

# Portable Cesium Vapor Magnetometer

HeritageGeophysics.com

## Model G-859 Mineral Mag™

### A Professional Magnetic Mapping System

For Minerals, Petroleum and Geologic Survey

**2 Year Warranty!**



- **Excellent Performance**  
Low Noise/High Sensitivity, best in the industry –  $0.008\text{nT}/\sqrt{\text{Hz}}$  RMS – and world wide operation
- **Very Fast** – Log mag and GPS at up to 5 samples per second for economic large area surveys at high sample density
- **Integrated GPS/Backpack** – Includes non-magnetic backpack and Novatel™ WAAS / EGNOS ready GPS
- **Low AC Field Interference** – Best in the industry for rejecting AC power line grid noise (50/60 Hz)
- **Easy-to-use** – Simple setup and rapid in-field map generation with free MagMap2000™ software
- **Reliability** – Our Cesium sensors *never* need calibration or factory realignment. Designed for extreme ruggedness and reliability.
- **Designed for large surveys**  
**Mining/Oil/Gas** – This versatile tool is specially designed for large area surveys with 8 hr data storage capacity and two 6 hr battery packs



This new low-cost Cesium vapor magnetometer system offers the mining/oil/gas survey companies the best total field magnetic survey tool available. Based on our industry standard G-858 MagMapper system, the G-859 incorporates all of the reliability and proven performance in a lightweight survey package with integrated WAAS/EGNOS enabled Novatel™ GPS.

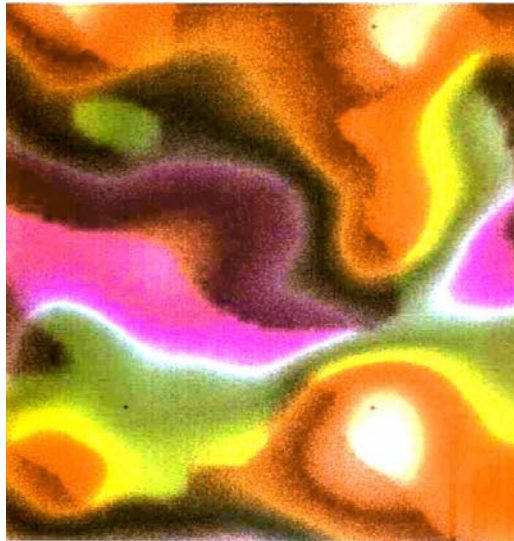
## OPERATION

The G-859 Mining Mag uses a graphical interface to make survey design and data acquisition quick and efficient. A "Simple" or "Mapped" Mode uses line numbers and known staked reference points to define the map parameters. Or the user may use the integrated Novatel Smart Antenna™ GPS for mapping positions automatically. Position information may come from an external GPS, from regularly spaced fiducial marks input by the operator or both. At any time, the user may switch to "profile" mode to observe the last 5 data lines as stacked profiles.

Data is collected in up to 5 separate survey files and transferred via high speed RS-232 data link (or USB with converter) to a computer for further analysis and map generation. The full featured graphical data editing program MagMap2000 is provided to allow repositioning, realignment, GPS smoothing, data filtering and interpolation of the data. After editing, the data is formatted in either Surfer for Windows or Geosoft formats for further plotting and analysis.

## SPEED AND EFFICIENCY

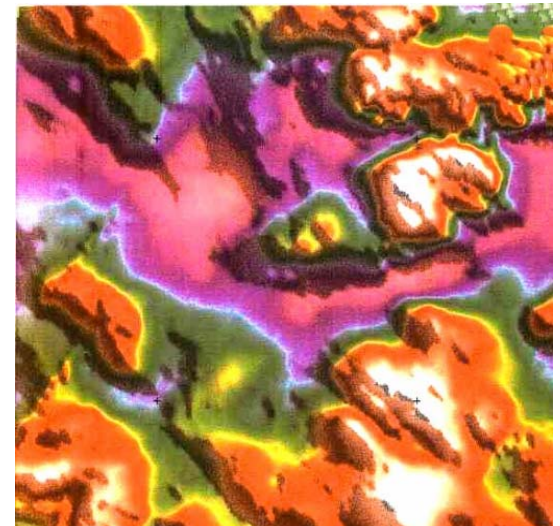
G-859 data acquisition offers either continuous (automatic) or discrete station recording. Data quality is uniformly high and lower costs are inherent for most projects due to the high sampling rate of the instrument in continuous mode. This allows the operator to survey an area at a fast pace, covering as much as 10 times more area in a given time period than other magnetometers.



The map on the right is was obtained from a ground survey of the same 1.5Km by 1.5Km area as shown above but this data was acquired using a portable cesium magnetometer with its backpack-mounted sensor positioned at a height of 3 m. The line spacing was 20m and the sample interval 1m. The grid cell size is 5m.

