Portable Cesium Magnetometer/ Gradiometer
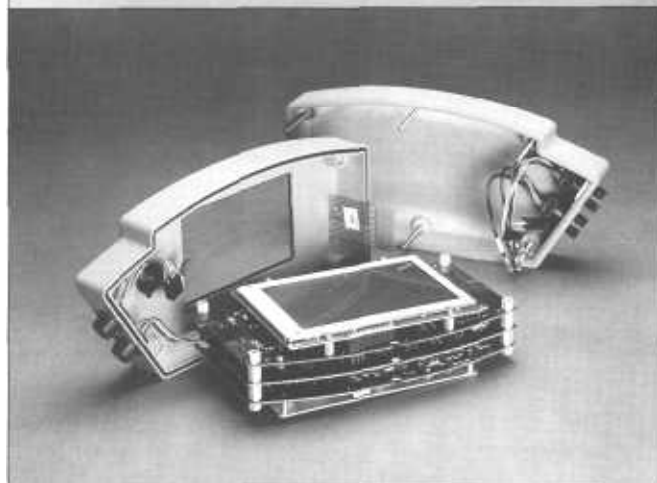
Model G-858

A Professional Magnetic Mapping System

For Minerals, Petroleum and Environmental/Search

G-858 Electronic Console

- **High Sensitivity** — Easily Detect a Single Drum Buried 6 Meters

- **Very Fast** — Cover Two Acres per Hour at 2 Meter Line Spacing

- **Immediate User Feedback** — Display Earth's Field Survey Grid, Position and 5 Stacked Survey Profiles

- **Easy-to-use** — Produce Hard Copy Maps at Base Site within Minutes, Uses Standard IBM-Compatible Computers, Printers/ Plotters

- **Options** for Simultaneous Vertical or Horizontal Gradiometer, Differential GPS Positioning, Target Analysis Software

G-858 Electronic Console showing internal layout and watertight "0" ring seal of the case

The G-858 MagMapper ¨ system comprises a belt-mounted display/logging console connected to a cesium sensor mounted on a hand-held counterbalanced staff. The console contains electronics to acquire magnetic field data with position and display it on an LCD screen for review and edit. The console stores high volumes of data in memory and transmits it at high speed to a processing computer for detailed analysis.

Operation

The MagMapper™ uses a graphical interface to make survey design and data acquisition quick and efficient. A simple survey mode uses line numbers and known "marks" to define the map parameters. Or the user may define the survey by setting up complete grid boundaries in "Map" Mode. During the survey, the operator can see the portion of the grid that has been completed, i.e. his position on the grid and the current data profile. Position information may come from an external GPS or from regularly spaced fiducial marks input by the operator. At any time, the user may switch to "profile" mode to observe the last 5 data lines as stacked profiles.

Data are collected in up to 5 separate survey files and transferred via high speed RS232 data link to a computer for further analysis and map generation. A full featured graphical data editing program is provided to allow repositioning, realignment and interpolation of the data. After editing, the data is formatted in either Surfer for Windows or Geosoft formats for gridding and contouring.

SPEED AND EFFICIENCY

G-858 data acquisition offers either continuous or discrete station recording. Data quality is uniformly high and lower costs are inherent for most projects due to the high sampling rate of the instrument in continuous mode. This allows the operator to survey an area at a fast walking pace, covering as much as 10 times more area in a given time period as previous magnetometers. Under certain conditions even lower costs may be achieved by the use of a gradiometer to widen the search radius.
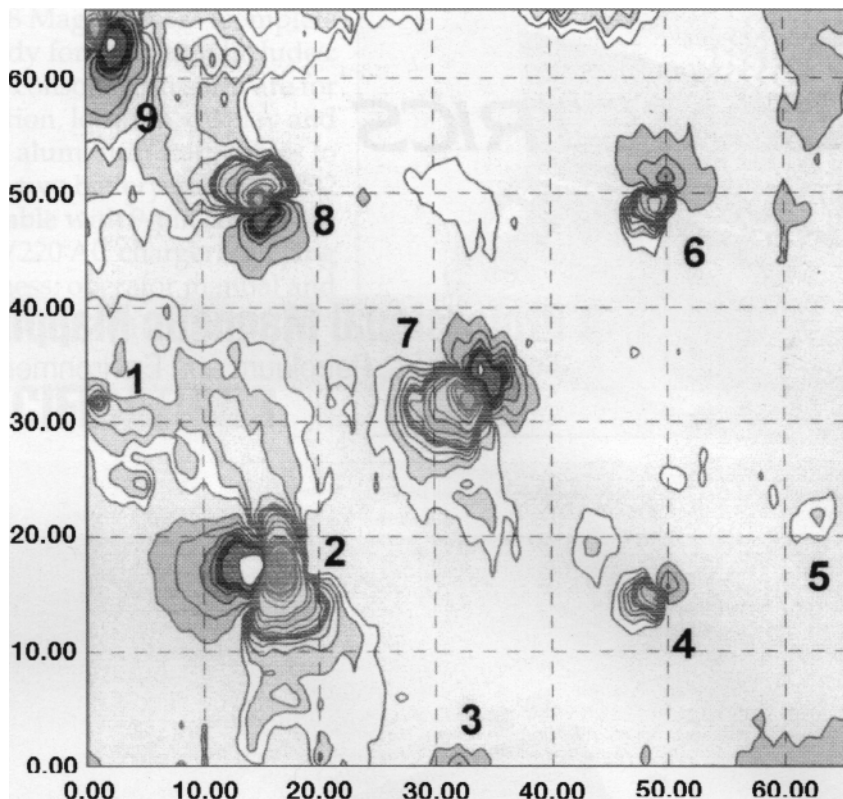
MAGNETIC ANOMALY MAP - FIREARM TEST SITE

