battery" warning, and an audible "OK" signal at the end of the setting cycle.

Detectors in use to date

Minelab first supplied the F1A4 (Version 1) mine detector to CMAC in 1997 having been selected as the detector of choice following international trials conducted in Cambodia. CMAC continued to purchase the F1A4 until 2001. During that period the F1A4 Version 1 underwent modification in response to field experience, customer requirements, and improved manufacturing processes. CMAC's inventory currently numbers in excess of 1,300 detectors and includes the latest version of the F1A4 (Version 8). Following the CMAC trial, the F1A4 was evaluated by the UN Mine Action Centre in Bosnia and Herzegovina and was accepted for use there.

Following these initial successes, the F1A4 has been involved in several trials and evaluations worldwide and is now used by several armed forces, the United Nations, the U.S. Department of State, NGOs, and commercial demining companies. Over the past three years, Minelab F1A4 detectors have been supplied to more than 150 customers in 45 countries. In 2002, the Australian Army decided to supplement its existing F1A4 detector fleet with a further significant purchase. The U.S. Army also purchased the F1A4 complete with an integrated logistic support package.

Factory support

Minelab will provide its Customer Service and Technical Support Team to participate in instructor training, at a designated site, to carry out "Train the Trainer" sessions. The training includes comprehensive theory coupled with component identification, set-up, operation and maintenance.

It is envisaged that based on a class size of up to 16 participants and the ease of operation of the unit, the F1A4 training course should not take more than three days.

Comprehensive training and instruction will also be provided for the appropriate technicians. This training will enable basic fault finding and component replacement, along with instruction for coordinating the Minelab repair system and arranging for medium-level repairs. Training and all documentation are provided in English, or if requested, in another language.

Support and spares are provided from Minelab's two manufacturing facilities in Australia and Ireland and from other authorised repair facilities regionally. The F1A4 is covered against material or manufacturing defects by a one-year warranty.

Maintenance and support

The F1A4 is a very simple detector to operate and repair and has a low requirement for spare parts, tools, equipment and maintenance. Technician training is minimal. Five minutes each day is all that is required by the operator to maintain the F1A4 and it has no lifetime programmed repair or maintenance. Project technicians are trained and supported by Minelab for basic fault finding and component replacement. A very limited workshop facility is all that is required to support the F1A4 in the field.



Test and evaluation

The following test and evaluation trials have concluded that the Minelab F1A4 is acceptable for humanitarian demining in all soil types:

- United Nations Mine Action Centre (UNMAC) Bosnia and Herzegovina, 1997;
- Armour Group Kosovo, 1999;
- United Nations Office for the Coordination of Humanitarian Assistance to Afghanistan (UNOCHA) Trial, 2000;
- Accelerated Demining Programme Mozambique, 2000;
- International Pilot Project for Technology Cooperation (IPPTC), 2001;
- United Nations Office for Project Services (UNOPS) Afghanistan, 2002;
- Gruppe Rüstung (Swiss Army), 2001.

Reported limitations and strengths¹

Limitations:

- Poor for pinpointing multiple targets.
- Weak screws securing the control box and head.

Strengths:

- Choice of earpiece (allows use of speaker at the same time).
- Ease of set-up and operating procedure.
- Versatility of control box location.

1. Y. Das, J.T. Dean, D. Lewis, J.H.J. Roosenboom, G. Zahaczewsky (eds), *A multi-national technical evaluation of performances of commercial off the shelf metal detectors in the context of humanitarian demining*, International Pilot Project for Technology Co-operation, Final report, European Commission, Joint Research Centre, Ispra, Italy, 2001, p.92.

Minelab F3

Minelab Electronics Pty Ltd., Australia



Transport case

General description

The **Minelab F3** has been designed from its inception with mine detector operators in mind and in consultation with many of Minelab demining clients. Due to be released in March/April 2003, the F3 is an extremely compact, full-size detector providing automatic ground balancing and rugged mechanical design. While the detector shares many features with the well-established Minelab F1A4 Mine Detector (for example its ability to “ground balance” to remove the response of ground mineralisation with negligible loss of target sensitivity), it also has a number of new features. Bipolar technology is employed to minimise the risk of the detector detonating magnetic influence mines, and direct coupling allows the detector to emit a tone when a metallic target is present, even if the detector search head is at rest.

Initially the F3 will be offered configured for demining operations but in time it will be provided with interchangeable coils allowing the deminer to alternate between mines and UXO without retuning the detector — this will be done automatically. The F3 does not require set-up or assembly, only to be extended via the telescopic shafts to the desired length and switched on. The F3 has only three simple buttons making it extremely easy for the operator to identify and operate. It is waterproof down to two metres allowing it to be operated in all climatic conditions.

The F3 and its bipolar technology will be the basis of a family of detectors to be released over the next few years including an UXO and miniature model for smaller applications.

Working methodology

The F3 metal detector is designed to detect a wide variety of mines and ordnance in even the most difficult ground conditions. It operates on the “pulsed induction” principle, using a monoloop transmit/receive coil. The F3 has “selectable sensitivity”, which can be directed by the demining section commander or site supervisor to the deminers in the field. The F3 will come with a number of rubber end caps, each with their own in-built level of sensitivity and coloured markings for identification. For example, a supervisor can order the black end cap to be exchanged with a red one, which automatically changes the sensitivity of the detector. Results from Laos show that in this mode, the F3 will largely ignore surface shrapnel but still find metal mines, such as the PMN-2, or BLU cluster bomblets at depth. Of course, if the threat is minimum-metal mines such as the M14 or type 72 it would be wise to select maximum sensitivity.

Minelab has designed the change of sensitivity this way to maintain their philosophy on safety. Many detectors have a sensitivity switch. This is considered to be unsafe, because an operator can accidentally select a lower sensitivity and the supervisor will never know. With the F3 the supervisor will always know the sensitivity of each of the detectors by looking at the colour of the end caps.



Minelab F3 in operation



Power supply

The F3's power system:

- operates with commercially-available alkaline and rechargeable batteries;
- operates for at least five days' normal operation before requiring battery change;
- makes maximum use of simplified start-up and "test and adjustment" procedures;
- has been designed to meet both military and civilian demining requirements and incorporates safety features such as a "low battery" audible warning.

Detectors in use to date

After several final field tests conducted in seven locations around the world, the F3 detector is ready for release in March/April 2003. However, no impartial test report is available at present.

Factory support

Minelab will provide its Customer Service and Technical Support Team to participate in instructor training, at a designated site, to carry out "Train the Trainer" sessions.

The training includes comprehensive theory coupled with component identification, set-up, operation and maintenance. It is envisaged that based on a class size of up to 16 participants and the ease of operation of the unit, the F3 training course should not take more than three days.

Comprehensive training and instruction will also be provided for the appropriate technicians. This training will enable basic fault finding and component replacement, along with instruction in coordinating the Minelab repair system and arranging for medium-level repairs. Training and all documentation are provided in English, or if requested, another language. Support and spares are provided from two manufacturing facilities in Australia and Ireland and from other authorised repair facilities regionally. The F3 is covered against material or manufacturing defects with a one-year warranty.

Maintenance and support

The F3, like its cousin the F1A4, is a very simple detector to operate and repair and has a low requirement for spare parts, tools, equipment and maintenance. Technician training is minimal. Five minutes each day is all that is required by the operator to maintain the F1A4 and it has no lifetime programmed repair or maintenance. Project technicians are trained and supported by Minelab for basic fault finding and component replacement. Only a very limited workshop facility is needed to support the F1A4 in the field.

Test and evaluation

The F3 has been tested by Minelab personnel and has undergone field acceptance trials by a number of clients in Laos and Mozambique.

As the detector is new on the market, it could not be tested in comparative trials.

Reported limitations and strengths

No information available at this time.

Schiebel AN-19/2

Schiebel Elektronische Geräte GmbH, Austria

Hand-held detectors



General description

The **AN-19/2 Mine Detecting Set** is one of the most widely-used and easily-recognisable mine detectors in the world. It is built to military standards to meet the requirements for mine clearance on the battlefield and is now also used for humanitarian demining. It has been in daily use for the last 11 years in all of the world's most mine-affected countries and is the standard detector for many NATO countries including the U.S. Army¹ (designated AN/PSS-12).

Because of its ease of use, low power requirement, lightweight design and the low mutual interference, the AN-19/2 is mission-suitable for all kind of demining activities. The equipment is able to detect mines with minimum metallic content and can be used in shallow fresh or salt water. Unaffected by ambient temperature, the excellent detection characteristics of the AN-19/2 qualify the equipment for use in all climates. The AN-19/2 is a reliable, long-life product based on rigorous standards of quality control during manufacture. Although there have been several modifications to the original AN-19/2 pulse detector throughout its life, culminating in the current Mod. 7, the method of operation has remained the same for all variations.

Working methodology

The search head emits an electromagnetic pulse, which induces eddy-currents in nearby metal objects. These eddy-currents give rise to a secondary field, which is detected by the search head receiving coil. The detected signal is processed in the electronics unit. The presence of a metal object is indicated by a tone in the headphone and by an optional LED visual signal, if fitted.

AN-19/2 detects nearly all mines at their operational depth (or deeper). Schiebel's test piece incorporates a 0.15g steel pin (approximately the same signature as the Chinese 72A anti-personnel mine) that can be detected at 17cm when buried in the ground¹ (only 12cm in light magnetic soil — for heavier magnetic soil, use the Schiebel ATMID™). This is maintained in fresh/salt water (down to 2m).

For large magnetic signature mines/UXO, the detector gives an over edge of target indication enabling the same precise location as for smaller targets.

Power supply

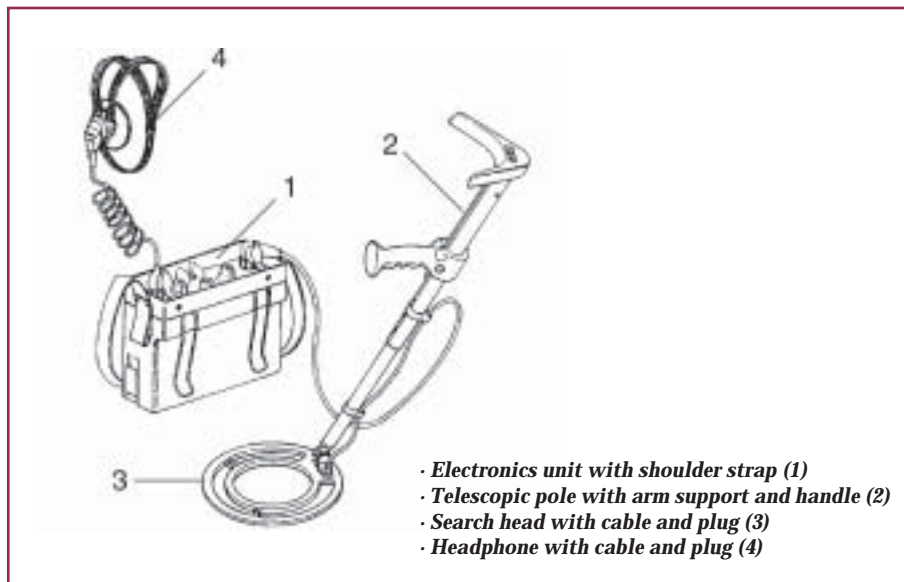
AN-19/2 is powered by four standard D size cells. The recommended alkaline cells provide approximately 70h operation. Similar rechargeable nickel-cadmium cells provide approximately 35h. All recommended cells are available worldwide as are suitable automatic chargers.

Rechargeable cells last for at least one year if correctly used/charged.

Detectors in use to date

According to the manufacturer more than 40,000 AN-19/2s have been sold in four versions (Modification 2, 5 and 7) since 1990. It is impossible to say how many of each are in service as many have been upgraded to later modifications. The current production is Mod. 7.

All different versions are in use in mine-affected regions all over the world, including in Afghanistan, Angola, Bosnia and Herzegovina, Croatia, Cambodia, northern Iraq, Kosovo, and Mozambique. They have been purchased and are still used by humanitarian demining organisations such as the United Nations, MAG (Mines Advisory Group), CMAC (Cambodian Mine Action Centre), Handicap International, most of NATO including the U.S., and many other armed forces (Colombia, India, Sweden, etc.).



Schematic diagram of AN-19/2

Factory support

- All detectors are covered by a 12-month, no-cost warranty, and operator/maintenance training is provided (on-site or at the factory as requested) as part of the procurement package. Further training can be provided at cost.
- Spare parts, all interchangeable (regardless of detector version), are available for a period of 10 years after purchase. These can be obtained directly from the factory or from the worldwide network of Schiebel agents.
- Operator and maintenance manuals are provided in most major languages (e.g. English, French, German, Spanish, etc).
- Schiebel technicians/factory repairs are available worldwide to provide additional support whenever required.

Maintenance and support

The AN-19/2 requires little maintenance and can be upgraded to the latest modification state. Most repairs can be carried out, at field level, by Schiebel trained personnel. Workshop repairs can be carried out by Schiebel trained technicians, using the recommended tools and test equipment (digital multi-meter and oscilloscope).

Test and evaluation

The AN-19/2 has been comprehensively field-tested in all climates by the manufacturer and all detector specifications are fully proven. It has also been evaluated and selected by a wide range of organisations, including the U.S. Army and the British NGO, MAG. Additional test reports are available on request from the manufacturer.

The European Commission Joint Research Centre (JRC) states that the Schiebel AN-19/2 detects a VPROM 1 with a sufficient safety margin at all angles.²

The detector performed above average in all types of soil (sand, clay, peat, and ferruginous)³

The most significant tests passed by the detector are:

- International Pilot Project for Technology Cooperation, March 1999 - June 2000;
- International Detector Test UNADP Mozambique, December 2000;
- U.S. Army Communications Electronics Command – Nicaraguan Field Test, October 2001;
- European Commission Directorate General JRC – Institute for Systems, Informatics & Safety.

Test reports were partially published and are accessible.

Reported limitations and strengths³

Limitations

- No external speaker.
- Exposed cable.
- Lack of ability to mount electronics box on detector shaft.

Strengths

- Light weight.
- Rugged and weatherproof.
- Easy to use.

1. According to the manufacturer.

2. M. Fernandez, A. Lewis, F. Littmann, *PROM 1 Anti-personnel landmines - Probability of activation by physical contact with a metal detector*, Special publication No. I.01.29, European Commission Directorate General JRC Joint Research Centre Institute for Systems, Informatics & Safety, Ispra, March 2001, Annex A, p. 100.

3. Y. Das, J.T. Dean, D. Lewis, J.H.J. Roosenboom, G. Zahaczewsky (eds), *A multi-national technical evaluation of performances of commercial off the shelf metal detectors in the context of humanitarian demining*, International Pilot Project for Technology Co-operation, Final report, European Commission, Joint Research Centre, Ispra, Italy, 2001, Annex A, p. 101.

Schiebel ATMID™

Schiebel Elektronische Geräte GmbH, Austria



Hand-held detectors

General description

The **ATMID™** (All Terrain Mine Detector) is the latest improvement of the AN-19/2 using the continuous wave mode combined with ground-compensating technology. The ATMID™ is a military standard detector that is unaffected by climatic variations and has been optimised to detect landmines with minimum-metal content in all types of soil, including laterite terrain, and/or in fresh or salt water. The manufacturer states that its sensitivity in ferromagnetic soils remains at the same level. The mine detector, including all accessories, is packed in a carry bag fitted with straps so that it can be carried like a rucksack. The ATMID™ however, when fitted with the standard AN-19/2 search head, will function in pulse mode with the same performance as the AN-19/2 (see the AN-19/2 data sheet for further details).

Because of its ease of use, low power requirement, lightweight design, environmental stability and automatic ground compensation, the ATMID™ is suitable for use anywhere in the world, in any terrain.

Working technology

The ATMID™ transmitting coil transmits a continuous wave (CW) that creates a magnetic field, which is able to compensate for magnetic soil. The sweeping movement of the search head over the ground induces eddy currents in any nearby metallic objects, which affect the created magnetic field. The receiver coil detects the resultant changes in magnetic field and produces a signal that is processed in the electronics unit to provide an audio tone indicating the presence of metal.

ATMID™ detects nearly all mines at deeper than operational depth in any/all soils. Schiebel's test piece incorporates a 0.15 gram steel pin (approximately the same signature as the Chinese 72A anti-personnel mine) that can be detected at 18cm when buried in the ground, including under surface fresh/salt water.¹

For large magnetic signature mines/UXO, the ATMID™ gives an edge of target indication enabling the same precise location as for smaller targets.

Power supply

The ATMID™ is powered by four standard D size cells. The recommended alkaline cells provide approximately 70h operation (in most conditions). Similar rechargeable nickel-cadmium cells provide approximately 35h operation. All recommended cells are available worldwide, as are suitable automatic chargers.

Rechargeable cells last for at least one year if correctly used/charged.

Detectors in use to date

The ATMID™ has been in service for two to three years and there are now more than 1,000 in use worldwide. They are being used in many regions, including Cambodia, Croatia, Ecuador, Laos, Lebanon, Mozambique, Peru, Slovakia, Taiwan, the U.S., and Viet Nam.