The land data offers significantly greater anomaly definition and improved resolution compared to the airborne presentation. Individual structures such as lithologic contacts, drainage channels, and alteration zones are evident. In addition, the land data reveals a NW-SE trending structural grain not seen in the airborne data. This detailed information can be used to focus geologic mapping, sampling, and drilling programs for greater efficiency. Most importantly, these high resolution land based data also provide the basis for high resolution numerical interpretation that will better reveal the subsurface structures.

This data was collected in the Goonumbla region of Australia, provided courtesy of North Exploration Ltd.



## Magnetic Anomaly Map Airborne vs. Land Based Cesium

Most magnetic surveys for minerals, oil, and natural gas are initially conducted as airborne surveys. Heritage Geophysics supplies a complete magnetometer product line for this purpose and can also offer integrated gamma ray and EM airborne survey hardware and software systems.

After interesting aeromagnetic anomalies are identified follow-up ground surveys are often performed using portable high performance land magnetometers. The purpose of these land surveys is to provide higher resolution magnetic field data and, ultimately, better information about the geologic structures it reveals.

The map on the left shows an area of approximately 1.5Km by 1.5Km and was produced from data collected from an airborne survey. The aircraft height was 70m and the line spacing 120m. The sample interval was 0.2s or approximately 14m with a grid cell size of 20m.

## RELIABLE, RUGGED & LOW COST DESIGN

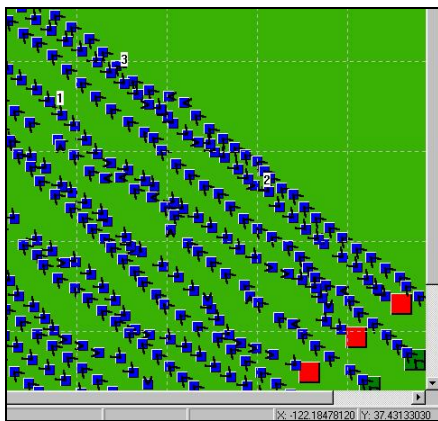
In addition to its speed and sensitivity, the G-859 is also reliable, economical, and easy to use. Electrical connectors on the G-859's sensor have been eliminated in order to increase reliability and reduce setup time. The G-859's internal firmware has been streamlined to include those features important for mining exploration. We are so confident in the improved design of the G-859 that it comes with **2 Year Warranty!** As for economy - Contact Heritage Geophysics for a quotation today! You'll be pleasantly surprised.

## APPLICATIONS

The concentration of magnetic minerals often varies with geological formation or chemical alteration and can indicate hydrocarbon bearing structures or economic mineral deposits. A primary application of the G-859 Mineral Magr™ is surveying for minerals and oil/gas exploration programs. The G-859 is an excellent instrument for use in academic research and education, and can also be used for local environmental studies such as mapping waste sites, locating buried metal drums and storage tanks buried pipelines, well-heads and other sizable ferrous structures.

## DIGITAL QUALITY

The G-859 system produces raw data of the highest quality. Data is digitally recorded in compressed form in high capacity RAM and later transferred to a 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 or GPS position data. *The system is ruggedly packaged for extreme field conditions.* Data storage is sufficient to record 8 hours of data at the maximum rate of 5 Hz. Battery life is approximately 8 hours powering both the Magnetometer and Novatel Smart Antenna™ GPS.

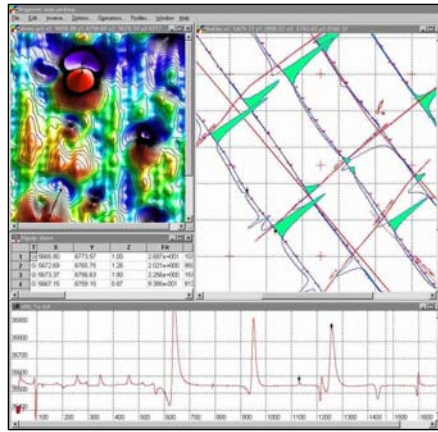


MagMap2000 GPS Track Plot

## BASIC SOFTWARE

A basic software package MagMap2000 is supplied as an integral part of the G-859 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)
- GPS track plot with adjustable smoothing and independent point editing
- Repositioning, linear interpolation and format of corrected data into X, Y, Z or Latitude/Longitude ASCII columnar values for use with Surfer for Windows, Geosoft or



other client supplied contouring programs.

- Conversion of GPS to UTM coordinate system using a selected Datum.

In addition to the standard MagMap2000 download and editing software, Heritage Geophysics is pleased to offer MagPick™, a full featured potential field analysis package with excellent profile and contour map generation capability.



**G-859 and GPS Re-Usable Shipping Case with foam padding and transport wheels**

MagPick™ can perform source body inversion, reduction to the pole, upward continuation and a variety of other transforms and gradient extractions. We are also pleased to offer a Windows™ version of CSAZII™, a world total field map, field inclination and sensor orientation program for performing surveys worldwide in any survey direction. MagMap2000, MagPick™ and

CSAZII™ are available on our website for free download. Manuals for these programs are supplied as internal documents in PDF format.

