



Magnetics for Archaeology

Since 1980
Leading the World of **Magnetics**

GEM Systems is the number one global leader in the manufacture and sale of high precision magnetometers.

GEM is the only commercial manufacturer of Overhauser magnetometers, that are accepted and used at Magnetic Observatories over the world.

Our Potassium Magnetometers are the most precise magnetometers in the world.

Our Proton sensors are considered the most practical and robust magnetometers for general field use.

Proven reliability based on R+D since 1980.

We deliver fully integrated systems with GPS and additional survey capability with VLF-EM for convenience and high productivity

Today we are creating the absolute best in airborne sensors with smaller and lighter sensors for practical UAV applications. We are also making very large sensors with the best sensitivity (30-50fT) for use in natural hazard research and global ionospheric studies.

Our Leadership and Success in the World of Magnetics is

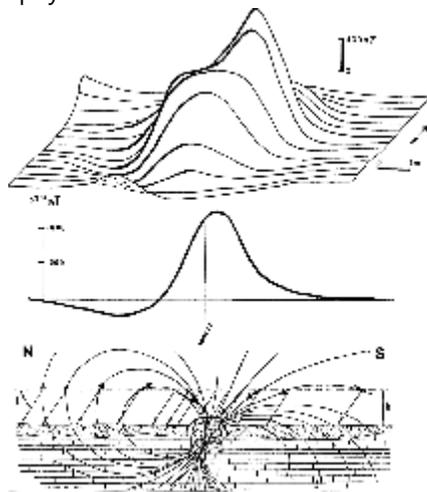
Your key to success in applications from Archaeology, Volcanology and UXO detection to Exploration and Magnetic Observation **Globally.**



GEM's **GSM-19GW** magnetometer / gradiometer system (shown above) offers very high sensitivity plus fast sampling rates.

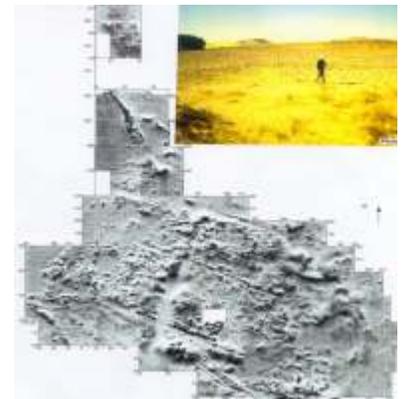
GEM - High Quality Instruments for practical applications

Magnetics are an **increasingly** key exploration method for archaeological applications. Main benefits lie in the ability to resolve **details** non-invasively, the wide range of artifacts and cultural affects that are detectable, and the low-cost of magnetics in comparison to other geophysical methods.



Detection of object that displays either it's own distinctive signature, or exhibits remanent magnetism in an orientation that is different to that of the current surroundings.

An Effective , Non-Invasive Method for Exploring



Old Kingdom site, Ein El-Gazareen, Egypt. Image shows mud brick enclosures (weakly magnetized) and kilns, fireplaces, etc. (strongly magnetized).

Having detailed knowledge of a site prior to investigation reduces excavation costs while ensuring that no part of the site is missed. In addition, as many projects are time-sensitive, availability of a rapid, effective method, such as magnetics, may mean the difference between recovery and non-recovery.

The method is based on the physical phenomenon that many cultural artifacts are magnetic, or that cultural activities

Our World is **Magnetics.**

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GEM's GSM-19 system in use in Denmark. This system provides a light weight, low cost solution for walking use. It also includes a "Walking" mode that enables nearly continuous coverage with resulting high productivity surveys. GEM Non-magnetic cart shown below for near surface surveys.



Specifications

Overhauser Performance

Sensitivity: 0.022 nT / $\sqrt{\text{Hz}}$
 Resolution: 0.01 nT
 Absolute Accuracy: 0.1 nT
 Range: 20,000 to 120,000 nT
 Gradient Tolerance: > 10,000 nT/m
 Samples at: 60+, 5, 3, 2, 1, 0.5, 0.2 sec.
 Operating Temperature: -40°C to +55°C

Dimensions & Weights:

Console: 223 x 69 x 240 mm, 2.1 kg
 Sensor: 175 x 75 mm dia. cylinder, 1.0 kg

Potassium Performance

Sensitivity: 0.0003 nT @ 1 Hz
 Resolution: 0.0001 nT
 Absolute Accuracy: 0.1 nT
 Range: 20,000 to 120,000 nT*
 Gradient Tolerance: 50,000 nT/m
 Low/High Field Options: 3000 to 350,000 nT
 Heading Error: +/- 0.05 nT between 10° to 80° and 360° full rotation about axis
 Samples at: 1, 5, 10, 20 Hz
 Operating Temperature: -40°C to +55°C

Dimensions & Weights:

Electronics box: 229 x 56 x 39 mm; 0.63 kg
 Sensor: 112 x 64 mm external dia., 0.9 kg

Overhauser and Potassium

Operating Modes

Manual: coordinates, time, date and reading stored automatically at min. 1 sec. interval
 Base Station: time, date and reading stored at 1 to 60 second intervals
 Walking Mode: ASCII format via an RS-232 COM port
 Remote Control (optional): RS-232 interface
 Input / Output: 6-pin weatherproof connector

Storage - (# of Readings)

Mobile: 1,465,623
 Base Station: 5,373,951
 Gradiometer: 1,240,142
 Walking Mag: 2,686,975

Optional VLF

Frequency Range: Up to 3 stations 15 to 30.0 kHz
 Resolution: 0.1% of total field

GEM Magnetometer systems come complete with an industry leading three year warranty

lead to disturbances in soils, etc. that can be detected using magnetic methods.

Magnetometer Requirements

The effectiveness of magnetics for archaeology is based on the wide range of magnetic susceptibilities for cultural objects ranging from very weak-magnetic items, such as limestone walls, to strongly magnetic fired materials or iron, such as is used in implements.

A key requirement is the availability of instrumentation with a very high sensitivity for detecting a full range of contrasts. GSM-19 Overhauser and GSMP-35 Potassium instruments meet the criteria for a full range of sensitivity.

Options for Non-Invasive work include;

- Multiple high resolution sensor configurations for optimizing the detection and characterization of near surface objects with walking apparatus.
- Non-Magnetic Cart with multiple sensor options for multiple horizontal and vertical gradiometers
- Optional, professional quality control and presentation software for easy 2D and 3D confirmation and visualization of results.



GEM's unique Overhauser & Potassium magnetometer/ gradiometer systems combine data quality, survey efficiency and options that deliver significant benefits for archaeological applications.

- Archaeology Mode' offers high sampling rates, and is available in mobile and gradiometer modes
- Highest sensitivity available, with zero heading error and no need for calibration
- Data export in XYZ (line-oriented) format for easy use in standard commercial software programs
- Programmable export format for full control over output GPS elevation values provide input for geophysical modeling
- Enhanced GPS positioning Standard includes:
 - 0.7m SBAS (WAAS, EGNOS, MSAS)
 - 0.1m NovAtel CORRECT (with TerraStar Service)
- Multi-sensor capabilities which are ideal for advanced surveys to resolve target geometry
- Picket and line marking / annotation for capturing related surveying information on-the-go.



Near surface apparatus for providing increased lateral detection and mapping. Maps and photos courtesy of Dr. Tatiana Smekalova, St. Petersburg State University.

GEM
SYSTEMS

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