They were purchased and are still being used by armed forces from a number of countries (Cambodia, Sweden, U.S., etc.), humanitarian demining organisations (CMAC, CROMAC, MAG, etc.) and commercial demining companies (Specialist Ghurkha Services [SGS], RONCO, Milsearch, TADS, etc.).¹

Factory support

- All detectors are covered by a 12-month, no-cost warranty and operator/maintenance training is provided (on-site or at the factory) as requested, as part of the procurement package. Further training can be provided at cost.
- Spare parts, all interchangeable, are available for a period of 10 years after purchase. These can be obtained directly from the factory or from the worldwide network of Schiebel agents. Operator and maintenance manuals are provided in most major languages (e.g. English, German, Spanish, etc.).
- Schiebel technicians/ factory repairs are available worldwide to provide additional support whenever required.

Maintenance and support

The ATMID™ requires little maintenance due to its high reliability. Most repairs can be carried out in the field by Schiebel-trained personnel. Limited workshop repairs can be carried out by Schiebel-trained technicians, using the recommended tools and test equipment (digital multi-meter and oscilloscope).

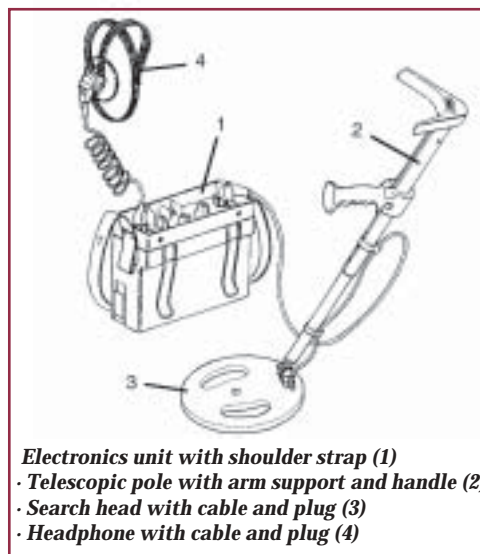
Test and evaluation

The manufacturer states that it has comprehensively field-tested the ATMID™ in all climates and that all detector specifications are fully proven. It has also been evaluated by several other organisations, including the British NGO MAG, CMAC, and many more. Additional test reports may be available on request from the manufacturer.

Tests passed by the detector include:

- UNOPS test for UN Mine Action Programme in Afghanistan, February - March 2002;
- International Pilot Project for Technology Cooperation, March 1999 - June 2000;
- International detector Test UNADP Mozambique, December 2000.

Test reports were partially published and are accessible.



Schematic diagram of ATMID™

Reported limitations and strengths²

Limitations

- No external speaker.
- Exposed cable.
- Lack of documentation for search head use.

Strengths

- Lightweight and easy to use.
- Rugged and weatherproof.
- Versatile.

1. According to the manufacturer.

2. Y. Das, J.T. Dean, D. Lewis, J.H.J. Roosenboom, G. Zahaczewsky (eds), *A multi-national technical evaluation of performances of commercial off the shelf metal detectors in the context of humanitarian demining*, International Pilot Project for Technology Co-operation, Final report, European Commission, Joint Research Centre, Ispra, Italy, 2001, Annex A, p. 102.

Schiebel MIMID™

Schiebel Elektronische Geräte GmbH, Austria



Hand-held detectors

General description

The **MIMID™** (Miniature Mine Detector) is based on the pulse mode technology of the AN-19/2 mine detector that has been the worldwide standard for minimal metal mine detection in both military and humanitarian demining for the past 10 years. It was developed to meet specific operational requirements of the U.S. Army Humanitarian Demining Team. It is waterproof to 30 metres and is suitable for use both on land and by divers for underwater operations.

The detector has been in service since 1997.

The lightweight, one-piece, foldable design makes it suited for use by Special Forces and any one else likely to come into contact with mines. The folded unit can be carried on a belt, in a trouser pocket, or in a rucksack. This unique feature allows operators immediate access to the unit when needed.

The MIMID™ can be set up for operation in 30 seconds. Controls are within easy reach of the operator and are identical to those of the AN-19/2. The length of its telescopic pole can be quickly adjusted for operation in the upright, kneeling or prone positions.

Working methodology

The transmitting coil of the search head emits an electromagnetic pulse, which induces an eddy current in metal objects in the vicinity of the search head. These eddy currents give rise to a secondary field, which is picked up by the receiving coil. The signal from this coil is processed in the electronics unit. The operator is alerted to the presence of a metal object by a sound in the headphone and a light signal on the visual indicator.

Schiebel's test piece incorporates a 0.15g steel pin (approximately the same signature as the Chinese 72A anti-personnel mine) that can be detected at a depth of 13cm when buried in the ground. This performance is maintained in underwater depths of some 30m.¹

For large magnetic signature mines/UXO, the detector gives an over edge of target indication enabling the same precise location as for smaller targets.

Power supply

The MIMID™ is powered by four standard AA size cells. The recommended alkaline cells provide around 7h¹ operation. Similar rechargeable nickel-cadmium cells provide approximately four hours. All recommended cells are available worldwide as are suitable automatic chargers.

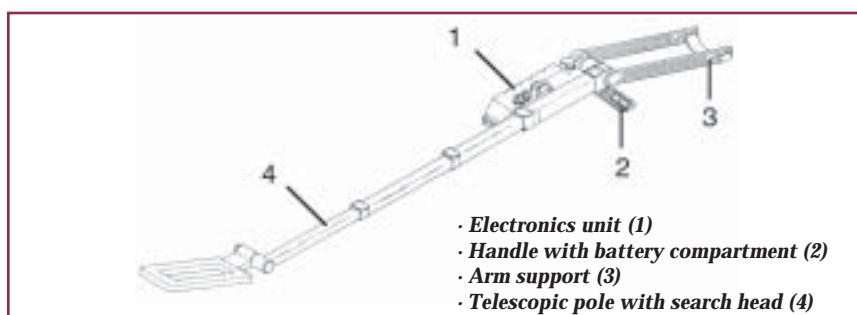
Rechargeable cells last for at least of one year if correctly used/charged.

Detectors in use to date

More than 1,500 MIMID™ have been sold since 1997. The detectors have been purchased and are still used by a number of armed forces, for example Israel and the U.S.

Factory support

- All detectors are covered by a 12-month, no-cost warranty, and operator/maintenance training is provided, (on-site or at the factory as requested), as part of the procurement package. Further training can be provided at cost.
- Spare parts, all interchangeable, are available for a period of 10 years after purchase. These can be obtained directly from the factory or from the worldwide network of Schiebel agents.
- Operator and maintenance manuals are provided in English, German, and Spanish. Schiebel technicians/factory repairs are available worldwide to provide additional support upon request.



Schematic diagram of MIMID™

Maintenance and support

The MIMID™ requires little maintenance due to its high reliability. Most repairs can be carried out at a workshop by Schiebel-trained technicians, using the recommended tools and test equipment (digital multi-meter and oscilloscope).

Test and evaluation

The MIMID™ has been comprehensively field-tested in all climates by the manufacturer, including underwater trials to 30m, and all detector specifications are fully proven. It has also been evaluated by Ecuador and the U.S. Test reports are available on request from the manufacturer. The detector scored well in all kind of soil types. The results achieved in ferruginous soil were above average.¹

Tests passed by the detector include:

- International Pilot Project for Technology Cooperation, March 1999-June 2000;
- Gruppe Rüstung (Switzerland): *Technische Erprobung von Minensuchgeräten*, August 2001.

Test reports were partially published and are open to the public.

Reported limitations and strengths²

Limitations:

- No transit case.
- Handle does not lock down.
- Elbow restraints and shaft latches are weak.

Strengths:

- Lightweight and compact.
- Weatherproof.
- Pre-assembled.

1. According to the manufacturer;

2. Y. Das, J.T. Dean, D. Lewis, J.H.J. Roosenboom, G. Zahaczewsky (eds), *A multi-national technical evaluation of performances of commercial off the shelf metal detectors in the context of humanitarian demining*, International Pilot Project for Technology Co-operation, Final report, European Commission, Joint Research Centre, Ispra, Italy, 2001. , Annex A, p. 104.

Vallon VMH2.1

Vallon GmbH, Germany



Front panel

General description

The **VMH2.1 Metal Mine Detector** has been designed for the highly accurate detection of all types of metallic mines as well as plastic mines with minimal metal content, bombs, ammunition, and other metallic objects located in the ground or in shallow water. A 60cm search head can additionally be used to locate buried metal-cased mines and UXO to a maximum depth of 1.8m.

The detector has a rugged design, is easy to operate and therefore seems to be suitable for conditions encountered in the developing world.

Along with the most modern integrated circuits the VMH2.1 uses the function principle of Vallon's advanced pulse field. It can work in strongly mineralized soils, like laterite, magnetite as well as in shallow water (salt and fresh water). According to the manufacturer, the "ground effect" as well as the strong magnetic influence of main powerlines have been eliminated, which means minimum false alarms, even when the search head contacts the soil or water.

Data input allows for further upgrade of the detector software, and data output enables measured data to be evaluated using Vallon EVA2000® software, running on a laptop or personal computer. The detector can also be connected to the Vallon Memobox MB4 and the Vallon Field Computer VFC1 data loggers.

Working methodology

The search head continuously emits electromagnetic pulses as the operator sweeps close to the surface. The electronics unit sends a pulse current to the search head. The pulsed current runs through the copper wire windings in the search head generating a pulsed magnetic field.

The search head acts as both a transmitter and a receiver as it senses the time behaviour of the pulsed field as it collapses. If there are no metal objects within the magnetic field, it will collapse quite quickly. If there is a metal object in the magnetic field range, the following happens:

- The primary-pulsed magnetic field induces a low current into the metal object,
- This current produces a "secondary" magnetic field around the metal object,
- The primary magnetic field collapses and the secondary magnetic field collapses a short time later,
- The search head receives the collapsing signals and sends them to the electronics unit,
- The electronics unit checks the characteristics of the collapse rate against the originally-produced pulses/collapse rate; thus an alarm signal is produced depending on the collapsing size of the metal target.

The emitted pulse of the VMH2.1 is specially shaped so that magnetic influence mines are not activated.¹

To ensure that the VMH2.1 can be used worldwide under different soil conditions, it is provided with a programme switch to select different detection features for the actual detection job. The correct programme setting and the wide range detection sensitivity allow the detection of even plastic mines with minimum metal content in strongly mineralized soil, and also near to 50Hz or 60Hz powerlines.

A processor internally “checks” the reliability and proper functioning of the detector during operation. The pulse signal generation, signal processing, battery voltages, external connections, and most importantly, the internal operation voltages, are constantly monitored. An acoustic alarm signal is produced when a fault is found in these functions.

Detection range VMH2.1 with standard search head ¹		
Mines	Programme 1 Distance in cm	Programme 2 Distance in cm
M 14	14	13
R2M2	16	14
Type 72	23	22
PFM 1	28	27
PMN 2	38	27
PMN 1	66	41

Programme 1 normal soil

Programme 2 mineralized soil

Detection range VMH2.1 with Option UXO (60-cm search head) ¹		
Mines	Programme 1 Distance in cm	Programme 2 Distance in cm
TM 62M	170	145
PMN1	128	102
M16	152	135
Schell160 (d) x 590 (l)	175	153
Aircraft bomb 50kg 210 (d) x 730 (l)	188	165
105mm Fog Shell HC-BE M84A1	159	136

Programme 1 normal soil

Programme 2 mineralized soil

Power supply

VMH 2.1 is powered by four 1.5V mono-cell IECLR 20 (ANSI std D) or rechargeable KR 35/62. The operational life of batteries is stated to be as follows:

- Operational life of battery: up to 100h,
- Operation time exclusive minimum metal mine detection: 30h.

Detectors in use to date

The Vallon VMH2.1 is an enhanced version of the predecessor model VMH1, the one-piece detector with “Switch On and Search” (SOS), with higher sensitivity in strongly mineralized soils and increased soil compensation.

Since 1999, more than 2,000 units of VMH2.1 and its predecessor model VMH1 have been sold. The detectors are in service with various humanitarian aid organisations, the United Nations and commercial mine clearance organisations.

Factory support

- Vallon runs a worldwide servicing network with spare parts in stock. Spare parts can be delivered with a corresponding maintenance manual directly to the customer for repair on site. Operation and maintenance training is offered either in the Vallon facilities or at a location required by the customer.
- The operation manuals and the maintenance manuals are available in English, French, German, and Spanish, and, on request, other languages.
- Warranty 12 months.

Maintenance and support

There are no special requirements for the technicians or the workshop facilities. All tools are standard and available in most workshops. For each detector a maintenance manual is available, with a step-by-step explanation on how to repair the detector.

Test and evaluation

The manufacturer allows access to several test reports available.

Tests passed by the detector include:

- UNOPS test for UN Mine Action Programme in Afghanistan, February - March 2002;
- International Pilot Project for Technology Cooperation (IPPTC), March 1999 - June 2000;
- International Detector Test UNADP Mozambique, December 2000.

Test reports were partially published and are publicly accessible.

During the latest “Afghanistan test” carried out under the auspices of UNOPS the detector performed as one of the only technically qualified pieces in the trial. (In total three detectors were considered to be technically qualified).²

The detector complies with environmental conditions according to MIL STD 810E 501.3/A1, 502.3/C1, 503.3, 506.3, 514.4/8.

Reported limitations and strengths³

Limitations

- Complex ground balancing .
- No confidence tone.

Strengths

- Rugged design.
- Good field case.
- Pre-assembled.

1. According to the manufacturer.

2. *Summary of Metal Detector Trial Report*, UN Mine Action Centre Programme Afghanistan, February-March 2002.

3. Y. Das, J.T. Dean, D. Lewis, J.H.J. Roosenboom, G. Zahaczewsky (eds), *A multi-national technical evaluation of performances of commercial off the shelf metal detectors in the context of humanitarian demining*, International Pilot Project for Technology Co-operation, Final report, European Commission, Joint Research Centre, Ispra, Italy, 2001.

Vallon VMM2

Vallon GmbH, Germany



Transport case

General description

The **VMM2 Metal Mine Detector** has been designed for the highly accurate detection of all types of metallic mines as well as plastic mines with minimal metal content, bombs, ammunition, and other metallic objects located in the ground or in shallow water. A 60cm search head can additionally be used to locate buried metal-cased mines and UXO to a maximum depth of 1.8m.

The detector has a rugged design, is easy to operate and seems to be suitable for professional clearance in battlefield operations and military training programmes.

Along with the most modern integrated circuits the VMM 2 uses the function principle of Vallon's advanced pulse field. It can also work in strongly mineralized soils, such as laterite, magnetite and in shallow water (salt and fresh water). According to the manufacturer, the "ground effect" and the strong magnetic influence of main powerlines have been eliminated. This means minimum false alarms, even when the search head contacts the soil or water.

Data input allows for further upgrade of the detector software, and data output enables measured data to be evaluated using Vallon EVA2000® software, running on a laptop or personal computer. The detector can also be connected to the Vallon Memobox MB4 and the Vallon Field Computer VFC1 data loggers.

Working methodology

The search head continuously emits electromagnetic pulses as the operator sweeps close to the surface. The electronics unit sends a pulsed current to the search head. The pulsed current runs through the copper wire windings in the search head generating a pulsed magnetic field.

The search head acts as both a transmitter and a receiver as it senses the time behaviour of the pulsed field as it collapses. If there are no metal objects within the magnetic field, it will collapse quite quickly. If there is a metal object in the magnetic field range, the following happens:

- The primary-pulsed magnetic field induces a low current into the metal object;
- This current produces a "secondary" magnetic field around the metal object;
- The primary magnetic field collapses and the secondary magnetic field collapses a short time later;
- The search head receives the collapsing signals and sends them to the electronics unit;
- The electronics unit checks the characteristics of the collapse rate against the originally-produced pulses/collapse rate; thus an alarm signal is produced depending on the collapsing size of the metal target.

- The emitted pulse of the VMM 2 is specially shaped so that magnetic influence mines are not activated.¹

To ensure that the VMM 2 can be used worldwide under different soil conditions, it is provided with a programme switch to select different detection features for the actual detection job. The correct programme setting and the wide range of detection sensitivity allow the detection even of plastic mines with minimum metal content in strongly mineralized soil and also close to 50Hz or 60Hz powerlines.

A processor internally “checks” the reliability and proper functioning of the detector during operation. The pulse signal generation, signal processing, battery voltages, external connections, and most importantly the internal operation voltages, are constantly monitored. An acoustic alarm signal is produced when a fault is found in these functions. Detection range is the same as for the VHM2.1 model, see tables p. 34.

Power supply

VMM 2 is powered by four 1.5V mono-cell IECLR 20 (ANSI std D) or rechargeable KR 35/62. The operational life of batteries is said to be as follows:

- Operational life of battery: up to 100h,
- Operation time exclusive minimum metal mine detection: 30h.

Detectors in use to date

The Vallon VMM 2 is an enhanced version of the predecessor model 1620C with higher sensitivity in strongly mineralized soils and automatic soil compensation.

Since 2001, more than 500 VMM 2 units have been sold. The detectors are in use with several NATO armed forces.

Factory support

- Vallon runs a worldwide servicing network with all spare parts in stock. Spare parts can be delivered with a corresponding maintenance manual directly to the customer for on-site repair.
- Operation and maintenance training is offered either in the Vallon facilities or at a location required by the customer.
- The operation manuals and the maintenance manuals are available in English, French, German, and Spanish, and other languages on request.
- Warranty 12 months.