## NOVATEL SMART ANTENNA™

Accurate data positions are as important as accurate magnetic field measurements and Heritage Geophysics is pleased to include the Novatel Smart Antenna™ as an integral part of the G-859 system. This small light-weight, all-in-one GPS Antenna and electronics package is WAAS/EGNOS ready for <1.5m positioning.



Novatel GPS Antenna/receiver

The Smart Antenna™ systems is installed on Geometrics non-magnetic back pack and carefully screened and degaussed for minimum magnetic interference.

The Smart Antenna™ is designed to be quickly assembled and installed on the backpack, with special mounting studs and a cable wiring harness for data and power distribution. The storage case allows the main components to be stored as a unit providing minimum assembly at the job site. The storage case is a rugged reusable fiberglass and aluminum travel case with handles and wheels for easy transport.

# G-859 Mineral Mag™ SPECIFICATIONS

## MAGNETOMETER / ELECTRONICS

**Operating Principle:** Self-oscillating split-beam Cesium Vapor (non-radioactive Cs<sub>133</sub>) 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 but operation will continue through 45°, ±35°. Sensor is automatic hemisphere switching.

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

- 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

**Noise:** < 0.008 nT/√Hz-RMS

**Heading Error:** < 1.5 nT including backpack and GPS

**Gradient Tolerance:** > 500 nT /inch (>20,000 nT/ meter)

**Temperature Drift:** < 0.05 nT per °C

**Cycle Rate:** Variable from 0.2 sec to 1 hr in 0.1 sec steps or by external trigger.

**Data Storage:** Non-volatile RAM with capacity for 8 to 12 hrs of magnetometer, time, event marks, field notes and XYZ or GPS locations.

**Audio Output:**

1. Audio tone of field variation; pitch and volume adjustable. (Search mode)
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 RS-232 standard serial port, optional continuous real time transmittal of data via RS-232 to PC. Total memory output transfer time less than 5 min. at 115,200 baud.

**Visual Output:** 320 x 200 graphic liquid-crystal display, daylight visible with selectable outputs for:

1. Data display: Up to 5 stacked profiles, real time or review mode. Survey grid showing boundaries and position.
2. All system set-up functions, e.g., memory status, data transfer, sample time.
3. All Survey set-up functions, e.g., survey profile number and direction, station number or GPS data transfer protocol, line number.
4. Survey monitoring functions, e.g. total field, noise level, profile number x or xy coordinates.

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

**Battery Life:**

1. 24 VDC rechargeable gel cell, 6 hrs for Mag w GPS. Magnetic effect less than 1.5 nT (γ) at 4 ft
2. Internal backup battery for clock and non-volatile 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, survey / map parameters and diagnostics.

**Post-acquisition Software:** MagMap2000 software for installation on customer's computer.

1. Data transfer and corrections:
  - a. Transfer of data from the field Magnetometer GPS, or Base station to PC.
  - b. Diurnal correction using base station data.
  - c. Processing the corrected data into ASCII values of X-Y-Z.
2. Data Processing functions include spike editing, spline filtering, repositioning of X, Y, Z or GPS Lat/Long, conversion to UTM coordinates, profile and contour map plotting..

## MECHANICAL

**Sensor:** 2-3/8" dia., 6-3/4" long, 12 oz. (6cm x 15 cm, 340 grams)

**Backpack:** Backpack for Magnetometer, 9.5 lb (4.3 kg). Includes Nylon chest harness with all cables attached (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) belt-mounted, 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 battery belt and harness. Magnetic effect less than 1 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:** Weatherproof in driving rain

**Shock:** Survive a 3 ft drop onto a hard surface

**WARRANTY:** 2 YEARS on G-859 and sensor, one year on accessories

## Novatel Smart Antenna™ Specs:

- Code and carrier phase tracking with 5 Hz Position, velocity, time output or 10 Hz raw data output
- SBAS capable and designed for harsh environments
- RS-232 compatible interface

Hardware Specs:

Size and Weight	115mm dia x 90mm height, Weight: 575 g
Input Voltage:	+9 to +36 VDC
Power Consumption:	1.4W (typical)
Com Ports:	2 RS-232 at up to 19,200 baud
Operating Temperature:	-30°C to +75° C

## GPS L1 Product Performance

Position Accuracy:	Single point L1	<5 m CEP
	WAAS L1	<1.5m CEP
Measurement Precision:	L1 C/A Code	75 cm RMS
	L1 Carrier Phase	1 cm RMS
Data Rates:	Measurements	10 Hz
	Position	5 Hz
Time to First Fix:	Cold Start	120 s
	Warm Start	45 s
	Hot Start	15 s
Signal Reacquisition:		<1 s typical

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