Several different types of firearms together with ammunition, were laid out at a test site. A densely spaced survey of magnetometer measurements (1 foot line spacing) was conducted over the site to determine the typical detection thresholds of these common firearms and to ascertain the time required from the start of the layout to a finished map. The map clearly shows the spatial relationship and the relative size of all magnetic objects.

The site measured 66 x 66 ft. and was covered with a series of parallel lines with 1 ft. separation between lines. The sensor was held 2 ft. above the ground and the data was collected along each line at a rapid walking speed. The instrument sensitivity was selected to be 0.05 nT at 10 measurements per second. This resulted in a measurement being made each 5 inches along the line or approximately 11,000 individual measurements. The total time required to layout the survey grid is estimated to be 0.5 hour and the time to collect the data was 34 minutes. Thus 4356 sq. feet were surveyed in a little over 1 hour with 2.5 measurements per square foot. Downloading the data into the computer and producing a map required an additional 0.5 hour. A commercially available software program, "Surfer for Windows", was used to plot the data.

For example, a horizontal transverse gradiometer (dual sensor array held orthogonally to the survey profile) provides twice the density of coverage on tightly spaced survey grids. Alternatively, only half the number of profiles are required to obtain normal coverage at 50% savings in time.

Since standard and readily available computers, printers/ plotters, and tape storage/backup units are employed, Geometrics encourages clients to provide their own processing hardware. Upon request, Geometrics will provide a complete and fully integrated processing station at a nominal price.

APPLICATIONS

The G-858 MagMapper™ may be used to locate buried drums or underground storage tanks; to find pipelines, well-heads and other utilities; to search for unexploded ordnance, discarded weapons or magnetic mines; to locate graves or archeological sites and assist in forensic investigations; to study geological structure associated with oil bearing rock and faulting; to find mineral deposits and aid in the siting of mines and quarries; and in research and education.

DIGITAL QUALITY

The G-858 system produces raw data of the highest quality. Data are digitally recorded in compressed form in high capacity RAM and later transferred to the base site computer for permanent storage and processing. Sensitivity, resolution and recording rate of the cesium magnetometer are user-selectable as well as mapped survey grid coordinates and display parameters. The system is ruggedly packaged for extreme field conditions. Battery life is a minimum 6 hours for the Magnetometer and 3 hours for the Gradiometer with GPS logging.

BASIC SOFTWARE

A basic software package MagMap™ is supplied as an integral part of the G-858 system and provides:

- Transfer of the raw magnetometer, base station and other survey data to the client PC;

* Standard corrections for position errors, transients, and time varying errors (diurnal)

- Repositioning, linear interpolation and format of corrected data into X,Y, Z ASCII columnar values for use with Surfer for Windows, Geosoft or other client-supplied contouring programs.

Surfer for Windows™ by Golden Software can be employed to grid the data and to generate 2D and 3D color contour maps with full text annotations. See examples in this data sheet.

OPTIONAL SOFTWARE

Geometrics is proud to announce the introduction of a new tool in target identification and location. Our recently developed maximum likelihood dipole pattern matching software MagAID ™ allows the user to generate estimations of object x-y position, size and depth using an interactive Windows™ graphical interface. Data is input from Surfer for Windows contour maps and output takes the form of informative icons placed in to the map as well as itemized target lists.