Maintenance and support

There are no special requirements for the technicians or the workshop facilities. All tools are standard and available in most workshops. For each detector a maintenance manual is available, with step-by-step explanation on how to repair the detector.

Test and evaluation

The manufacturer allows access to several available test reports.

The detector did not undergo significant independent testing during the last few years. However, as the detector has the same working methodology and technical specification as the VMH2.1 version, performance can be expected to be identical.

Reported limitations and strengths

No information available due to lack of test reports. See Vallon VMH2.1 for likely strengths and limitations.

1. According to the manufacturer.

Technical specifications

CEIA MIL-D1

Detector

1.	Brand:	CEIA
2.	Model:	MIL-D1
3.	Version:	3.3
	Used detection technology:	Electromagnetic Induction – CW (Continuous wave)

Dimensional data

4.	Working length:	
	• min. length:	1 000mm
	• max. length:	1 620mm
5.	Search head:	
	• size:	External diameter: 282mm
	• weight:	0.645kg
	• shape:	Circular
6.	Transport case:	
	• weight:	7kg
	• with equipment (full):	12.5kg
	• dimensions:	975 x 450 x 160mm
	• hard/soft case (material):	High impact polypropylene/synthetic canvas
7.	Weight, hand-held unit:	—
8.	Weight, carrying (operational detection set):	3.2kg
9.	Weight, additional equipment:	—
10.	Weight distribution/balance:	Well balanced – optimized for continuous operation
11.	Other specifications:	—

Detection system specifications

12.	Control of working depth:	Knob sensitivity adjustment
13.	Status:	In production
14.	Detectors/systems in use to date:	3,200
15.	Other types:	—
16.	Location of use:	Afghanistan, Egypt, Ethiopia, Finland, Lebanon, Sweden, Thailand, etc.

Environmental influence

17.	Humidity (limitations):	No influence
18.	Temperature (limitations)	
	• storage:	-55°C to +75°C
	• operational:	-40° to +65°C
19.	Water resistant:	Yes, IP68 (IEC 529)
20.	Shock/vibration resistant:	Yes, exceeding MIL STD 810 E
21.	Environmental compensation:	Auto
	Operational hours/operating endurance	
	• low temperature (around 0°C):	MTBF = 27500 ¹
	• medium temperature (around 20°C):	MTBF = 22500 ¹
	• high temperature (higher than 30°C):	At 35°C MTBF = 18,000 ¹

Detection specifications

22.	Calibration/set-up	
	• auto/manual:	Auto
	• duration:	No limit
23.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal content mines:	Optimized according to the mines and soils
	• anti-tank mines:	Optimized according to the mines and soils
	• UXO:	Optimized according to the mines and soils
24.	Output indicator:	Sound (display as option)
25.	Pinpointing feature:	Dual tone

Hand-held detectors

Hand-held detectors

26.	Adjustment of search head angle:	0° up to 97°
27.	Soil influence:	Self-learning compensated
28.	Best use in:	
	• sand:	Yes
	• peat:	Yes
	• clay:	Yes
	• ferruginous soil (laterite):	Yes
29.	Optimal sweep speed:	From 0cm/s to to the maximum human operator sweep
30.	Search coil/antenna:	Circular
31.	Limitations:	—
32.	Interference (with other detectors):	—

Power

33.	Power supply/source:	4 x 1.5V alkaline batteries or 4 x 1.2V Ni-Mh rechargeable batteries
34.	Operating time:	> 65h with alkaline batteries; > 35h with rechargeable batteries
35.	Power supply:	
	• weight:	Total for no. 4 batteries: 0.580kg (alkaline batteries)/ 0.61kg (rechargeable batteries)
	• no. of batteries/size/type:	4 /ANSI std D – IEC std LR20/alkaline or rechargeable
	• rechargeable:	Yes
	• other:	—

Costs

36.	Price:	
	• for one detector:	—
	• reduction for higher quantity:	—
37.	System price	
	• with training:	—
	• spare parts:	—
	• extended warranty:	—
38.	Total:	—
39.	Availability for hire:	—

Others

40.	Duration of warranty:	—
41.	Additional equipment:	Battery charger MIL-D1/BC
42.	additional technical data/information:	On request
46.	Compliant standards:	MIL-STD 810 E and others on request

1. According to MIL-HDBK 217.

Technical specifications

Ebinger EBEX® 420 H-Solar

Detector:

1.	Brand:	Ebinger
2.	Model:	EBEX® 420-H
3.	Version:	01/2002
4.	Used detection technology:	Metal detector/sine wave

Dimension data:

5.	Working length:	
	• min. length:	670mm (short version)
	• max. length:	1,840 mm (long version)
6.	Search head:	
	• size:	Ø 200mm
	• weight:	0,5kg
	• shape:	Circular
7.	Transport case	
	• weight:	2kg
	• with equipment:	5kg
	• dimension:	—
	• hard/soft case:	Hard plastic / canvas satchel
8.	Weight, hand-held unit:	0,88kg (short)/1,45kg (long)
9.	Weight, carrying (operational detection set)	0,88kg (short)/1,45kg (long)
10.	Weight, additional equipment:	—
11.	Weight distribution/balance:	—
12.	Other specifications:	Modular systems without any cables

Detection system specifications

13.	Control of working depth:	Sensitivity adjustment manual
14.	Status:	In production
15.	Detectors/systems in use to date	Approx. 2,000
16.	Other types:	—
17.	Location of use:	Worldwide

Environmental influence

18.	Humidity (limitations):	0-95%
19.	Temperature (limitations):	
	• storage:	-53°C to +70°C
	• operational:	-30°C to +55°C
20.	Water resistant:	Yes up to 1,3m
21.	Shock/vibration resistant:	Yes
22.	Environmental compensation	Manual
23.	Operational hours/operating endurance:	
	• low temperature (around 0°C):	Up to 75h depends on solar radiation
	• medium temperature (around +20°C):	up to 75h depends on solar radiation
	• high temperature (around +30°C):	up to 75h depends on solar radiation

Detection specifications

24.	Calibration/set-up:	
	• auto / manual:	Manual
	• duration	Continual
25.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal content mines:	Depending on their size, material and the local interference
	• anti-tank mines:	Depending on their size, material and the local interference
	• UXO	Depending on their size, material and the local interference
26.	Output indicator:	Sound
27.	Pinpointing feature:	Yes
28.	Adjustment of search head angle:	Yes
29.	Soil influence:	—

Hand-held detectors

30.	Best use in	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	No
31.	Optimal sweep speed:	0.2-1.5m per second
32.	Search coil / antenna:	Ø 200mm circular
33.	Limitations:	No
34.	Interference (with other detectors):	< safety distance

Power

35.	Power supply/source	Battery
36.	Operation time:	see point 23
37.	Power supply:	
	• weight:	
	• no of batteries:	1 x 9V dry battery LR61
	• rechargeable:	1 x 9V rechargeable LR61
	• other:	Power supply from solar panel

Costs

38.	Price:	
	• for one detector:	US\$1,000 - US\$2,000
	• reduction for higher quantity:	Yes
39.	System price	
	• with training:	On request
	• spare parts:	On request
	• extended warranty:	On request
40.	Total:	—
41.	Availability for hire:	On request

Other

42.	Duration of warranty:	24 months
43.	Additional equipment:	Extension rod
44.	Additional technical data/information:	—
46.	Compliant standards:	MIL-STD 461, MIL-STD 810, DIN EN ISO 900: 2000

Technical specifications

Ebinger EBEX® 420 PBD

Detector:

1.	Brand:	Ebinger
2.	Model:	EBEX® PBD (stands for pulse bipolar dynamic)
3.	Version:	11/1996
4.	Used detection technology:	Metal detector/pulse induction

Dimension data:

5.	Working length:	
	• min. length:	1,080mm (short version)
	• max. length:	1,650mm (long version)
6.	Search head:	
	• size:	Ø 260 x 156mm
	• weight:	0,5kg
	• shape:	Oval
7.	Transport case:	
	• weight:	2kg
	• with equipment:	8.5kg
	• dimension:	—
	• hard/soft case (material):	hard plastic/canvas satchel
8.	Weight, hand-held unit:	2.2kg (short)/2.4kg (long)
9.	Weight, carrying (operational detection set):	2.2kg (short)/2.4kg (long)
10.	Weight, additional equipment:	—
11.	Weight distribution/balance:	—
12.	Other specifications:	Modular systems without any cables

detection system specifications

13.	Control of working depth:	Sensitivity adjustment manual
14.	Status:	In production
15.	Detectors/systems in use to date:	Approx. 5,000
16.	Other types:	—
17.	Location of use:	Worldwide

Environmental influence

18.	Humidity (limitations):	0-95%
19.	Temperature (limitations)	
	• storage	-53°C to +70°C
	• operational:	-30°C to +55°C
20.	Water resistant:	Yes up to 1,3m
21.	Shock/vibration resistant:	Yes
22.	Environmental compensation:	Auto / manual
23.	Operational hours/operating endurance:	
	• low temperature (around 0°C):	Up to 50h, depends on type of battery
	• medium temperature (around +20°C):	Up to 50h, depends on type of battery
	• high temperature (around +30°C):	Up to 50h, depends on type of battery

Detection specifications

24.	Calibration/set-up	
	• auto / manual	Manual - automatic
	• duration	Continual
25.	Detection range/sensitivity details/ detection performance working depth	
	• low metal content mines:	Depending on their size, material and the local interference
	• anti-tank mines:	Depending on their size, material and the local interference
	• UXO	Depending on their size, material and the local interference
26.	Output indicator:	Sound
27.	Pinpointing feature:	Yes
28.	Adjustment of search head angle:	Yes
29.	Soil influence:	

Hand-held detectors

30.	Best use in:	
	• sand:	Yes
	• peat:	Yes
	• clay:	Yes
	• ferruginous soil (laterite):	Under certain circumstances
31.	Optimal sweep speed:	0,2-1,5m/s
32.	Search coil / antenna:	Ø 260 x 156mm oval
33.	Limitations:	No
34.	Interference (with other detectors):	< safety distance

Power

35.	Power supply/source:	Battery
36.	Operation time:	See point 23
37.	Power supply:	
	• weight:	—
	• no of batteries:	6 x 1.5V dry batteries C-cell
	• rechargeable:	6 x 1.2V rechargeable batteries
	• other:	1 x 12V battery-pack

Costs

38.	Price:	
	• for one detector:	US\$2,000-US\$,000
	• reduction for higher quantity:	Yes
39.	System price:	
	• with training:	On request
	• spare parts:	On request
	• extended warranty:	On request
40.	Total:	—
41.	Availability for hire:	On request

Other

42.	Duration of warranty:	24 months
43.	Additional equipment:	UXO head Ø 45cm, cylinder probe
44.	Additional technical data/information:	-
46.	Compliant standards:	MIL-STD 461, MIL-STD 810, DIN EN ISO 9001:2000

Technical specifications

Ebinger EBEX® 421 GC

Detector:

1.	Brand:	Ebinger
2.	Model:	EBEX® 421 GC (stands for ground compensation)
3.	Version:	11/2002
4.	Used detection technology:	Metal detector/pulse induction

Dimensional data:

5.	Working length:	
	• min. length:	1,000mm (short version)
	• max. length:	1,700mm (long version)
6.	Search head:	
	• size:	Ø 230mm (300 x 170mm)
	• weight:	0.5kg
	• shape:	Circular, oval
7.	Transport case	
	• weight:	2kg
	• with equipment	3,8kg/8,5kg
	• dimension	—
	• hard/soft case (material)	Hard plastic/canvas satchel
8.	Weight, hand-held unit:	2.2kg (short)/2.4 kg (long)
9.	Weight, carrying (operational detection set):	2.2kg (short) /2.4 kg (long)
10.	Weight, additional equipment:	—
11.	Weight distribution/balance:	—
12.	Other specifications:	Modular systems without any cables

Detection system specifications

13.	Control of working depth:	Sensitivity adjustment manual
14.	Status:	In production
15.	Detectors/systems in use to date	Approx. 2,000
16.	Other types:	—
17.	Location of use:	Worldwide

Environmental influence

18.	Humidity (limitations):	0-95%
19.	Temperature (limitations)	
	• storage	-53°C to +70°C
	• operational:	-30°C to +55°C
20.	Water resistant:	Yes, up to 1,3m
21.	Shock/vibration resistant:	Yes
22.	Environmental compensation:	Auto/manual
23.	Operational hours/operating endurance:	
	• low temperature (around 0°C):	Up to 75h, GC mode up to 25h, depends on type of battery
	• medium temperature (around +20°C):	Up to 75h, GC mode up to 25h, depends on type of battery
	• high temperature (around +30°C):	up to 75h, GC mode up to 25h, depends on type of battery

Detection specifications

24.	Calibration/set-up:	
	• auto / manual	Manual - automatic
	• duration	Continual
25.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal content mines:	Depending on their size, material and the local interference
	• anti-tank mines:	Depending on their size, material and the local interference
	• UXO:	Depending on their size, material and the local interference
26.	Output indicator:	Sound
27.	Pinpointing feature:	Yes
28.	Adjustment of search head angle:	Yes
29.	Soil influence:	Specially developed for laterite soil

Hand-held detectors

30.	Best use in:	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
31.	Optimal sweep speed:	0,2-1,5m/s
32.	Search coil / antenna:	Ø 230mm circular, (300 x 170mm oval)
33.	Limitations:	No
34.	Interference (with other detectors):	< safety distance

Power

35.	Power supply/source	Battery
36.	Operation time:	See point 23
37.	Power supply:	
	• weight:	—
	• no of batteries:	8 x 1.5V dry batteries C-cell
	• rechargeable:	8 x 1.2V rechargeable batteries
	• other:	1 x 12V battery pack

Costs

38.	Price:	
	• for one detector:	US\$2,000 - US\$3,000
	• reduction for higher quantity:	Yes
39.	System price	
	• with training:	On request
	• spare parts:	On request
	• extended warranty:	On request
40.	Total	—
41.	Availability for hire:	On request

Other

42.	Duration of warranty	24 months
43.	Additional equipment:	UXO head Ø 45cm
44.	Additional technical data/information:	—
46.	Compliant standrds:	MIL-STD 461, MIL-STD 810, DIN EN ISO 9001:2000

Technical specifications

Foerster Minex 2FD 4.500

Detector

1.	Brand:	Foerster
2.	Model:	Minex
3.	Version:	Minex 2FD 4.500
4.	Used detection technology:	Metal detector working by continuous wave EMI with two parallel frequencies in combination with a gradiometric coil-system.

Dimensional data

5.	Working length	
	• min. length:	850mm
	• max. length:	1,800mm
6.	Search head	
	• size:	210 x 285mm
	• weight:	N/A since forming part of the one-piece unit
	• shape:	Oval
7.	Transport case	
	• weight	4.0kg
	• with equipment (full):	Approx. 7kg
	• dimensions:	97 x 24 x 37cm
	• hard/soft case (material):	Hardcase/plastics (optional backpack)
8.	Weight, hand-held unit:	2.15kg (2.55kg including batteries)
9.	Weight, carrying (operational detection set):	2.55kg
10.	Weight, additional equipment:	Backpack 0.8kg , headphones 0.1kg
11.	Weight distribution/balance:	Balanced around the handgrip
12.	Other specifications:	—

Detection system specifications

13.	Status:	In production
14.	Detectors/systems in use to date:	No information provided by the manufacturer
15.	Other types:	Modified Soil Compensation Programme (Minex 2FD 4.500 AFG)
16.	Location of use:	Afghanistan

Environmental influence

17.	Humidity (limitations):	No limitations
18.	Temperature (limitations)	
	• storage:	- 40°C to + 70°C
	• operational:	- 32°C to + 60°C
19.	Water resistant:	Search head and telescope waterproof. Electronic unit (upper approx. 30cm of the total unit) is highly splash-proof. See Mil-STD Specs.
20.	Shock/vibration resistant:	See MIL-STD Specs.
21.	Environmental compensation:	Automatic, control of very aggressive soil supported by manual push-button operation.
22.	Operational hours/operating endurance	
	• low temperature (around 0°C):	Depending on working rhythm, approx. 25h with alkaline batteries
	• medium temperature (around 20°C):	Depending on working rhythm, approx. 30-50h with alkaline batteries
	• high temperature (higher than 30°C):	Depending on working rhythm, approx. 30-50h with alkaline batteries

Detection specifications

23.	Calibration/set-up	
	• auto/manual:	Automatic; manual control with test piece
	• duration:	30 seconds

Hand-held detectors

Hand-held detectors

24.	Detection range/sensitivity details/ detection performance/working depth	Type 72A - approx. 18cm TM 62 M - up to approx. 60cm see anti-tank mine for exemplary comparison on bigger objects; for UXO search Foerster offers highly-specialised magnetometers
	• low metal content mines:	
	• anti-tank mines:	
	• UXO:	
25.	Output indicator:	Audio by inbuilt speaker or headphones
26.	Pinpointing feature:	Two sounds, switching when passing an object with the centre of the search head
27.	Adjustment of search head angle:	Manual
28.	Soil influence:	Up to a certain degree automatic adaptation, aggressive soil can be learned by pushing a button.
29.	Best use in	
	• sand:	Yes
	• peat:	Yes
	• clay:	Yes
	• ferruginous soil (laterite)	Yes
30.	Optimal sweep speed:	Signal-quality not speed-dependent, no particular limit
31.	Search coil/antenna:	Gradiometric coil system (one sending/two receiving coils) Printed multi-layer construction.
32.	Limitations:	Not usable by divers
33.	Interference (with other detectors):	Within approx. 5m

