

# GROUND VLF SYSTEM

Portable fast resistivity solutions

**NEW**  
Resistivity Sections

**Our Supplier 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.

**GEM's Potassium Magnetometers are the most precise magnetometers in the world.**

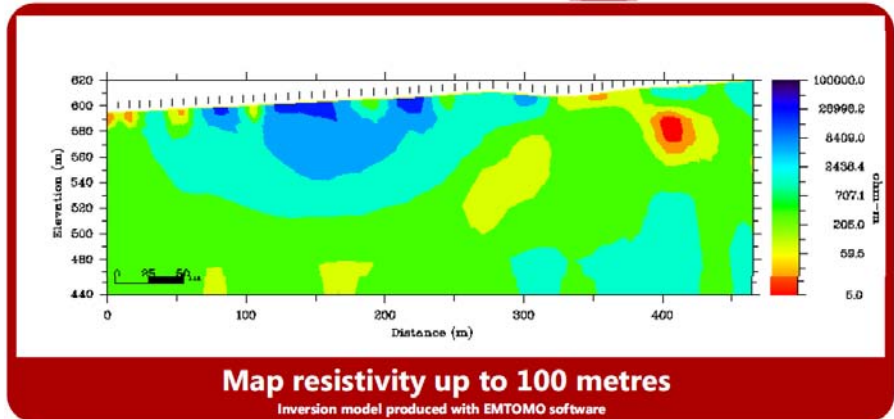
GEM's Proton sensors are considered the most practical and robust magnetometers for general field use.

Proven reliability based on GEM's 35 years of R&D

Integrated systems with GPS and additional survey capability with VLF-EM are available as options for convenience and high productivity

**GEM is creating the absolute best in airborne sensors and are leading the way in super sens ally designed for highly sensitive studies with super large sensors for research of Natural Hazards globally and now smaller and lighter sensors for practical UAV applications**

GEM 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-Portable VLF System

The GEM GSM-19V portable VLF system is a robust tool for environmental and exploration purposes.

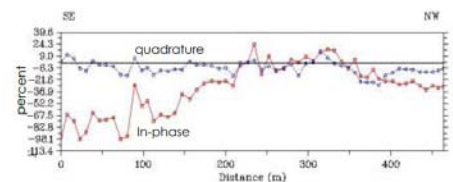
## Technically Superior

This new evolved system builds off our proven airborne technology. The GEM VLF takes **true** measurements of the Vertical in-phase & Out-of-phase components as % of total field within the VLF frequency range of 15 - 30kHz. Many older systems only measure the total field and quadrature components of the field. Like the airborne system it features a 3-coil sensor and can acquire data from up to 3 VLF transmitting stations simultaneously without sensor orientation.



**3 light weight Orthogonal Air Coils** provide reduced noise and allow true in-phase and quadrature data to be gathered for more accurate results

The GSM - 19V also has a correction for the tilt level of the VLF sensor for up to 10° from the horizontal plane.



In-phase and quadrature VLF data (Transmitter 24.0 kHz. Cutler Maine, data used to produce the resistivity section above)

## ABOUT – VLF

The VLF-EM survey method is a passive electromagnetic system that utilizes distant, globally positioned, transmitters broadcasting at frequencies in the range of 15kHz and 30kHz. (in some cases a private/custom transmitter may be utilised in regions with sparse transmitters) In a VLF investigation, the magnetic field components of the transmitted signal, which are effected by local ground conditions, are measured.



Global VLF frequency transmitter stations

## Applications are many;

- Resistivity imaging and bedrock mapping
- Delineate contrasts in conductivity at depth
- Map geological contacts, faults
- Search for mineralized bodies
- Water exploration



Robust GEM GSM 19V VLF shown with optional Magnetic Gradiometer System and GPS

## GEM/EMTOMO - VLF Resistivity

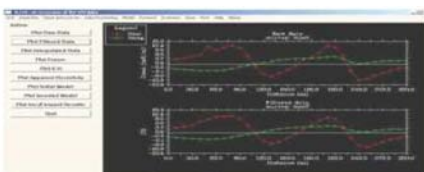
Gem uses the VLF2DMF Software platform created by EMTOMO™. This program provides 2D inversion of multi-frequency VLF-EM data.

The package includes a map module for display of the survey, the selection of profiles for inversion and displays the survey results. The program can also be used for modeling studies. The user can build a complex resistivity model and calculate its VLF-EM response.

Features include;

- 2d resistivity sections
- Resistivity depth plan slices
- Forward Modeling
- Fraser Filter
- Karous-Hjelt Filter (current density sections)

The inversion procedure used in VLF2DMF is two-dimensional (2-D) and is based on the Occam technique (e.g. DeGroot and Constable 1990, Sasaki 1989, Sasaki 2001). The forward modelling of VLF2DMF program is based on the finite-element method.



VLF2DMF 2D inversion software interface

## WHY USE VLF

VLF surveying has been utilized since 1964 as a rapid means to find large linear conductive features to provide information about the subsurface for geological mapping. Large area surveys have provided regional structural information but due to a lack of quantitative information such as depth to structure information the method had been marginalized until quite recently. In 2007, the Geological Survey of Sweden demonstrated that not only could VLF data be rapidly and efficiently collected it could provide excellent structure and resistivity information to depths of 100 m and theoretically to over 200 m.

Advances in both technology to collect VLF data properly and advances in computer technology and mathematical inversion techniques have provided the industry with a new cost-effective means for imaging the top 100 meters of the earth.

The robust GEM multi frequency GSM 19V VLF system provides the user with a practical way to collect meaningful resistivity information in a very cost effective manner. In addition, the VLF system can be easily combined with GEM magnetometers for additional subsurface insight.

## Specifications

**VLF Frequency :** 15 to 30.0 kHz. with up to 3 stations(user selected)

**Parameters:** Vertical in-phase and out-of-phase components as % of total field. 2 components of horizontal field amplitude and total field strength in pT.

**Resolution:** 0.1% of total field for VLF fields of 5 pT or stronger

### Performance

Operating Temperature: -40°C to +50°C

### Dimensions

Sensor: 14 x 15 x 9 cm. (5.5 x 6 x 3 inches)  
Console: 22.3 x 6.9cm x 2.4 cm

### Weights

Sensor: 1.0 kg (2.2 lb.)  
Console with Belt: 2.1 kg (4.63lb.)

### Standard Components

GSMV-19 console, GEMLink software, batteries, harness, charger, sensor with cable, RS-232 cable and USB adapter, instruction manual and shipping case.

**Storage:** Automatic with: time, coordinates, slope, EM field, frequency, in- and out-of-phase vertical, and both horizontal components for each selected station

**Input / Output:** RS-232 output using 6-pin weatherproof connector with USB adapter  
Data export in standard XYZ (i.e. line-oriented) format for easy use in standard commercial software programs

### Options:

**VLF2DMF software by EMTOMO**

**Standard GPS Option B: 0.6m**

- SBAS (WAAS, EGNOS, MSAS)

**High resolution GPS Option : 4cm**

- Novatel (plus TerrasStar-C subscription)

Our VLF systems can add either single or multi-sensor Magnetometer capability or can be added to existing Magnetometer systems to provide a truly robust exploration solution.

The GSM-19V units come complete with an industry leading three year warranty