OPTIONAL GRADIOMETER AND GPS

An optional gradiometer configuration (horizontal or vertical) is available with the addition of a second cesium sensor and staff. The G-858 includes an RS232 port to interface to customer supplied GPS or other data source. Both gradiometer and GPS can enhance the precision of the survey and the definition and delineation of small magnetic anomalies. A selection of user definable field notes describing site conditions can annotate the stored data.
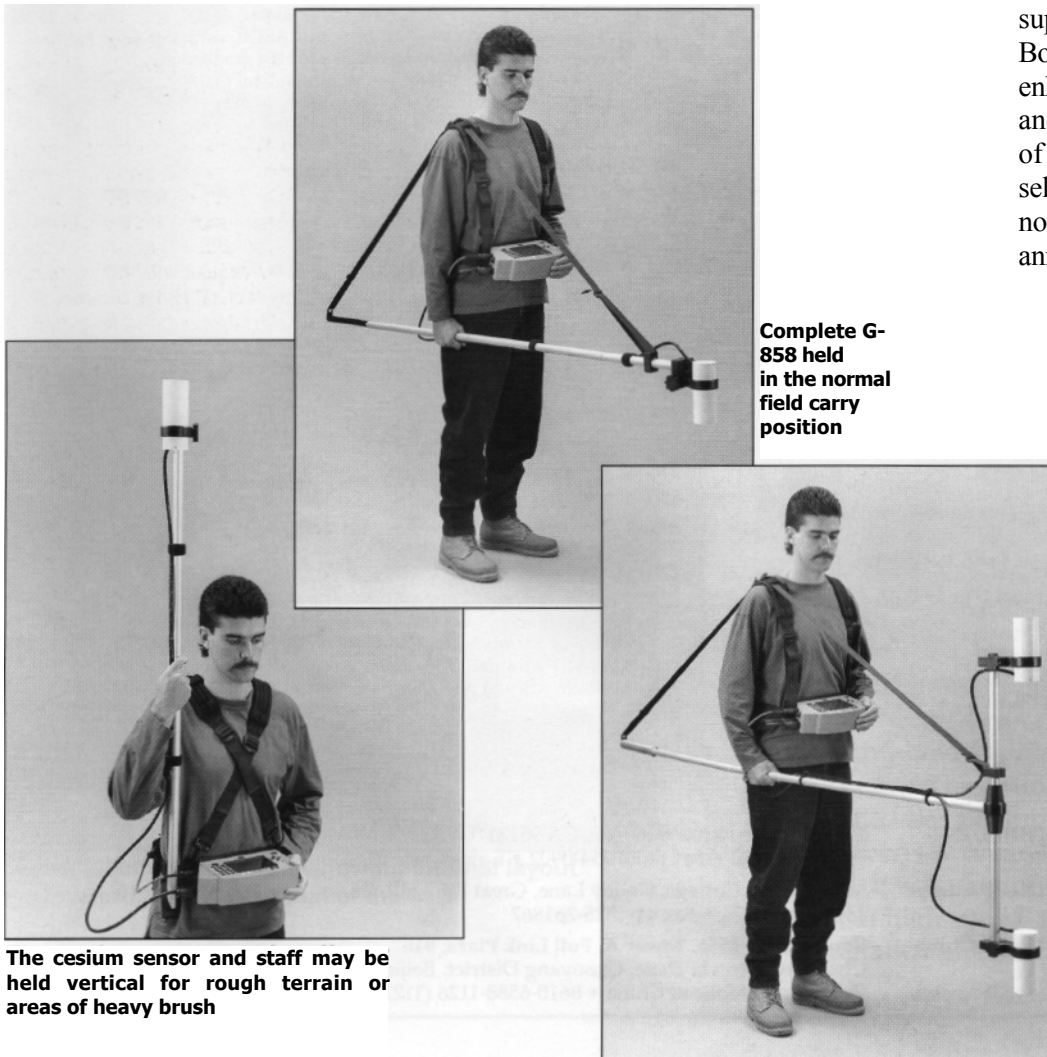

Complete G-858 held in the normal field carry position

The cesium sensor and staff may be held vertical for rough terrain or areas of heavy brush

G-858 Gradiometer with the sensors located in the vertical position

The G-858 MagMapper™ complete and ready for operation includes: electronic console with software for data acquisition, location, display and transfer; aluminum staff; cables to sensor(s), two battery packs, RS232 output cable with 9-pin connector; 110/220 AC charger; carrying harness; operator manual and reusable shipping container.
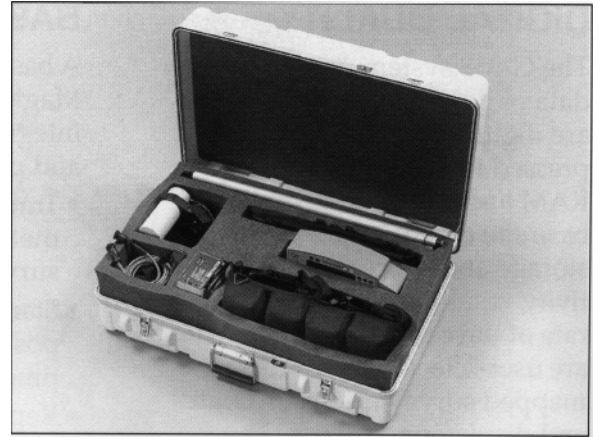
G-858 MAGMAPPER SPECIFICATIONS

MAGNETOMETER/ELECTRONICS

Operating Principle: Self-oscillating split-beam Cesium Vapor (non radioactive Cs133) with automatic hemisphere switching.