Power

34.	Power supply/source:	Batteries
35.	Operating time:	25-50h with alkaline batteries
36.	Power supply	
	• weight:	N/A since forming part of the one-piece unit
	• no. of batteries/size/type:	3 x 1.5V mono-cell IECLR (ANSI STD.size D)
	• rechargeable:	Possible

Costs

37.	Price:	
	• for one detector:	€2,790
	• reduction for higher quantity:	Yes
38.	System price	
	• with training:	Depending on quantity
	• spare parts:	Depending on quantity
	• extended warranty:	Available on request
39.	Total:	t.b.d.
40.	Availability for hire:	Available

Others

41.	Duration of warranty:	24 months
42.	Additional equipment:	Headphones, backpack, workshop equipment and tools
43.	additional technical data/information:	Service manuals, training programme
44.	Compliant standards:	MIL-STD 810E 514.4-1 random vibration MIL-STD 810E 516.4 mechanical shock MIL-STD 810E 516.4 drop test MIL-STD 810E 501.3 high temperatures MIL-STD 810E 502.3 low temperatures MIL-STD 810E 506.3-1 blowing rain MIL-STD 810E 503.3 temperature shock MIL-STD 810E 512.2 leakage test MIL-STD 810E 505.3 solar radiation (sunshine) procedure I Mission MTBF = 24 480h (in accordance to MIL-STD-217F) EMC according to EN 55022:1998 (Class B) and EN 61000-4-3:1996+A1:1998

Technical specifications

Geophex GEM-3

Detector

1.	Brand:	Geophex
2.	Model:	GEM-3
3.	Version:	—
4.	Used detection technology:	Broadband electromagnetic metal detector

Dimensional data

5.	Working length:	
	• min. length:	1m
	• max. length:	1.5m
6.	Search head:	
	• size:	30-40cm circular
	• weight:	500g
7.	Transport case	
	• weight:	2kg
	• with equipment (full):	5kg
	• without equipment (empty):	2kg
	• dimensions:	40 x 30 x 10cm
	• material:	Plastic
8.	Weight, detector:	3kg
9.	Weight, carrying (operational detection set):	3kg
10.	Weight, additional equipment:	0
11.	Other specifications:	—

Detection system specifications

12.	Control of clearing/working depth:	30cm
13.	Status:	In production
14.	Detectors/systems in use to date:	About 30
15.	Other types:	—
16.	Location of use:	—

Environmental influence

17.	Humidity (limitations):	Up to 90%
18.	Temperature (limitations)	
	• storage:	-20 to 50° C
	• operational:	-20 to 50° C
19.	Water resistant:	Yes
20.	Operational hours/operating endurance:	
	• low temperature (below 0°C):	4h
	• medium temperature (around 20°C):	8h
	• high temperature (higher than 30°C):	6h

Detection specifications

21.	Detection range/Sensitivity details/ Detection performance/Working depth	
	• low metal content mines:	M14 at 15cm
	• anti-tank mines:	VS2.2 at 30cm
	• UXO:	155mm round at 150cm
22.	Signal	
	• audio:	Yes
	• visual:	Yes
	• other:	—
23.	Soil influence:	Adjustable for detection
24.	Best use in:	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
25.	Optimal sweep speed:	m/s
26.	Handling:	—

Hand-held detectors

27.	Sensitivity:	—
28.	Detection range:	—
29.	Search coil:	—
30.	Readings/detections:	—
31.	Limitations:	—
32.	Interference (with other detectors):	—

Power

33.	Power supply/source:	Internal rechargeable battery
34.	Operating time:	8h
35.	Power supply	
	• weight:	Included in the sensor
	• no of batteries/size/type:	—
	• rechargeable:	Yes
	• other:	—

Costs

36.	Price:	Contact Geophex for latest prices
37.	System price	
	• with training:	—
	• spare parts:	—
	• extended warranty:	—
34.	Total:	—
35.	Availability for hire:	—

Others

36.	Duration of warranty:	Usual
37.	Additional equipment:	Discrimination software
38.	Additional technical data/information:	—

Technical specifications

Minelab F1A4

Detector

1.	Brand:	Minelab
2.	Model:	F1A4
3.	Version:	Version 8
4.	Used detection technology:	Pulse induction

Dimensional data

5.	Working length	
	• min. length:	1,200mm
	• max. length:	1,450mm
6.	Search head	
	• size:	200mm diameter
	• weight:	—
	• shape:	Circular - monoloop
7.	Transport case	
	• weight:	4kg
	• with equipment (full):	8kg
	• dimensions:	320mm x 840mm x 180mm
	• hard/soft case (material):	Impact plastic/cordura
8.	Weight, hand-held unit:	1.5kg
9.	Weight, carrying (operational detection set):	3.0kg
10.	Weight, additional equipment:	—
11.	Weight distribution/balance:	Adjustable
12.	Other specifications:	—

Detection systems specifications

13.	Status:	In production
14.	Detectors/systems in use to date:	Over 6,000
15.	Other types:	F1A4 MIM, F1A4 UXO
16.	Location of use:	45 countries

Environmental influence

17.	Humidity (limitations):	Nil
18.	Temperature (limitations)	
	• storage:	-30°C to + 60°C
	• operational:	—
19.	Water resistant:	Yes (control box IP65)
20.	Shock/vibration resistant:	Yes
21.	Environmental compensations:	Auto
22.	Operational hours/operating endurance	
	• low temperature (around 0° C):	—
	• medium temperature (around 20° C):	16h
	• high temperature (higher than 30° C):	—

Detection specifications

23.	Calibration/set-up	
	• auto/manual	Auto
	• duration	—
24.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal content mines:	Type 72 at 15-19cm
	• anti-tank mines:	500lb bomb at 1.8m
	• UXO:	—
25.	Output indicator:	Audio
26.	Pinpointing feature:	Edge detection
27.	Adjustment of search head angle:	Yes
28.	Soil influence:	Automatic rejection
29.	Best use in:	Independent of soil type
30.	Optimal sweep speed:	0.6m/s
31.	Search coil	Enclosed

Hand-held detectors

32.	Limitations:	—
33.	Interference (with other detectors)	3-4m

Power

34.	Power supply/source:	4 x D cell alkaline/Ni-Cad batteries
35.	Operating time:	Alkaline batteries 16h
36.	Power supply:	4 x D cell
	• weight:	800g
	• no. of batteries/size/type:	4 x D cell alkaline
	• rechargeable	4 x D cell
	• other	

Costs

37.	Price	
	• for one detector:	US\$1,000-US\$2,000
	• reduction for higher quantity	Yes
38.	System price	
	• with training	Yes (subject to quantity purchased)
	• spare parts	Available
	• extended warranty	Yes
39.	Total:	Included free of charge for quantity purchase
40.	Availability for hire:	No

Others

41.	Duration of warranty:	15 months
42.	Additional equipment:	F series battery charger
43.	Additional technical data/information:	—
44.	Compliant standards:	Military specifications

Technical specifications

Minelab F3

Detector

1.	Brand:	Minelab
2.	Model:	F3
3.	Version:	New release
4.	Used detection technology:	Bipolar pulse induction

Dimensional data

5.	Working length	
	• min length:	650mm
	• max length:	1,500mm
6.	Search head	
	• size	200mm
	• weight	—
	• shape	Circular - monoloop
7.	Transport case	
	• weight:	4kg
	• with equipment (full):	8kg
	• dimensions:	850 x 400 x 185mm
	• hard/soft case (material):	Cordura
8.	Weight, hand-held unit:	2.1kg (battery pack removed)
9.	Weight, carrying (operational detection set):	3.0kg
10.	Weight, additional equipment:	—
11.	Weight distribution/balance:	Adjustable
12.	Other specifications:	—

Detection system specifications

13.	Status :	Initial production
14.	Detectors/systems in use to date:	—
15.	Other types:	—
16.	Location of use:	—

Environmental influence

17.	Humidity (limitations):	Nil
18.	Temperature (limitations):	
	• storage:	-30°C to +60°C
	• operational:	—
19.	Water resistant:	Waterproof
20.	Shock/vibration resistant:	Yes
21.	Environmental compensations :	Automatic
22.	Operational hours/operating endurance	
	• low temperature (around 0° C)	—
	• medium temperature (around 20° C)	19h (continuous use)
	• high temperature (higher than 30° C)	—

Detection specifications

23.	Calibration/set-up	
	• auto/manual	Automatic
	• duration	—
24.	Detection range/sensitivity details/detection performance/working depth	
	• low metal content mines:	Type 72: 15-19cms
	• anti-tank mines:	500lb – 1.8m
25.	Output indicator:	Audio
26.	Pinpointing feature:	DC couple edge detection
27.	Adjustment of search head angle:	Yes
28.	Soil influence:	Automatic rejection
29.	Best use in:	Independent of soil type
30.	Optimal sweep speed:	N/A
31.	Search coil:	Enclosed monoloop
32.	Limitations:	Nil
33.	Interference (with other detectors):	2-3m

Hand-held detectors

Power

34.	Power supply/source:	4 x D Cell alkaline/Ni-Cad
35.	Operating time:	19h
36.	Power supply	
	• weight:	1kg
	• no. of batteries/size/type	4 x D cell
	• rechargeable	4 x D cell
	• other:	—

Costs

37.	Price	
	• for one detector:	US\$ 2,000-US\$3,000
	• reduction for higher quantity:	Yes
38.	System price	
	• with training:	Yes (subject to quantity purchased)
	• spare parts:	Available
	• extended warranty:	Yes
39.	Total:	
40.	Availability for hire:	No

Others

41.	Duration of warranty:	15 months
42.	Additional equipment:	F Series Battery Charge – UXO coil (in development)
43.	Additional technical data/information:	—
44.	Compliant standards:	Military specifications

Technical specifications

Schiebel AN-19/2 Mine Detecting Set

Detector

1.	Brand:	Schiebel
2.	Model:	An-19/2 Mine Detecting Set
3.	Version:	M7
4.	Used detection technology:	Electromagnetic pulse induction

Dimensional data

5.	Working length	
	• min. length:	1,400mm
	• max. length:	1,600mm
6.	Search head	
	• size:	267mm diameter
	• weight:	0,60 kg
	• shape:	Round
7.	Transport case	
	• weight:	2.2kg
	• with equipment (full):	6.02kg
	• dimensions:	802 X 315 X125mm
	• hardcase (material):	Metal
	• soft material, backpack carry bag with accessories and detector:	4kg
8.	Weight, hand-held unit:	Search head with telescopic pole 1.22kg
9.	Weight, carrying (operational detection set):	2.41kg + set of batteries 0.58kg
10.	Weight, additional equipment:	—
11.	Weight distribution/balance:	Electronic unit is shoulder-strap mounted, headphone on head, and hand-held item is balanced by the armrest.
12.	Other specifications:	—

Detection system specifications

13.	Status:	In production
14.	Detectors/systems in use to date:	Over 40,000
15.	Other types:	—
16.	Location of use:	Worldwide

Environmental influence

17.	Humidity (limitations):	No
18.	Temperature (limitations)	Virtually none
	• storage:	-55°C to +85°C (-67°F to +185°F)
	• operational:	-40°C to +70°C (-40°F to +158°F)
19.	Water resistant:	Yes
20.	Shock/vibration resistant:	Yes
21.	Environmental compensation :	Auto
22.	Operational hours/operating endurance	
	• low temperature (around 0°C):	Approx. 65h
	• medium temperature (around 20°C):	Approx. 70h
	• high temperature (higher than 30°C):	75h or more

Detection specifications

23.	Calibration/set-up:	
	• auto/manual:	Calibration not required. Manual set-up using single control for sensitivity. Sound may also be adjusted to suit local conditions.
	• duration:	Less than 30s
24.	Detection range/sensitivity details/detection performance/working depth	
	• low metal content mines:	72A – 18cm, M14 – 14cm
	• anti-tank mines:	Metal anti-tank at 1m; plastic anti-tank: nearly all types at operational threat depth
	• UXO:	NATO standard 7.62 rounds at 40cm, AK 47 at 30+cm; all larger items down to 1m in depth

Hand-held detectors!

Hand-held detectors

25.	Output indicator:	Sound and optional visual-led display
26.	Pinpointing feature:	Yes by edge of target warbling tone
27.	Adjustment of search head angle:	Easily adjusted by angle wingnut to cover all necessary operational situations (more than 180 degrees)
28.	Soil influence:	Can operate in light magnetic soil with reduced but normally acceptable performance
29.	Best use in:	
	• sand:	Yes
	• peat:	Yes
	• clay:	Yes
	• ferruginous soil (laterite):	No
30.	Optimal sweep speed:	Static to 2m/s
31.	Search coil:	Yes
32.	Limitations:	Medium and heavy (strong) magnetic soil
33.	Interference (with other detectors):	None at distance above 2m separation

Power

34.	Power supply/source:	Standard D size alkaline cells
35.	Operating time:	Approx. 70h
36.	Power supply:	
	• weight:	0.58kg
	• no. of batteries/Size/Type:	4 x 1.5V R20 ANSI size D
	• rechargeable:	Rechargeable Ni-Cad cells can be used but operating time is reduced to 38h

Costs

37.	Price:	
	• for one detector:	€2,000-€3,000
	• reduction for higher quantity:	Yes
38.	System price:	
	• with training:	—
	• spare parts:	—
	• extended warranty:	—
39.	Total:	—
40.	Availability for hire:	—

Others

41.	Duration of warranty:	12 months, extension possible
42.	Additional equipment:	—
43.	Additional technical data/information:	—
44.	Compliant standards:	ISO-9001, AQA P4

Technical specifications

Schiebel ATMID™ All Terrain Mine Detector

Detector

1. Brand:	Schiebel
2. Model:	ATMID All Terrain Mine Detector
3. Version:	—
4. Used detection technology:	Electromagnetic pulse and continuous wave induction

Dimensional data

5. Working length	
• min. length:	1,400mm
• max. length:	1,600mm
6. Search head	
• size:	267mm diameter
• weight:	0.82kg
• shape:	Round
7. Transport case	
• weight:	2.20kg
• with equipment (full):	6.36kg
• dimensions:	802 x 315 x 125mm
• hard/soft case (material):	Metal
8. Weight, hand-held unit:	1.61kg
9. Weight, carrying (operational detection set):	3.27kg including set of batteries
10. Weight, additional equipment :	Headphone 0.17kg
11. Weight distribution/balance:	Electronic unit is shoulder-strap mounted, headphone on Head and hand-held item is balanced by the armrest.
12. Other specifications:	—

Detection system specifications

13. Status:	In production
14. Detectors/systems in use to date:	Over 900
15. Other types:	AN-19/2 various, MIMID
16. Location of use:	Worldwide

Environmental influence

17. Humidity (limitations):	No
18. Temperature (limitations)	
• storage:	-55°C to +85°C
• operational:	-40°C to +70°C
19. Water resistant:	Yes
20. Shock/vibration resistant:	Yes
21. Environmental compensation:	Auto
22. Operational hours/operating endurance	
• low temperature (around 0°C):	Approx. 65h
• medium temperature (around 20°C):	approx. 70h
• high temperature (higher than 30°C):	Approx. 75h

Detection specifications

23. Calibration/set-up	
• auto/manual:	Automatic ground balance; manually initiated and sensitivity then manually adjusted by a single control
• duration:	Approx. 30s
24. Detection range/sensitivity details/ detection performance/working depth	
• low metal content mines:	72A - 20cm, M14 - 16cm
• anti-tank mines:	Metal anti-tank at down to m, plastic anti-tank nearly all types at operational threat depth
• UXO:	NATO standard 7.62 rounds, at 40+cm, larger items down to 1m in depth
25. Output indicator (sound/display/other):	Audio tone
26. Pinpointing feature:	Yes

Hand-held detectors

Hand-held detectors

27.	Adjustment of search head angle:	Easily adjusted by angle winch to cover all necessary operational situations (more than 180 degrees)
28.	Soil influence:	Automatically balanced out
29.	Best use in	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
30.	Optimal sweep speed:	0.25-0.7 metres per second
31.	Search coil/antenna:	Search coil
32.	Limitations:	Proximity to high power rf/radar transmitters
33.	Interference (with other detectors):	Mutual interference possible up to 8m in CW mode

Power

34.	Power supply/source:	Battery DC voltage
35.	Operating time:	Approx. 70h
36.	Power supply	
	• weight:	0.58kg
	• no. of batteries/size/type:	4 x 1.5V R20 ANSI size D cells
	• rechargeable:	Ni/Cad 1.5V

Costs

37.	Price:	
	· for one detector:	€2,000-€3,000
	· reduction for higher quantity:	Yes
38.	System price	
	· with training:	—
	· spare parts:	—
	· extended warranty:	—
39.	Total:	—
40.	Availability for hire:	—

Others

41.	Duration of warranty:	12 months
42.	Additional equipment:	—
43.	Additional technical data/information:	—
44.	Compliant standards:	ISO 9001, AQAP 4

Technical specifications

Schiebel MIMID™ Miniature Mine Detector

Detector

1.	Brand:	Schiebel
2.	Model:	MIMID™ Miniature Mine Detector
3.	Version:	—
4.	Used detection technology:	Electromagnetic pulse induction

Dimensional data

5.	Working length	
	• min. length:	656mm
	• max. length:	1,262mm
6.	Search head	
	• size:	328mm
	• weight:	Integrated in mine detector
	• shape:	Rectangular
7.	Transport case	
	• weight:	0.64kg
	• with equipment (full):	2kg
	• dimensions:	328 x 102 x 56mm
	• hard/soft case (material):	Soft
8.	Weight, hand-held unit:	1.36kg
9.	Weight, carrying (operational detection set):	1.36kg + set of batteries 0.1kg
10.	Weight, additional equipment:	Mine prodder
11.	Weight distribution/balance:	Various. All of the weight is hand-held but the unit is counterbalanced at the handle by the entire armrest.
12.	Other specifications:	—

Detection system specifications

13.	Status:	In production
14.	Detectors/systems in use to date:	More than 1,500
15.	Other types:	—
16.	Location of use:	Worldwide

Environmental influence

17.	Humidity (limitations):	No
18.	Temperature (limitations)	
	• storage:	+55°C to +85°C
	• operational:	-40°C to +70°C
19.	Water resistant:	Waterproof to 30m (
20.	Shock/vibration resistant:	Yes
21.	Environmental compensation:	Auto
22.	Operational hours/operating endurance	
	• low temperature (around 0°C):	Approx. 6.5h
	• medium temperature (around 20°C):	Approx. 7h
	• high temperature (higher than 30°C):	Approx. 7.5h

Detection specifications

23.	Calibration/set-up:	
	• auto/manual:	Calibration not required. Manual set-up using single control for sensitivity. Sound may also be adjusted to suit local conditions.
	• duration:	Less than 30s
24.	Detection range/sensitivity details/detection performance/working depth	
	• low metal content mines :	72 A - 14cm; M14 - 12cm
	• anti-tank mines:	Metallic mines down to 80cm - plastic mines at threat depth
	• UXO:	NATO standard 7.62 round - 32cm. Larger items down to 80cm
25.	Output indicator:	Audio tone and visual LED display
26.	Pinpointing feature:	Yes
27.	Adjustment of search head angle:	Easily adjusted to cover all necessary operational situations (more than 180 degrees)

Hand-held detectors

28.	Soil influence:	—
29.	Best use in:	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Light laterite with reduced sensitivity
30.	Optimal sweep speed:	0-2m/s
31.	Search coil/antenna:	Search coil
32.	Limitations:	—
33.	Interference (with other detectors):	None above 2m separation

Power

34.	Power supply/source:	Battery DC voltage
35.	Operating time:	Approx. 7h
36.	Power supply	
	• weight:	0.1kg
	• no. of batteries/size/type:	4 x 1.5V LR6 ANSI size AA
	• rechargeable:	Yes, but operating time is reduced to 4h

Costs

37.	Price:	
	• for one detector:	€3,000 -€4,000
	• reduction for higher quantity:	Yes
38.	System price	—
39.	Total:	—
40.	Availability for hire:	—

Others

41.	Duration of warranty:	12 months
42.	Additional equipment:	Titanium mine prodder, test piece. Carry bag available in green, camouflage or black.
43.	Additional technical data/information:	—
44.	Compliant standards:	ISO 9001, AQAP 4

Technical specifications

Vallon VMH 2.1

Detector

1.	Brand:	Vallon
2.	Model:	VMH2.1
3.	Version:	Metal Mine Detector
4.	Used detection technology:	Pulse induction

Dimensional data

5.	Working length	
	· min. length:	810mm
	· max. length:	1,360mm
6.	Search head	
	· size:	170 x 305mm
	· weight:	With telescopic pole 1.5kg
	· shape:	Oval
7.	Transport case	
	· weight:	3.1kg
	· with equipment (full):	6.2kg
	· dimensions:	900 x 390 x 220mm
	· hard/soft case (material):	Semi hard carrying case/artificial leather
8.	Weight, hand-held unit:	3.1kg
9.	Weight, carrying (operational detection set):	3.1kg
10.	Weight, additional equipment:	Headset 250g
11.	Weight distribution/balance:	—
12.	Other specifications:	—

Detection system specifications

13.	Status:	In production
14.	Detectors/systems in use to date:	Approx. 2,000
15.	Other types:	—
16.	Location of use:	Worldwide

Environmental influence

17.	Humidity (limitations):	According to MIL STD 810E
18.	Temperature (limitations)	
	· storage:	-55°C to +75°C
	· operational:	-32°C to +60°C
19.	Water resistant:	Yes up to 1.5m
20.	Shock/vibration resistant:	Yes
21.	Environmental compensation:	Auto
22.	Operational hours/operating endurance	
	· low temperature (around 0°C):	In mode M up to 100h, in mode P up to 30h, depending on battery type and soil programme
	· medium temperature (around 20°C):	In mode M up to 100h, in mode P up to 30h, depending on battery type and soil programme
	· high temperature (higher than 30°C):	In mode M up to 100h, in mode P up to 30h, depending on battery type and soil programme

Detection specifications

23.	Calibration/set-up	
	· auto/manual:	Automatic
	· duration:	Continual
24.	Detection range/sensitivity details/ detection performance/working depth	
	· low metal content mines:	Type 72A at 23cm
	· anti-tank mines:	TM 62M at 125cm
	· UXO:	Schell 160 (d) x 590 (l) at 120cm
25.	Output indicator:	Sound
26.	Pinpointing feature:	Second sound, shape of the search head, dynamic/static operation
27.	Adjustment of search head angle:	With a joint
28.	Soil influence:	Adjustable

Hand-held detectors

29.	Best use in	
	· sand	Yes
	· peat	Yes
	· clay	Yes
	ferruginous soil (laterite)	Yes
30.	Optimal sweep speed:	0.2-1.5m/s
31.	Search coil/antenna:	Oval shape, 170 x 305mm
32.	Limitations:	No
33.	Interference (with other detectors):	Distance of 16m

Power

34.	Power supply/source:	Battery
35.	Operating time:	See point 23
36.	Power supply	
	· weight:	—
	· no. of batteries/size/type:	4 x 1.5V standard batteries D-size
	· rechargeable:	4 x 1.24V rechargeable battery KR35/62
	· other:	—

Costs

37.	Price:	
	· for one detector:	US\$2,000-US\$3,000
	· reduction for higher quantity:	Yes
38.	System price:	
	· with training:	
	· spare parts:	
	· extended warranty:	
39.	Total:	
40.	Availability for hire:	

Others

41.	Duration of warranty:	12 months
42.	Additional equipment:	Option UXO, option stick probe
43.	Additional technical data/information:	
44.	Compliant standards:	DIN EN, ISO 9001:2000

Technical specifications

Vallon VMM2

Detector

1.	Brand:	Vallon
2.	Model:	VMM2
3.	Version:	Metal Mine Detector
4.	Used detection technology:	Pulse induction

Dimensional data

5.	Working length	
	• min. length:	960mm
	• max. length:	1,900mm
6.	Search head	
	• size:	170 x 305mm
	• weight:	With telescopic pole 1.7kg
	• shape:	Oval
7.	Transport case	
	• weight:	6.8kg
	• with equipment (full):	11.5kg
	• dimensions:	782 x 300 x 142mm
	• hard/soft case (material):	Hard case/aluminium
8.	Weight, hand-held unit:	3.1kg
9.	Weight, carrying (operational detection set):	3.2kg
10.	Weight, additional equipment:	Headset 250g
11.	Weight distribution/balance:	—
12.	Other specifications:	—

Detection system specifications

13.	Status:	In production
14.	Detectors/systems in use to date:	Approx. 600
15.	Other types:	—
16.	Location of use:	Worldwide

Environmental influence

17.	Humidity (limitations):	According to MIL STD 810E
18.	Temperature (limitations)	
	• storage:	-55°C to +75°C
	• operational:	-40°C to +60°C
19.	Water resistant:	Yes up to 2.5m
20.	Shock/vibration resistant:	Yes
21.	Environmental compensation:	Auto
22.	Operational hours/operating endurance	
	• low temperature (around 0°C):	In mode M up to 100h, in mode P up to 30h, depending on battery type and soil programme
	• medium temperature (around 20°C):	In mode M up to 100h, in mode P up to 30h, depending on battery type and soil programme
	• high temperature (higher than 30°C):	In mode M up to 100h, in mode P up to 30h, depending on battery type and soil programme

Detection specifications

23.	Calibration/set-up	
	• auto/manual:	Automatic
	• duration:	Continual
24.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal content mines:	Type 72A at 23cm
	• anti-tank mines:	TM 62M at 125cm
	• UXO:	Schell 160 (d) x 590 (l) at 120cm
25.	Output indicator:	Sound
26.	Pinpointing feature:	Second sound, shape of the search head, dynamic/static operation
27.	Adjustment of search head angle:	With a joint
28.	Soil influence:	Adjustable

Hand-held detectors

29.	Best use in	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
30.	Optimal sweep speed:	0.2-1.5m/s
31.	Search coil/antenna:	Oval shape, 170 x 305mm
32.	Limitations:	No
33.	Interference (with other detectors):	Distance of 16m

Power

34.	Power supply/source:	Battery
35.	Operating time:	See point 23
36.	Power supply	
	• weight:	—
	• no. of batteries/size/type:	4 x 1.5V standard batteries D-size
	• rechargeable:	4 x 1.24V rechargeable battery KR35/62
	• other:	—

Costs

37.	Price:	
	• for one detector:	US\$3,000-US\$ 4,000
	• reduction for higher quantity:	Yes
38.	System price:	
	• with training:	—
	• spare parts:	—
	• extended warranty:	—
39.	Total:	—
40.	Availability for hire:	—

Others

41.	Duration of warranty:	12 months
42.	Additional equipment:	Option UXO, option stick probe
43.	additional technical data/information:	—
44.	Compliant standards:	DIN EN ISO 9001:2000

Section 2

Large-loop detectors

Ebinger UPEX[®] 740 M

Ebinger, Germany



General description

The Ebinger Large Loop Technology **UPEX 740[®] M** is a valuable asset in the field of Explosive Ordnance Clearance (EOC). It has been used for humanitarian and commercial battle area clearance operations in Afghanistan, Angola, Cambodia, France, Kosovo, Laos, the UK, and Viet Nam. Due to its size, large areas can be inspected and cleared of ammunition in a short period of time.

Main characteristics:

- The sturdy electronics unit is compact, lightweight and splash waterproof;
- Target acquisition is indicated by audio alarm and by galvanometer reading;
- Detection results can be stored in a Data Logger for plotting or further processing by software;
- Different indication characteristics can be selected to suit adverse working conditions;
- The equipment's audio control pulses indicate the battery condition. Audible confidence clicks inform operators that equipment is functioning correctly;
- UPEX[®] is also available for underwater use or vehicle-mounted.

Working technology

UPEX[®] 740 M is as easy to use as a conventional mine detector. Detection signals are easy to interpret and no advanced training is required for the operators. The UPEX[®] detector applies the eddy current pulse induction principle for the detection of metal components in UXO. The device can be adjusted to various types of non-co-operative soils and to suppress surface-bound small fragmentation.

No further detailed technical information is given by the manufacturer.

Detectors in use to date

Since 1993, more than 500 UPEX[®] 740M units have been purchased. This detector is in service with various humanitarian demining organisations, the United Nations and many other commercial companies.

Power supply

- The UPEX[®] 740 M is powered by 8 x 1.5V C-cell or alternative; rechargeable battery pack 3,8Ah/12V.

- Operational life of battery (8x1.5V alkaline 8Ah): 55h in position Low¹, 25h in position High;¹
- Operational life of rechargeable batteries (8x1.2V 3,5Ah): 38h in position Low¹, 19h in position High.¹

Factory support

- All detectors are covered by a 24- month warranty. The world wide service network ensures permanent availability of spare parts.
- Operation and maintenance training is provided at Ebinger facilities or on site.
- Additional factory support by specially trained staff is provided on request.
- Instruction and maintenance manuals are available in Arabic, English, French, German, Italian, Russian; other languages available on request.

Maintenance and support

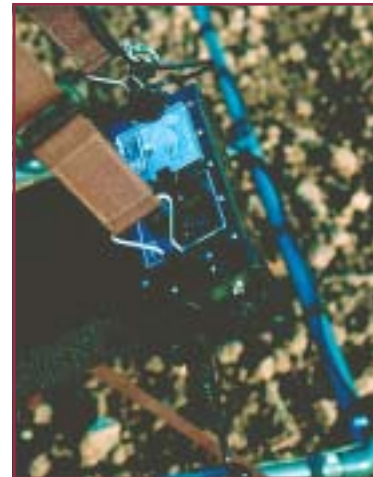
- There are no special requirements for the technicians or the workshop facilities. Most repairs can be carried out by Ebinger-trained staff on site.
- The step by step explanation of the manuals ensure easy maintenance of the system.

Test and evaluation

The detector went through comprehensive internal tests. Reports displaying the performance can be provided by the manufacturer on request.



Training on battle area clearance in Afghanistan



Control panel

Reported limitations and strengths

The system has been in service for several years, however it has not been tested in comparative trials. Therefore no statement regarding known limitations and strengths can be given.

1. According to the manufacturer.

Technical specifications

Ebinger UPEX® 740 M

Detector:

1.	Brand:	Ebinger
2.	Model:	UPEX® 740M Large-Loop Detector
3.	Version:	11/2002
4.	Used detection technology:	Metal detector/pulse induction

Dimensional data:

5.	Working length:	
	• min. length:	270 x 90 x 70mm electronic unit
	• max. length:	290 x 105 x 50mm battery container
6.	Search head:	
	• size:	Ø 255mm, 2,000 x 1,000mm (260mm)
	• weight:	3,5kg including PVC-Frame
	• shape:	square, (circular)
7.	Transport case	
	• weight:	2kg
	• with equipment	4.5kg/8.5kg
	• dimension	—
	• Hard/soft case :	Hard plastic / canvas satchel
8.	Weight, hand held unit:	1.2kg
9.	Weight, carrying (operational detection set)	4.5kg
10.	Weight, additional equipment:	—
11.	Weight distribution/balance	—
12.	Other specifications:	—

Detection system specifications

13.	Control of working depth:	Sensitivity adjustment manual
14.	Status:	In production
15.	Detectors/systems in use to date:	Approx. 500
16.	Other types:	—
17.	Location of use:	Worldwide

Environmental influence

18.	Humidity (limitations):	0-95%
19.	Temperature (limitations)	
	• storage	-53°C to +70°C
	• operational:	-30°C to +55°C
20.	Water resistant:	Yes
21.	Shock/vibration resistant:	Yes
22.	Environmental compensation	Auto / manual
23.	Operational hours/operating endurance	
	• low temperature (around 0°C):	Up to 75h, depends on type of battery
	• medium temperature (around +20°C):	Up to 75h, depends on type of battery
	• high temperature (around +30°C):	Up to 75h, depends on type of battery

Detection specifications

24.	Calibration/setup	
	• auto / manual	Manual - automatic
25.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal contents mines:	Depending on their size, material and the local interference
	• anti-tank mines:	Depending on their size, material and the local interference
	• UXO:	Depending on their size, material and the local interference
26.	Output indicator:	Optical and sound
27.	Pinpointing feature:	Yes
28.	Adjustment of search head angle:	Yes
29.	Soil influence:	Adjustable

Large-loop detectors

30.	Best use in	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
31.	Optimal sweep speed:	0,2-1,5m/s
32.	Search coil/antenna:	Ø 2600mm circular, (2000 x 1000mm)
33.	Limitations:	No
34.	Interference (with other detectors):	< safety distance

Power

35.	Power supply/source:	Battery
36.	Operation time:	See point 23
37.	Power supply:	
	• weight:	—
	• no of batteries:	8 x 1.5V dry batteries C-cell
	• rechargeable:	8 x 1.2V rechargeable batteries
	• other:	1 x 12V battery pack

Costs

38.	Price:	
	• for one detector:	US\$4,000-US\$5,000
	• reduction for higher quantity:	Yes
39.	System price	
	• with training:	On request
	• spare parts:	On request
	• extended warranty:	On request
40.	Total:	—
41.	Availability for hire:	On request

Other

42.	Duration of warranty	24 months
43.	Additional equipment:	UXO head Ø 45cm
44.	Additional technical data/information:	—
46.	Compliant standards:	DIN EN ISO 900: 2000

Section 3

UXO detectors

Ebinger MAGNEX 120 LW

Ebinger, Germany



General description

MAGNEX® 120 LW has been developed for accurate bomb disposal and in particular for the detection of ferromagnetic ammunition located in the ground or in shallow water. The locator is designed for borehole use to indicate deep buried UXO or for operation in areas with substantial interference from surface bound fragments.

The pinpoint location with audio signal and the digital multi-channel system ensure a high level of reliability and user friendliness.

Working methodology

MAGNEX® 120 LW works on the gradiometer principle which can detect geomagnetic field interference. Objects made from ferromagnetic material can show a magnetic field which superimposes to the natural terrestrial field. Amplitude and polarity of the local anomaly are used to indicate the position of the UXO.

Digital measurement data logging:

To ease data collection and storage the MAGNEX® locators and the MAGNETO® system suit each other perfectly and increase productivity in bomb disposal substantially. A high degree of field input makes the system very user-friendly. Its functionality facilitates its use when investigating the extent of pollution or when processing detection data from ammunition. In conjunction with the DLM data logger the system can be used as a man portable single-channel or triple-channel system.