Operating Range: 17,000 nT to 100,000 nT

Operating Zones: For highest signal-to-noise ratio, the sensor long axis should be oriented at 45', ±30' to the earth's field angle, but operation will continue through 45', ±35'. Sensor is automatic hemisphere switching.

Sensitivity: 90% of all reading will fall within the following Peak-to Peak envelopes:

0.05 nT at 0.1 sec cycle rate

0.03 nT at 0.2 sec cycle rate

0.02 nT at 0.5 sec cycle rate

0.01 nT at 1.0 sec cycle rate

Information Bandwidth: < 0.004 nT / $\sqrt{Hz}$RMS)

Heading Error: $< \pm 1$ nT

Gradient Tolerance: > 500 nT / inch $> 20,000$ nT / meter

Temperature Drift: 0.05 nT per 'C

Cycle Rate: Variable from 0.1 sec to 1 hr in 0.1 sec steps or by external trigger.

Data Storage: Nonvolatile RAM with capacity for 8 hrs of Magnetometer time, event marks, field notes, location, or 3 hrs of Gradiometer and GPS at maximum sample rates.

Audio Output:
1. Audio tone of earth's field variation, pitch and volume adjustable. (Search)
2. Audio pulse each 1 second (Pace metronome).
3. Alarm for loss of signal, low battery or Quality Control setting exceeded

Data Output: Three wire RS232 standard serial port, optional continuous real time transmittal of data via RS232 to PC. Total memory output transfer time less than 5 min. at 115,200 KBaud.

Visual Output: 320 x 200 graphic liquid crystal display, day light visible with selectable outputs for:
I. Data display: Up to 5 stacked profiles, real time or review mode. Survey grid showing boundaries and position.
2. All system setup functions, e.g., memory status, data transfer, sample time.
3. All Survey setup functions, e.g., survey profile number and direction, station or GPS number, test line number.
4 Survey monitoring functions, e.g., total field, noise level, profile number x or xy coordinates.
5. System diagnostics e.g., lamp brightness, signal level, battery state.

Internal Clock: Resolution of 0.1 sec, drift: < 1 sec/day

Battery Life:
1. 12 VDC rechargeable gel cell, 6 hrs Magnetometer or 3 hrs Gradiometer usage. Magnetic effect less than I nT at 4 ft. 2. Internal backup battery for clock and nonvolatile RAM

Software: Supplied as part of the basic system and including functions for:

Operating Software:

1. Survey Modes:
   a. Search survey b.
   Simple survey
   c. Map survey, station or continuous d.
   Base station
2. Data acquisition/ display:
   a. Acquire and store data and survey functions.
   b. Display profiles, total field to 0.1 nT resolution, gradient (differential)
   to 0.1 nT, survey/map parameters and diagnostics.
PC Support Software for installation on customer or Geometrics supplied data processing computer:

1. Data transfer and corrections:
   a. Transfer of data from the field Magnetometer, Gradiometer, Differential GPS, or Base station to PC.
   b. Diurnal correction using base station data.
   c. Processing the corrected data into ASCII values of XYZ for the magnetometer and/or X,Y,ZI,Z2,Z3 for the gradiometer.
2. Optional bundled "Surfer for Windows" by Golden. Provides data presentation/plotting into a contour map or 3D isomagnetic map with Text annotation and color blends.

MECHANICAL

Sensor: 23/8" dia., 63/4" long, 12 ounces (6cm x 15 cm, 340 grams) Staff/Harness: Staff for Magnetometer or Gradiometer, 1.5 lb to 2.5 lb (0.9 kg to 1.1 kg).

Nylon chest harness with cables attached, 2 lb to 3 lb (1 kg to 1.3 kg) Battery: 3" H, 5" W, 8" *L*, 3.5 lbs (8 cm x 13 cm x 20 cm, 1.6 kg) attaches to harness.

Console: 6" W, 3" H, 11" *L*, 3.5 lbs. (15 cm x 8 cm x 28cm, 1.6 kg), attaches to harness. Magnetic effect less than I nT at 4 ft

ENVIRONMENTAL

Operating Temperature: -25°C to +50°C (-13°F to +122°F)

Storage Temperature: -35°C to +60°C (-30°F to +140°F) Water

Tight: To 3 ft (0.9 m) depth Shock: Drop 3 ft on a hard surface

without damage

OPTIONS

1. Gradiometer, horizontal and/or vertical configuration
2. GPS navigation (real time differential with radio link to GPS base station or FM-transmitted RTCM codes)
3. MagAID Anomaly Identification Software, for use in estimating position, size and depth of source bodies and buried objects.