The detector is equipped with a new Ebinger-developed inductor system which ensures a base clearance of 430mm.

Ease of operation and a rigid mechanical design facilitate reliable operation for professional clearing tasks. The stepping switch offers the following sensitivity ranges:

- Level 1 3,000 nT/m
- Level 2 1,000 nT/m
- Level 3 300 nT/m
- Level 4 100 nT/m
- Level 5 30 nT/m
- Level 6 10 nT/m

No further detailed information is given by the manufacturer.

Detectors in use to date

Since 1993, more than 1.200 units of MAGNEX® 120 have been purchased. The detector is in service with various NGOs and commercial companies world wide.

Power supply

- The MAGNEX® 120 LW is powered by 6 x 1,5V round cell LR20;
- Operational life of battery: approximately 40h.¹

Factory support

- All detectors are covered by a 24-month warranty. The worldwide service network ensures permanent availability of spare parts.
- Operation and maintenance training is provided at Ebinger facilities or on site.
- Additional factory support by specially trained staff is provided on request.
- Instruction and maintenance manuals are available in Arabic, English, French, German, Italian, Russian; other languages available on request.

Maintenance and support

- There are no special requirements for the technicians or the workshop facilities. Most repairs can be carried out by Ebinger trained staff on site;
- The step by step explanation of the manuals ensure easy maintenance of the system.

Test and evaluation

The detector went through comprehensive internal tests. Reports displaying the performance can be provided by the manufacturer on request.

Reported limitations and strengths

No information available at this time.

1. According to the manufacturer.

Foerster FEREX 4.032

Institut Dr. Foerster, Germany



General description

The **FEREX 4.032** is a metal detector using the fluxgate magnetometer principle to detect magnetic anomalies caused by ferromagnetic objects. It's primary use is the search of UXO at depths to approximately 8m.¹ Under certain circumstances (for example anti-tank mines covered by desert sand) the FEREX can successfully be used for mine detection.

The detector replaces the FEREX 4.021 which was introduced on the market in the mid 1990s.

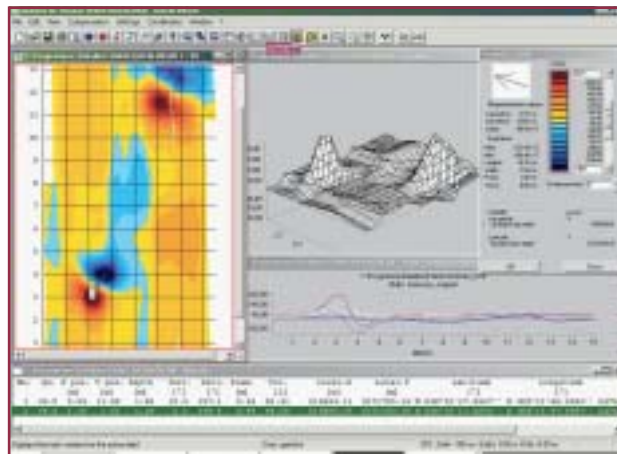
Due to the tension band technology inside the Foerster magnetometer, the system is known as one of the most sensitive fluxgate magnetometers available. These probes are lifetime calibrated — even if used within a rough environment or within an extreme climate.

The standard hand-held version “FEREX 4.032 API” indicates ferromagnetic objects by a pointer instrument and sound.

Due to the modular character of the system a simple exchange of the control box upgrades the unit to a FEREX 4.032 DLG datalogger. This detector combines the API features with an integrated four channel data logger for scanning fields in order to evaluate the resulting map of magnetic anomalies on a standard PC. The software Dataline calculates, among other data, the exact position, depth or orientation of the scanned objects.

The system is capable of fulfilling tasks like underwater or borehole search.

The high end solution within this instrument family is a vehicle-based multichannel system (Foerster Multicat), supported by a differential Global Positioning System (GPS).



Display of scanned area

Working methodology

By detecting variations within the earth's magnetic field, the FEREX will indicate plus and minus poles of ferromagnetic objects. Geometry and strength of the detected poles enable the user to determine location, depth and size of the object.

Power supply

Being in service since early 2000 the FEREX 4.032 meanwhile is in use in the following countries: Afghanistan, Australia, Austria Canada, Croatia, Denmark, Egypt, Finland, France, Germany, Indonesia, Iran, Ireland, Italy, Japan, the Netherlands, Portugal, Poland, Russia, Spain, Tunisia, U.K., Uruguay, the U.S., and Viet Nam.

Detectors in use to date

As standard, the FEREX 4.032 gets powered by four 1.5V D cells. Rechargeable batteries can be used, the indicated operating times varying depending on their quality and age. Under all circumstances, sensitivity and detection quality are not influenced by the battery condition.

Factory support

Spare parts are available exclusively from Foerster. Standard rechargeable batteries can be purchased on the free market.

Besides the direct support from Foerster in Germany, the company provides a worldwide net of representatives in over 40 countries. Most of them offer complete after sale service. Besides offering training on the customer's site, Foerster provides modern test and training facilities in Reutlingen, Germany. A full training programme for trainers including lessons on background knowledge with various training material is available in German and English. On request, training forms part of a purchasing package. Standard manuals and service documentation are available in English, French German and Spanish languages. Other languages available on request.

Maintenance and support

- The FEREX maintenance system is organized on two levels: Level one — Basic field maintenance; Level two — Workshop maintenance.
- The recommended number of workshops depends on the logistic circumstances. The personnel for handling a workshop must be familiar with some basic knowledge about mechanical and electronic repairs.
- Foerster offers supply of complete tool sets and testing equipment as well as service training.

Test and evaluation

Foerster performs tests within its own facilities mainly for research and quality control.

The manufacturer states that tests are largely carried out under "real" conditions.



FEREX Array

Reported limitations and strengths

No information available at this time.

1. According to the manufacturer.

Geonics EM 61-Mk2

Geonics Ltd., Canada



EM 61-Mk2

General description

The **EM 61-Mk2 Metal Detector** is a high power, high sensitivity metal detector suitable for applications in the detection of both ferrous and non-ferrous metal.

Based on the design principles of time domain electromagnetics (TDEM), each system includes a coincident transmitter/receiver coil (1 x 0.5m); a second receiver coil (1 x 0.5m); backpack-mounted system electronics and power supply; and, a GPS-compatible data acquisition system with supporting software.

Since the introduction of the original EM 61 Metal Detector in 1994, advances in design and application have provided greater functionality and enhanced detection capabilities within a wider range of operating environments. In addition to the current EM 61-Mk2 model, several modifications and variations are available to address specific targets and/or operating conditions. Options include: a hand-held coil system for increased lateral target resolution; a submersible coil for use in both fresh and salt water environments; and a high power modification to increase detection limits associated with all targets.

For a substantial increase in productivity, particularly over larger survey areas, multiple systems can be configured as a single array to be towed behind a vehicle.

The EM 61 series of metal detectors is recognized within the North American defense community as a standard application technology for the detection of UXO. Complementary applications include the delineation of environmental hazards, utilities and infrastructure at both active and inactive military installations.¹

Working methodology

Operating on the principles of time domain electromagnetics, the EM 61-MK2 generates a primary magnetic field that induces electrical eddy currents in nearby metallic objects. The receiver coils measure the strength of secondary magnetic fields associated with the induced eddy current flow.

The standard EM61-MK2 will detect metallic objects to a depth of 5m maximum. The maximum depth at which any individual object can be detected is determined uniquely by the size, composition and orientation of the object. Increased detection depths for all objects can be achieved with a high power modification to the system.

The EM 61-MK2 provides both audio and visual anomaly indicators. The visual indicator can be presented in both graphical and text formats.

Designed to be relatively insensitive to the soil/water matrix, the EM 61-Mk2 can be operated in most environments without geologic interference. A simple nulling procedure establishes the zero reference level at each site.

Detectors in use

Since the introduction of the original EM 61 in 1994, total sales have exceeded 300 units worldwide. Customer groups are varied and include consultants to the environmental/engineering/defense industries, military agencies, government research institutes and universities.

For applications in ordnance detection specifically, operations have been concentrated geographically within Canada and the U.S., primarily at military installations (e.g. Fort. Ord, California; Fort. Hood, Texas) and unpopulated target ranges.

Outside of North America, the EM 61 series has been applied to ordnance detection in several countries, including Australia, Germany, Poland, Spain, and the U.K.



EM 61-HH Mk2 (modification of EM 61-Mk2)

Power supply

Power is supplied from a self-contained, rechargeable 12V gel cell battery mounted on an operator-carried backpack. Two batteries, with chargers, are supplied with each system. Average battery life during continuous operation is 4h; optional high power batteries are available for extended applications.

Factory support

- Technical support is provided by Geonics Ltd. directly. Assistance is also available from an extensive network of representatives worldwide.
- An inventory of spare parts is maintained at the factory. The standard warranty provides coverage on coils and cables for six months, and one year on all other components.
- Introductory (half day) training at the factory is included with purchase. Extended training, at the factory or on-site, is available; additional cost is associated with any extended training programme.
- Technical notes, case studies and instruction manuals, included with purchase, are available in English; limited documentation in other languages can be made available upon request.

Maintenance and support

- The EM 61-Mk2 does not require general maintenance. The system should be stored dry and clean with the batteries fully charged.
- The EM 61-Mk2 requires a single operator only.
- Repair/service generally requires either simple component replacement or return to the factory.
- Comprehensive on-site service by operator/technician requires training.

Test and evaluation

Several models of the EM 61 series have been tested and evaluated through government-sponsored projects for applications in the detection of UXO. Reports associated with such tests are published and available for distribution upon request.^{2,3}

Applications in landmine detection have received only limited consideration. Preliminary indications suggest that the EM 61-Mk2 would be sensitive to larger (e.g. anti-tank) targets only.

Reported limitations and strengths¹

Specific applications can be limited by available coil configurations — e.g. the standard configuration can be difficult to operate in vegetative overgrowth. Modified operating procedures or application-specific configurations can address most limitations.

Soils with a very high magnetic susceptibility response can present noise in the data. A recently patented technique should reduce the effect of such noise.

As the detector has not been tested in comparative trials there is no further and detailed information available.

1. According to the manufacturer.

2. M. Fernandez, A. Lewis, F. Littmann, *PROM 1 Anti-personnel landmines - Probability of activation by physical contact with a metal detector*, Special publication No. I.01.29, European Commission Directorate General JRC Joint Research Centre Institute for Systems, Informatics & Safety, Ispra, March 2001, Annex A, p. 100.

3. Y. Das, J.T. Dean, D. Lewis, J.H.J. Roosenboom, G. Zahaczewsky (eds), *A multi-national technical evaluation of performances of commercial off the shelf metal detectors in the context of humanitarian demining*, International Pilot Project for Technology Co-operation, Final report, European Commission, Joint Research Centre, Ispra, Italy, 2001, Annex A, p. 101.

Vallon VMX2™

Vallon, Germany



Transport case



General Description

The **UXO Detector VMX2™** has been designed for the highly accurate detection of all types of metallic mines as well as bombs, ammunition, and other metallic objects located in the ground or in shallow water.

Ease of operation and a rigid mechanical design facilitate reliable operation for professional ordnance clearing in battlefield operations and military training programmes.

Along with integrated modern circuits the VMX2™ uses the function principle of Vallon's advanced pulse-field. It can work also in very heavily mineralized soils, like laterite, magnetite as well as in shallow water (salt and fresh water). Both the "ground effect" as well as the strong magnetic influence of main power lines have been eliminated.¹ That means a reduced false alarm rate, even when the search head contacts the soil or water.

Main components

1. Watertight round search head with telescopic carrying bar (two sections), an internally run connection cable and an electronics unit consists of:
 - integrated non-magnetic loudspeaker;
 - battery compartment for four batteries (alkaline mono cells, or Ni-Cad accumulators);
 - operating controls, essential during the detection, which are all arranged at the front panel and are protected against mechanical damage and unintentional changes;
 - filter switch with 4 programmes to optimize the operation under power lines;
 - data connector which is normally closed by a protection cap. This data connector has two functions: data input for upgrading the software, and data output for computer-aided detection.
2. Detection test piece (non-magnetic).
3. Batteries, 4 each (D-size), factory shipment.
4. Carrying bag will store 8 each (including 4 spares).
5. Non-magnetic, watertight headset with nylon head straps and a pocket clip.
6. Carrying belt for the electronics unit.
7. Semi hard carrying case/artificial leather
8. Operation manual.
9. Field instructions.

Working methodology

Principle of operation:

The search head continuously emits electromagnetic pulses as the operator sweeps close to the surface. The electronics unit is sending a pulse current to the search head. The pulsed current is running through the copper wire windings in the search head generating a pulsed magnetic field. The search head acts as both an emitter and a receiver as it senses the time behaviour of the pulsed field as it is collapsing.

If there are no metal objects within the magnetic field, it will collapse rather fast. If there is a metal object in the magnetic field range, the following happens:

- The primary pulsed magnetic field induces a low current into the metal object;
- This current produces a “secondary” magnetic field around the metal object;
- The primary magnetic field collapses and the secondary magnetic field collapses a short time later;
- The search head receives the collapsing signals and sends them to the electronics unit;
- The electronics unit checks the characteristics of the collapse rate against the originally produced pulses/collapse rate; thus an alarm signal is produced depending on the collapsing size of the metal target;
- The shape of the pulse in the VMX2™ is designed to avoid activation of magnetically-fuzed mines are not activated.

To ensure that the VMX2™ can optimally be used worldwide under different soil conditions, it is provided with a programme switch to select different detection features for the actual detection job.

The correct programme setting and the wide range detection sensitivity allow to detect even plastic mines with minimum metal content in strongly mineralized soil and also near to 50Hz or 60Hz power lines.¹

A processor internally “checks” the reliability and proper function of the detector during operation. The pulse signal generation, signal processing, battery voltages, external connections, and most important, the internal operation voltages are constantly monitored. An acoustic alarm signal is produced when a fault is found in these functions.

This complicated procedure of measuring, operating, and controlling by the electronics unit ensures the high performance and reliability of the detector. The user is free to operate the VMX2™ very easily and concentrate fully on the detection tasks.

Detection range VMX2™ 1		
Mines	Programme 1 Distance in cm	Programme 2 Distance in cm
TM 62M	170	145
PMN1	128	102
M16	152	135
Schell160 (d) x 590 (l)	175	153
Aircraft Bomb 50 kg 210 (d) x 730 (l)	188	165
105 mm Fog Shell HC-BE M84A1	159	136

Programme 1 normal soil

Programme 2 mineralized soil

Detectors in use

Since 2000 nearly 300 units of VMX2™ have been sold. The detectors are in service with several armed forces and commercial mine clearance organisations.

Power supply

- Type of battery: 4 x 1.5V mono-cell IECLR 20 (ANSI std. size D) or rechargeable KR35/62;
- Operational life of battery: up to 60h;
- Operation time exclusive metal mine detection: 60h;
- Operation time exclusive minimum metal mine detection: 10h.

Factory support

- Vallon runs several service centres around the world with current spare parts on stock. Spare parts can be provided together with a corresponding maintenance manual directly to the customer for repair on site.
- Operation and maintenance training is offered in Vallon facilities or worldwide.
- The operation manuals and the maintenance manuals are available in English and German. Other languages available on request.
- Warranty 12 months.

Maintenance support

There are no special requirements for the technicians or the workshop facilities. All tools are standard and available in most of the workshops. For each detector a maintenance manual with step by step explanation for the repair of the detector is available.

Test and evaluation

Internal test reports can be provided by the manufacturer on request.

Reported limitations and strengths

No information at this time.

1. According to the manufacturer

Technical specifications

Ebinger MAGNEX® 120 LW

Detector:

1.	Brand:	Ebinger
2.	Model:	MAGNEX® 120 LW Magnetometer
3.	Version:	05/2001
4.	Used detection technology:	Difference Magnetometer using fluxgate principle

Dimensional data:

5.	Working length:	
	• length:	1,280mm complete
	• probe:	600mm
6.	Search head:	
	• size:	600 x 43mm
	• weight:	1,5kg
	• shape:	Cylinder probe
7.	Transport case:	
	• weight:	3kg
	• with equipment	4,2kg/11kg
	• dimension	880 x 280 x 180mm
	• hard/soft case (material)	Hard plastic / canvas satchel
8.	Weight, hand held unit:	1,2kg
9.	Weight, carrying (operational detection set):	4,2kg
10.	Weight, additional equipment:	—
11.	Weight distribution/balance:	—
12.	Other specifications:	—

Detection system specifications

13.	Control of working depth:	Sensitivity adjustment manual/auto
14.	Status:	In production
15.	Detectors/systems in use to date:	More than 1,200
16.	Other types:	—
17.	Location of use:	Worldwide

Environmental influence

18.	Humidity (limitations):	0-95%
19.	Temperature (limitations)	
	• storage	-53°C to +70°C
	• operational:	-30°C to +55°C
20.	Water resistant:	Yes
21.	Shock/vibration resistant:	Yes
22.	Environmental compensation:	Auto / manual
23.	Operational hours/operating endurance	
	• low temperature (around 0°C):	up to 75h, depends on type of battery
	• medium temperature (around +20°C):	up to 75h, depends on type of battery
	• high temperature (around +30°C):	up to 75h, depends on type of battery

Detection specifications

24.	Calibration/setup	
	• auto / manual	Manual - automatic
	• duration	Continual
25.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal contents mines:	—
	• anti-tank mines:	Depending on their size, material and the local interference
	• UXO:	Depending on their size, material and the local interference
26.	Output indicator:	Optical, sound and data output
27.	Pinpointing feature:	Yes
28.	Adjustment of search head angle:	Yes
29.	Soil influence:	—

UXO detectors

30.	Best use in	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
31.	Optimal sweep speed:	0,2-1,5m/s
32.	Search coil / antenna:	Probe 600mm
33.	Limitations:	Only ferromagnetic material
34.	Interference (with other detectors):	< safety distance

Power

35.	Power supply/source	Battery
36.	Operation time:	See point 23
37.	Power supply:	
	• weight:	—
	• no of batteries:	6 x 1.5V dry batteries LR-20
	• rechargeable:	7 x 1.2V rechargeable batteries
	• other:	—

Costs

38.	Price:	
	• for one detector:	US\$4,000-US\$5,000
	• reduction for higher quantity:	Yes
39.	System price	
	• with training:	On request
	• spare parts:	On request
	• extended warranty:	On request
40.	Total:	—
41.	Availability for hire:	On request

Other

42.	Duration of warranty	24 months
43.	Additional equipment:	Borehole cable
44.	Additional technical data/information:	—
46.	Compliant standards:	EMC tests according to MIL-STD 461 D, DIN EN ISO 9001:2000

Technical specifications

Foerster FEREX 4.032

Detector

1.	Brand:	Foerster
2.	Model:	FEREX 4.032
3.	Version:	API, DLG, DLG Kartograph
4.	Used detection technology:	Metal detector working by fluxgate magnetometers

Dimensional data

5.	Working length:	Approx. 1,4m
6.	Search sensor:	
	• size:	Length 853-1,800mm /diameter 35mm
	• weight:	0.55 - 1.00kg
	• shape:	tube
7.	Transport case:	
	• weight:	Approx. 4kg
	• with equipment (full):	Approx. 9kg
	• dimensions:	995 x 265 x 335mm
	• hard/soft case (material):	Hardcase/plastics
8.	Weight, hand-held unit:	Approx. 4kg
9.	Weight, carrying (operational detection set):	Approx. 4kg
10.	Weight, additional equipment:	Headphones 0.1kg
11.	Weight distribution/balance:	Balanced around the handgrip
12.	Other specifications:	—

Detection system specifications

13.	Status	In production
14.	Detectors/systems in use to date:	—
15.	Other types:	—
16.	Location of use:	—

Environmental influence

17.	Humidity (limitations):	No limitations
18.	Temperature (limitations)	
	• storage:	-57°C to + 70°C
	• operational:	-35°C to + 70°C
19.	Water resistant:	Sensor is 100m sea-waterproof. Electronics unit is highly splash-proof. See MIL-STD Specs.
20.	Shock/vibration resistant:	See MIL-STD Specs.
21.	Environmental compensation:	6 operation modes for suppression of electromagnetic influences and filter for big / small objects
22.	Operational hours/operating endurance	
	• medium temperature (around 20°C):	depending on working-rhythm and instrument type : approx. 35-80h with alkaline batteries

Detection specifications

23.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal content mines:	No
	• anti-tank mines:	Full metal case (ferromagnetic) approx. 2m
	• UXO:	Hand grenade: approx. 50cm; 500lbs bomb (Mk 82): 4-6m max.; 1,000lbs bomb: 5-8m. max.
24.	Output indicator:	Audio by inbuilt speaker or headphones, visible by pointer instrument and on screen via evaluation software Dataline
25.	Adjustment of search head angle:	Manual
26.	Best use in	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
27.	Interference (with other detectors):	No

Power

28.	Power supply/source:	4 x 1.5V mono-cell IECLR (ANSI standard size D)
29.	Operating time:	35-80h with alkaline batteries
30.	Power supply	
	• weight:	n.a. since forming part of the unit
	• no of batteries/size/type:	4 x 1.5V mono-cell IECLR (ANSI standard size D)
	• rechargeable:	Possible
	• other:	n.a.

Costs

31.	Price:	
	• for one detector:	More than US\$5,000
	• reduction for higher quantity:	Yes
32.	System price	
	• with training:	Depending on quantity
	• spare parts:	Depending on quantity
	• extended warranty:	Available on request
33.	Total:	t.b.d.
34.	Availability for hire:	Available

Other

35.	Duration of warranty:	24 months
36.	Additional equipment:	Headphones, workshop equipment and tools, GPS, multi-probe-holders (hand-held and vehicle based), underwater cables, borehole equipment
37.	Additional technical data/information:	Service manuals, training programme
46.	Compliant standards:	MIL-STD 810EEMC according to MIL-STD 461D

Technical specifications

Geonics EM 61 HH - Mk2

Detector

1.	Brand:	Geonics Limited
2.	Model:	EM 61HH - Mk2
3.	Version:	—
4.	Used detection technology:	Time domain electromagnetic induction

Dimensional data

5.	Working length	
	• min. length:	1m
	• max. length:	1.5m
6.	Search head	
	• size:	33x20cm
	• weight:	2.8kg
	• shape:	Elliptical
7.	Transport case:	
	• weight	—
	• with equipment (full):	50kg
	• dimensions:	117 x 50 x 54cm
	• hard/soft case (material):	Hard, plywood, aluminium laminated
8.	Weight, hand-held unit:	—
9.	Weight, carrying (operational detection set):	4kg
10.	Weight, additional equipment:	7.5kg with optional wheels
11.	Weight distribution/balance:	—
12.	Other specifications:	—

Detection system specifications

13.	Status (development/in production):	In production
14.	Detectors/systems in use to date:	50
15.	Other types:	5 (production)
16.	Location of use:	Worldwide

Environmental influence

17.	Humidity (limitations):	100%
18.	Temperature (limitations)	
	• storage:	-40°C to +50°C
	• operational:	-30°C to +50°C
19.	Water resistant:	Yes
20.	Shock/vibration resistant:	Yes
21.	Environmental compensation:	Auto
22.	Operational hours/operating endurance:	4h per battery
	• low temperature (around 0°C):	3.5h
	• medium temperature (around 20°C):	4h
	• high temperature (higher than 30°C):	4h

Detection specifications

23.	Calibration/setup	
	• auto/manual:	Auto
	• duration:	10s
24.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal content mines:	No
	• anti-tank mines:	Yes
	• UXO:	20mm cartridge to 7m, 103mm projectile to 1.3m
25.	Output indicator:	Sound, graphic display
26.	Pinpointing feature:	Yes
27.	Adjustment of search head angle:	Yes
28.	Soil influence:	Extreme magnetic susceptibility

UXO detectors

29.	Best use in:	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
30.	Optimal sweep speed:	1m/s
31.	Search coil/antenna:	—
32.	Limitations:	—
33.	Interference (with other detectors):	Variable, depending on detector type

Power

34.	Power supply/source:	12V rechargeable gel cell battery
35.	Operating time:	4h
36.	Power supply	
	• weight:	4,5kg
	• no of batteries/size/type:	1
	• rechargeable:	Yes
	• other:	Optional high power battery

Costs

37.	Price:	
	• for one detector:	More than US\$5,000
	• reduction for higher quantity:	—
38.	System price	
	• with training:	Additional US\$600 per day
	• spare parts:	Available upon request
	• extended warranty:	n/a
39.	Total:	US\$19,375
40.	Availability for hire:	Yes

Others

41.	Duration of warranty:	6 months on coils, cables and batteries; 1 year on other components
42.	Additional equipment:	Includes hand-held PC for data storage and GPS capabilities
43.	Additional technical data/information:	—
44.	Compliant standards:	Hazards of electromagnetic radiation on ordnance

Technical specifications

Geonics EM 61-Mk2

Detector

1.	Brand:	Geonics Limited
2.	Model:	EM 61- Mk 2
3.	Version:	—
4.	Used detection technology:	Time domain electromagnetic induction

Dimensional data

5.	Working length	
	• min. length:	—
	• max. length:	—
6.	Search head	
	• size:	1 x 0,5m
	• weight:	7kg
	• shape:	Rectangular coil
7.	Transport case	
	• weight	
	• with equipment (full):	74kg (2 boxes)
	• dimensions:	106 x 61 x 33cm; 54 x 45 x 56cm
	• hard/soft case (material):	Hard, plywood, aluminium laminated
8.	Weight, hand-held unit:	—
9.	Weight, carrying (operational detection set):	23kg
10.	Weight, additional equipment:	—
11.	Weight distribution/balance:	—
12.	Other specifications:	—

Detection system specifications

13.	Status:	In production
14.	Detectors/systems in use to date:	More than 300
15.	Other types:	5 (production)
16.	Location of use:	Worldwide

Environmental influence

17.	Humidity (limitations):	100%
18.	Temperature (limitations)	
	• storage:	-40°C to +50°C
	• operational:	-30°C to +40°C
19.	Water resistant:	Yes
20.	Shock/vibration resistant:	Yes
21.	Environmental compensation:	Auto for coils
22.	Operational hours/operating endurance :	4h per battery
	• low temperature (around 0°C):	3.5h
	• medium temperature (around 20°C):	4h
	• high temperature (higher than 30°C):	4h

Detection specifications

23.	Calibration/setup	
	• auto/manual:	Auto
	• duration:	10s
24.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal content mines:	No
	• anti-tank mines:	Yes
	• UXO:	20mm cartridge to 7m; 500 lbs bomb to 5m, 103mm projectile to 1.3m
25.	Output indicator:	Sound, graphic display
26.	Pinpointing feature:	Yes
27.	Adjustment of search head angle:	n/a
28.	Soil influence:	Extreme magnetic susceptibility

UXO detectors

29.	Best use in	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
30.	Optimal sweep speed:	1m/s
31.	Search coil/antenna:	—
32.	Limitations:	—
33.	Interference (with other detectors):	Variable, depending on detector type

Power

34.	Power supply/source:	12V rechargeable gel cell battery
35.	Operating time:	4h
36.	Power supply	
	• weight:	4.5kg
	• no of batteries/size/type:	1
	• rechargeable:	Yes
	• other:	Optional high power battery

Costs

37.	Price:	
	• for one detector:	More than US\$5,000
	• reduction for higher quantity:	—
38.	System price	
	• with training:	Additional US\$600 per day
	• spare parts:	Available upon request
	• extended warranty:	n/a
39.	Total:	US\$21,300
40.	Availability for hire:	Yes

Others

41.	Duration of warranty:	6 months on coils, cables and batteries, 1 year on other components
42.	Additional equipment:	Includes hand-held PC for data storage + GPS capabilities
43.	Additional technical data/information:	—
44.	Compliant standards:	Hazards of electromagnetic radiation on ordnance

Technical specifications

Vallon VMX2

Detector

1.	Brand:	Vallon
2.	Model:	VMX2
3.	Version:	UXO Detector
4.	Used detection technology:	Pulse induction

Dimensional data

5.	Working length:	
	• min. length:	920mm
	• max. length:	1,370mm
6.	Search head	
	• size:	Diameter 615mm
	• weight:	With telescopic pole 1.9kg
	• shape:	Round
7.	Transport case	
	• weight	3.8kg
	• with equipment (full):	7.6kg
	• dimensions:	820 x 720 x 165mm
	• hard/soft case (material):	Semi-hard carrying case/artificial leather
8.	Weight, hand-held unit:	3.6kg
9.	Weight, carrying (operational detection set):	2.3kg
10.	Weight, additional equipment:	Head set 250g
11.	Weight distribution/balance:	—
12.	Other specifications:	—

Detection system specifications

13.	Control of working depth:	Sensitivity adjustment
14.	Status:	In production
15.	Detectors/systems in use to date:	—
16.	Other types:	—
17.	Location of use:	Different places in the world

Environmental influence

18.	Humidity (limitations):	According to MIL STD 810E
19.	Temperature (limitations)	
	• storage:	-55°C to +75°C
	• operational:	-40°C to +60°C
20.	Water resistant:	Yes up to 2m
21.	Shock/vibration resistant:	Yes
22.	Environmental compensation:	Auto
23.	Operational hours/operating endurance	
	• low temperature (around 0°C):	In mode M up to 60h; in mode P up to 10h; depending on battery type and soil programme
	• medium temperature (around 20°C):	In mode M up to 60h; in mode P up to 10h; depending on battery type and soil program
	• high temperature (higher than 30°C):	In mode M up to 60h; in mode P up to 10h; depending on battery type and soil program

Detection specifications

24.	Calibration/setup:	
	• auto/manual:	Automatic
	• duration:	Continual
25.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal content mines:	PMN-1 in 128cm
	• anti-tank mines:	TM 62M in 170cm
	• UXO:	Schell 160 (d) x 590 (l) in 175cm
26.	Output indicator:	Sound

UXO detectors

27.	Pinpointing feature:	Second sound, shape of the search head, dynamic/static operation
28.	Adjustment of search head angle:	With a joint
29.	Soil influence:	Adjustable
30.	Best use in:	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
31.	Optimal sweep speed:	0.2 – 1.5 m/s
32.	Search coil/antenna:	Round shape with 615mm diameter
33.	Limitations:	No
34.	Interference (with other detectors):	Distance of 16m

Power

35.	Power supply/source:	Battery
36.	Operating time:	See point 23
37.	Power supply	
	• weight:	
	• no of batteries/size/type:	4 x 1.5 V standard batteries D-size
	• rechargeable:	4 x 1.24 V rechargeable battery KR35/62
	• other:	—

Costs

38.	Price:	
	• for one detector:	US\$4,000-US\$5,000
	• reduction for higher quantity:	Yes
39.	System price:	
	• with training:	—
	• spare parts:	—
	• extended warranty:	—
40.	Total:	—
41.	Availability for hire:	—

Other

42.	Duration of warranty:	—
43.	Additional equipment:	—
44.	additional technical data/information:	—
46.	Compliant standards (civil/military):	—

Section 4

Vehicle-mounted detectors

Foerster MINEX Array 4.550

Institut Dr. Foerster, Germany



General description

The **MINEX Array 4.550** represents a combination of technologies found in the MINEX 2FD 4.500 for vehicle based research. In mid-2002 it left the prototype stage and has since been tested under various scenarios in the field. Due to its light weight and easy mounting it can be connected to almost all existing vehicles whether it is needed in front, behind or beside the vehicle.

Basic technical features:

- continuous wave induction with two primary transmitting frequencies;
- one transmitting coil;
- multiple receiving coils;
- automatic compensation soil, salt water, AC fields;
- ground learning procedure.

Its three main components are:

- the array itself integrated within a topography- adaption- frame;
- control unit with integrated PC;
- target marking device.

Working methodology

The MINEX Array 4.550 needs only one cable as standard connection between the control unit and the array. Data sampling, evaluation and display via the control unit offers the following display of results:

- object map/list in real time;
- object marking on field surface in real time.

Integrated filter settings are offering

- reduction of false alarms;
- preselection of object size.

Rough indication of sensitivity:¹

- TM 62 anti-tank mine: approx. 70cm;
- PMN anti-personnel mine: approx 30cm;
- same sensitivity for low metal content mines like the MINEX 2FD 4.500.

Power supply

Power supply 220 VAC or 24 VAC (normally fed via the vehicle's power supply).

Detectors in use to date

No information provided by the manufacturer.

Factory support

No information provided by the manufacturer.

Maintenance and support

No information provided by the manufacturer.

Test and evaluation

The MINEX Array 4.550 has been tested by Foerster personnel and has undergone field acceptance trials.

As the detector has recently been introduced to the open market it could not be tested in comparative trials.

Reported limitations and strengths

No information available at this time.

1. According to the manufacturer.

Schiebel VAMIDS™

Schiebel Elektronische Geräte GmbH, Austria



VAMIDS™ drawbed



VAMIDS™ mounted on mine-protected vehicle

General description

VAMIDS™ provides the ability to detect low-metal content mines from a vehicular platform.¹ The system is ideal for route clearance/verification, area reduction and quality assurance applications. It can be mounted on virtually any medium or heavy-duty tactical or civilian vehicle, providing an efficient and cost-effective detection system. The system is designed for use on established (though possibly primitive) routes, however, it is also ideally suited for clear, open land.

The system is capable of operating at speeds of up to 15km/h while providing real-time detection, which significantly increases the productivity of clearance operations. VAMIDS™ is based upon the proven technology of the AN-19/2 Mine Detecting Set, by combining this technology with a sophisticated visualization and marking system. VAMIDS™ allows its operators to quickly and efficiently detect landmines and mark the ground prior to clearance.

The VAMIDS™ marking system is designed to accurately mark the location of targets and the cleared lane using an easily identifiable fluid. With up to eight spray nozzles per meter the system provides highly accurate, target-proportional marking capability. The criteria for marking is selected and controlled via the VAMIDS Manager™ software. A wide variety of marking fluids may be used.

Working methodology

The flexible arrays are pulled over the ground, ensuring optimal coverage. The individual detection heads are mounted on a flexible drawbed structure that serves as a wear sheet, both supporting and protecting the assembled detection heads.

VAMIDS™ requires only one dedicated operator, who may be trained on all operational aspects, typically within a day. All functions are controlled, and all parameters are set, using the VAMIDS Manager™ software.

Once the system is calibrated (in a metal-free area), and a functional check is completed, the system is ready for deployment. The VAMIDS™ operator may observe the metal content in the ground under the VAMIDS™ with the real-time display on the system console. The operator has full control over all marking and safety alarm parameters.

Power supply

The control unit is powered from a nominal 12 up to 36V DC standard vehicle battery. The input power is fused and filtered on the power card. All DC-DC converters can operate over an input range from 10V DC to 40V DC thereby providing large margins for the specified nominal battery supply voltage.

Detectors in use to date

VAMIDS™ has been purchased and is used by humanitarian and commercial demining organizations in various countries. No further detailed information is given by the manufacturer.

Factory support

- All systems are covered by a 12-month, no cost warranty and operator/maintenance training is provided (on-site or at the factory) as requested, as part of the procurement package. Further training can be provided at cost.
- Spare parts are available for a period of ten years after purchase. These can be obtained directly from the factory or from the worldwide network of Schiebel agents.
- Operator and maintenance manuals are provided in most major languages (e.g. English, German, Spanish, etc).
- Schiebel factory repairs or technicians are available to provide additional support worldwide whenever required.

Maintenance and support

Due to its rugged design VAMIDS™ requires little maintenance and can be upgraded to the latest modification state. Most repairs can be carried out, at field level, by Schiebel-trained personnel. Workshop repairs can be carried out by Schiebel-trained technicians, using the recommended tools and test equipment.

Test and evaluation

VAMIDS™ has been comprehensively field-tested in all climates by the manufacturer and all detector specifications are fully proven. It has also been evaluated and selected by a range of organisations. (No detailed information is provided by the manufacturer).

However the detector could not be tested in comparative trials.



Marking suspect area

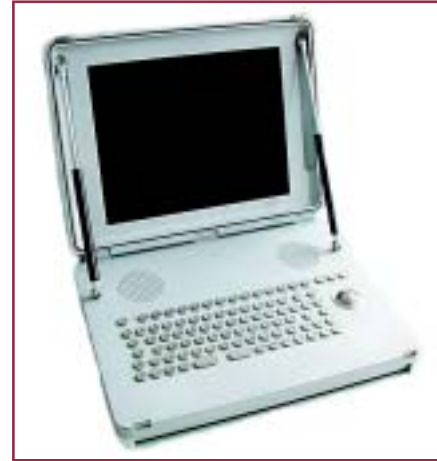
Reported limitations and strengths

No information available at this time.

1. According to the manufacturer.

Vallon VMV 8

Vallon, Germany



Force Ware Mobile PC

General description

The metal detector **VMV 8** has been designed for the localisation of metal objects in the ground, e.g. metal mines, plastic mines with higher metal content, and UXO.

Quality control is considered to be one of the most suitable applications for this detector.

The unit consists of a search head, a waterproof detection — and evaluation electronics, and a special personal computer to display metal parts, to operate the unit, and for the documentation.

The search head is specially designed for users needs and allows the following applications:

- mounting in front of the vehicle;
- mounting aside the vehicle;
- trailer version.

The metal detector VMV8 has a rugged design and can be operated in all weather and soil conditions as well as climatic zones.

This unit is also suitable for the integration of multi-sensor platforms, including infrared, ground penetration radar or microwave for the detection.

Main components VMV 8:

1. Central control unit containing 8 detection channels with 8 voltage stabilizers, 8 transmitters and 8 receivers, 8 digital-analog-converters as well as interface for data transfer to the mobile PC (MPC). Cooling by fan-operation.
2. 1 relay box 16 channels, providing:
 - 1 channel for breaking signal;
 - 8 channels for painting system;
 - 7 channels AUX.
3. Force Ware Mobile Personal Computer MPC specially configured for VMV 8

Technical data:

- Processor: Pentium MMX 266MHz Tillamook CPU with 66MHz front side Bus;
- Chipset: ALI Aladdin PCI; M 1541 North Bridge; M 1543C South Bridge;
- Main memory: 256MB SDRAM with 3.3V technology in 168-pin standard DIMM socket;
- Graphic board: Chips & Technology 69000 PCI VGA controller (integrated on the main board) 2MB RAM;
- Interface up to 4 x RS232 (standard 2 x RS232); parallel port (PS/2 or ECP or EPP); PS/2 mouse interface; PS/2 keyboard interface;
- Hard disk: 2,5" IDE flash disk with 448MB;

- Floppy disk: standard 3,5" 1,44MB;
 - LCD monitor, size 15"; active TFT matrix; 262144 colour; resolution 1024 X 768 pixel; 500cd/m² (suitable for daylight), temperature range -10°C to +70°C;
 - Operation power: 18V to 36V DC.
4. VMV 8 software installed on the MPC
 5. Search head made from glassfibre, dimensions approx. 3.000 x 470 mm with 8 integrated detection coil systems. Other dimensions on request.
 6. Headphone standard
 7. Loudspeaker
 8. Mounting kit (glasfibre bars)
 9. Protection spoiler 3.050 mm x 735 mm

Working methodology

Principle of operation

The search head consists of 8 electromagnetic sensors which are continuously emitting pulses. There is a short pause between each magnetic pulse. The electromagnetic reaction of metal objects is registered during these pauses at the central control unit.

By means of the detector's "automatic adjustment", it will spontaneously adapt itself to the natural ground conditions. Detection work can be carried out even in adverse soil conditions such as magnetite soil and soils with changing conductivities.

The sensitivity level of the detector is adjustable. The set sensitivity level will remain constant even under changing ground or water conditions.

Measuring data is transferred via the 8-fold high speed RS 232 I/O Card to the PC.

Automatic soil compensation.

The unit is operated via a special personal computer. Various functions can be displayed on the PC-screen:

1. Signal strength per detector coil as a bar graph,
2. Total picture of the metal density below the search head as a coloured map,
3. Display of the operating elements of the metal detector and their settings via the keyboard or mouse,
4. Output for subsequent printout of the total checked area as a 2D-coloured map.

Detection range VMV 8 ¹		
Mine	User 1	Soil
PMN-1 (AP)	76cm	43cm
PFM-1 (AP)	34cm	21cm
M16 (AP)	125cm	85cm
TM62P3 (AT)	80cm	50cm
TM46 (AT)	88cm	53cm

Power supply

- The power supply of the detector accepts car batteries with 24V DC. The internal controls stabilize voltage fluctuations between 18-32V DC.
- Power consumption of VMV 8 at 24V is approx. 1A.
- Safety fuse: 2A.
- Separate DC converter from 12V to 24V is included.

Detectors in use to date

Since 1996 nearly 100 units of VMV 8 and its predecessor model ML 1621 have been sold. The detectors are in service with various military users and commercial mine clearance organisations.

Factory support

- The manufacturer runs several service centres around the world with current spare parts on stock. Spare parts can be provided together with a corresponding maintenance manual to the customer for repair on site.
- Operation and maintenance training is offered at all Vallon facilities worldwide.
- The operation manuals and the maintenance manuals are available in English and German. Other languages available on request.
- Warranty 12 months.

Maintenance and support

There are no special requirements for the technicians or the workshop facilities. All tools are standard and available in most of the workshops. For each detector a maintenance manual is available, with step by step explanation for the repair of the detector.

Test and evaluation

Internal test reports can be provided on request by the manufacturer.

Reported limitations and strenghts

No information available at this time.

1. According to the manufacturer.

Technical specifications

Foerster MINEX Array 4.550

Detector

1.	Brand:	Foerster
2.	Model:	MINEX Array 4.550
3.	Used detection technology:	Metal detector working by continuous-wave EMI with two parallel frequencies in combination multiple receiving coils

Dimensional data

4.	Working length • min. length:	1,200mm - 2500mm depending on customer's request
5.	Search head • size: • weight: • shape:	(1,200mm-2,500mm) x 310 mm x 50mm Approx. 15kg plus (growing with length) Rectangular
6.	Topographic adaption • weight:	Approx. 35kg plus (growing with length)
7.	Weight, control unit:	Approx. 8kg/shockproof

Detection system specifications

8.	Status:	Production on request
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Environmental influence

9.	Humidity (limitations):	No limitations
10.	Temperature (limitations) • storage: • operational:	-57°C to + 70°C -35°C to + 70°C
11.	Water resistant:	Coilsystem: yes / Control Box IP 65
12.	Shock/vibration resistant:	Yes
13.	Environmental compensation:	Automatic, control of very aggressive soil supported by soil-learn-procedure

Detection specifications

14.	Detection range/sensitivity details/ detection performance/working depth: • low metal content mines: • anti-tank mines :	Type 72 A - approx. 19cm TM 62 M - approx 70cm
15.	Output indicator:	Realtime on screen and spray-marking
16.	Best use in: • sand • peat • clay • ferruginous soil (laterite)	Yes Yes Yes Yes
17.	Optimal sweep speed:	Diving speed < 1m/s

Power

18.	Power supply/source:	220V AC or 24V DC/consumption < 25W
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Costs

19.	System price:	—
20.	Total:	Approx. €95,000; subject to requested modifications and customers wishes
21.	Availability for hire:	Available

Others

22.	Duration of warranty:	24 months
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Technical specifications

Schiebel VAMIDS™ Vehicular Array Mine Detection System

Detector

1.	Brand:	Schiebel Elektronische Geräte GmbH.
2.	Model:	VAMIDS™ Vehicular Array Mine Detection System
3.	Version:	2.0
4.	Used detection technology:	Pulse mode

Dimensional data

5.	Working length	
	• min. length:	Min. 1m array
	• max. length:	Max. 6m array
6.	Search head	
	• size:	1,168mm wide; 613mm long; 150mm thick per metre array
	• weight:	20kg per metre array
	• shape:	Search head is round; array is rectangular
7.	Transport case	
	• weight:	—
	• with equipment (full):	—
	• dimensions:	—
	• hard/soft case (material):	—
8.	Weight, hand-held unit:	—
9.	Weight, carrying (operational detection set):	—
10.	Weight, additional equipment:	—
11.	Weight distribution/balance:	—
12.	Other specifications:	—

Detection system specifications

13.	Control of working depth:	Depending on soil and properties of target
14.	Status:	In production
15.	Detectors/systems in use to date:	No comment
16.	Other types:	—
17.	Location of use:	No comment

Environmental influence

18.	Humidity (limitations):	No
19.	Temperature (limitations)	Virtually none
	• storage:	-55°C to +85°C (-67°F to +85°F)
	• operational:	-40°C to +55°C (-40°F to +131°F)
20.	Water resistant:	Yes
21.	Shock/vibration resistant:	Yes
22.	Environmental compensation :	Auto
23.	Operational hours/operating endurance:	Not applicable

Detection specifications

24.	Calibration/setup :	Not applicable
25.	Detection range/sensitivity details/ detection performance/working depth:	
	• low metal content mines:	72A -18cm, M14 -14cm
	• anti- tank mines:	Metal anti-tank at 1m; plastic anti-tank nearly all types at operational threat depth
	• UXO:	NATO standard 7.62 rounds at 40cm, AK 47 at 30+cm all larger items down to a metre in depth
26.	Output indicator:	Visual, acoustic, data-based, and electric relay-based galvanically separated output
27.	Pinpointing feature:	No
28.	Adjustment of search head angle:	—
29.	Soil influence:	Can operate in light magnetic soil with reduced but normally acceptable performance

Vehicle-mounted detectors

30.	Best use in	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	No
31.	Optimal sweep speed:	Vehicle velocity 0 – 15kmh
32.	Search coil/antenna:	8 coils per meter up to 48 coils
33.	Limitations:	Medium and heavy magnetic soil
34.	Interference (with other detectors):	None at distance above 2m separation

Power

35.	Power supply/source:	Standard vehicle battery
36.	Operating time:	—
37.	Power supply:	12 up to 36V DC

Costs

38.	Price:	
	• for one detector:	US\$3,000-US\$4,000
	• reduction for higher quantity:	Yes
39.	System price	
	• with training:	Included
	• spare parts:	As required
	• extended warranty:	Available
40.	Total:	To be determined
41.	Availability for hire:	Yes

Other

42.	Duration of warranty:	12 months
43.	Additional equipment:	N/A
44.	Additional technical data/information:	Available
46.	Compliant standards:	MIL-D-0023359G; ISO 9001

Technical specifications

Vallon VMV8

Detector

1.	Brand:	Vallon
2.	Model:	VMV8
3.	Version:	Vehicle-Mounted Metal Mine Detector
4.	Used detection technology:	Pulse induction

Dimensional data

5.	Working length:	
	• min. length:	1,500mm
	• max. length:	2,084mm
6.	Search head	
	• size:	3,000 x 460mm
	• weight:	35kg
	• shape:	Rectangle
	Spoiler	
	• size:	3,050 x 735mm
	• weight:	15kg
	• shape:	U form
7.	Transport case	
	• weight:	85kg
	• with equipment (full):	160kg
	• dimensions:	3,100 x 780 x 500mm
	• hard/soft case (material):	Wooden case
8.	Weight, hand-held unit:	—
9.	Weight, carrying (operational detection set):	—
10.	Weight, additional equipment:	Head set 250g
11.	Weight distribution/balance:	—
12.	Other specifications:	—

Detection system specifications

13.	Control of working depth:	Sensitivity adjustment
14.	Status:	In production
15.	Detectors/systems in use to date:	—
16.	Other types:	—
17.	Location of use:	Various locations

Environmental influence

18.	Humidity (limitations):	According to MIL STD 810E
19.	Temperature (limitations)	
	• storage:	-55°C to +75°C
	• operational:	-32°C to +60°C
20.	Water resistant:	Yes up to 1.5m
21.	Shock/vibration resistant:	Yes
22.	Environmental compensation:	Auto
23.	Operational hours/operating endurance	
	• low temperature (around 0°C):	Depending on battery type and soil programme
	• medium temperature (around 20°C):	Depending on battery type and soil programme
	• high temperature (higher than 30°C):	Depending on battery type and soil programme

Detection specifications

24.	Calibration/setup	
	• auto/manual:	Automatic
	• duration:	Continual
25.	Detection range/sensitivity details/ detection performance/working depth	
	• low metal content mines:	PMN-1 in 76cm
	• anti-tank mines:	TM 46 in 88cm
	• UXO:	Schell 160 (d) x 590 (l) in 140cm
26.	Output indicator:	Sound and bargraph

Vehicle-mounted detectors

27.	Pinpointing feature:	Sound and bargraph
28.	Adjustment of search head angle:	Automatic
29.	Soil influence:	Automatic adjustable
30.	Best use in:	
	• sand	Yes
	• peat	Yes
	• clay	Yes
	• ferruginous soil (laterite)	Yes
31.	Optimal sweep speed:	0.2 – 1.5 m/s
32.	Search coil/antenna:	Rectangle 3,000 x 460mm
33.	Limitations:	No
34.	Interference (with other detectors):	Distance of 16m

Power

35.	Power supply/source:	Car battery
36.	Operating time:	See point 23
37.	Power supply	
	• weight:	—
	• no of batteries/size/type:	Car battery 24V
	• rechargeable:	
	• other:	Converter from 12V to 24V

Costs

38.	Price:	
	• for one detector:	More than US\$5,000
	• reduction for higher quantity:	Yes
39.	System price:	
	• with training:	—
	• spare parts:	—
	• extended warranty:	—
40.	Total:	—
41.	Possibility to rent/lease:	—

Other

42.	Duration of warranty:	—
43.	Additional equipment:	—
44.	additional technical data/information:	—
46.	Compliant standards (civil/military):	—

List of manufacturers

CEIA

•MIL-D1, p. 4

CEIA

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Ebinger

•EBEX® 420 H-Solar, p. 6

•EBEX® 420 PBD, p. 8

•EBEX® 421 GC, p. 10

•UPEX® 740 M, p. 66

•MAGNEX 120 LW, p. 72

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Geophex

GEM-3, p. 16

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•MINEX 2FD 4.500, p. 13

•FEREX 4.032, p. 74

•MINEX Array 4.550, p. 94

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•F1A4, p. 20

•F3, p. 23

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Schiebel Elektronische Geräte GmbH

- AN-19/2, p. 26
- ATMID™, p. 29
- MIMID™, p. 31
- VAMIDS™, p. 96

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Vallon GmbH

- VMH2.1, p. 33
- VMM 2, p. 36
- VMX2™, p. 79
- VMV 8, p. 98

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Appendix B

Glossary

A	Ampere
BAC	battle area clearance
CMAC	Cambodian Mine Action Centre
cm	centimetre
CROMAC	Croatian Mine Action Centre
EOC	Explosive Ordnance Clearance
EOD	explosive ordnance disposal
GPS	Global Positioning System
h	hour
HALO Trust	Hazardous Areas Life-Support Organization
Hz	Hertz
IPPTC	Internationa Pilot Project for Technology Cooperation
JRC	Joint Research Centre (European Commission)
kg	kilogram
LCD	liquid crystal display
LED	light-emitting diod
m	metre
mA	milliAmpere
MAG	Mines Advisory Group
NATO	North Atlantic Treaty Organization
nT/m	nanotesla per metre
NGO	non-governmental organisation
PC	personal computer
s	second
TDEM	time domain electromagnetics
UNADP	United Nations Accelerated Deming Programme
UNDP	United Nations Development Programme
UNMAC	United Nations Mine Action Centre
UNOCHA Afghanistan	United Nations Office for the Coordination of Humanitarian Assistance to Afghanistan
UNOPS	United Nations Office for Project Services
UXO	unexploded ordnance
V	Volt
w	watt



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