DATA SHEET
Issue 5

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RM85 / FAB1

Gradiometer Data Logging System - Handheld or with MSP25

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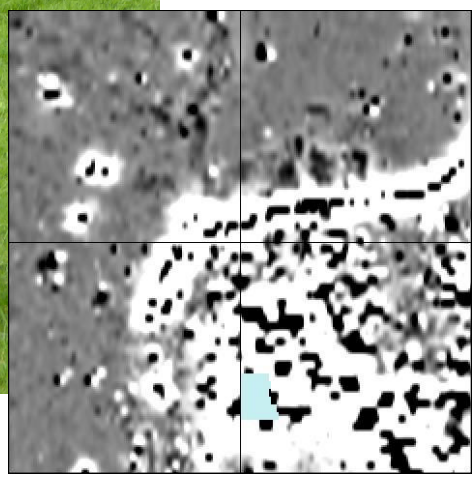
Handheld gradiometer survey: 60m x 60m x 0.25m x 1m, 30m grids, 0.7s/m. Littlemoor Castle gardens, in-filled ornamental pond. +/- 10 nT (dark positive)



System Features

- **Convert an RM85 into a handheld fluxgate gradiometer** - the addition of a single SENSYS FGM650 sensor, FAB1 adapter box, CF51 carry frame (includes Start/Stop switch) creates a handheld gradiometer. No alignment required, wide dynamic range.
- **Add gradiometer logging to an MSP25 / RM85** Square Array cart system - requires addition of a single SENSYS FGM650 sensor, FAB1 adapter box, gradiometer mount system.
- **FAB1 (Fluxgate Adapter Box 1)** interfaces the output of a SENSYS FGM650 fluxgate gradiometer sensor with the RS232 port of an RM85 (BASIC or ADVANCED).
- **Simultaneous GPS and gradiometer logging possible.**

GR GEOSCAN RESEARCH

RM85 / FAB1

Gradiometer Data Logging System - Handheld or with MSP25

Introduction

Building on the success of the RM85 resistance meter, operating in probe and wheel mode, the functionality of the RM85 has been expanded to include the logging of fluxgate gradiometer data. The RM85 then becomes a cost effective 3-in-1 instrument able to offer both resistance and magnetic measurements. The addition of the FAB1 (Fluxgate Adapter Box 1) acts as an interface for the output of a SENSYS FGM650 fluxgate gradiometer to the RM85. It can be programmed via an RM85 menu for gradiometer operation (averaging for noise reduction, GPS baud rates etc). Measurements can be made with a handheld system or MSP25 cart system.

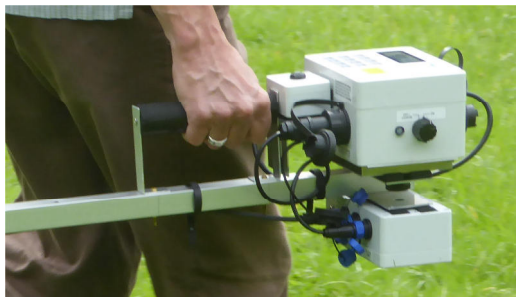
FAB1

Handheld Measurements

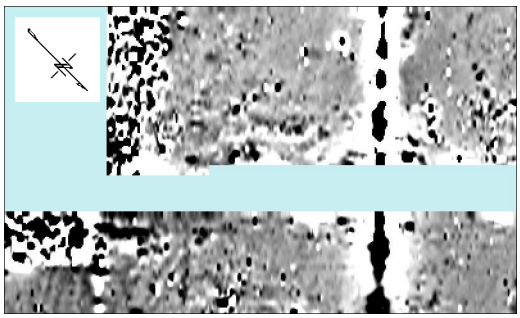
For use as a handheld gradiometer, a BASIC or ADVANCED RM85 is mounted on an aluminium CF51 carrying frame with the FAB1 positioned underneath the meter and a SENSYS FGM650 held vertically at the opposite end of the frame.

The CF51 has an integral Start/Stop switch mounted next to the carrying handle which initiates data collection; data collection rate is controlled by an internal timer. On more challenging terrains, the switch unit can be removed and used as a separate hand-log trigger by adding an optional extension lead. Sample trigger logging provides increased data sampling and enhances data quality and interpretation without increase in survey time. Pressing the start/stop switch initiates a sequence of “beeps” that sound every metre whilst internally data is logged at the set sample interval. The operator walks along the survey line at a pace that ensures the “beeps” coincide with 1m marks along the tape - with practice the tape can be dispensed with and sighting flags or pegs used for even faster surveys. The “beep” rate is variable between 0.4s and 4.0s, in 0.02s steps. Both manual and sample trigger logging can operate with digital averaging for improved data quality.

Digital averaging can be turned on to improve the signal to noise ratio, useful on sites where anomaly strength is comparable with system noise. A wide range of averaging cycles (2 to 9), allows the user to optimise the trade off between significant noise reduction and optimum speed.



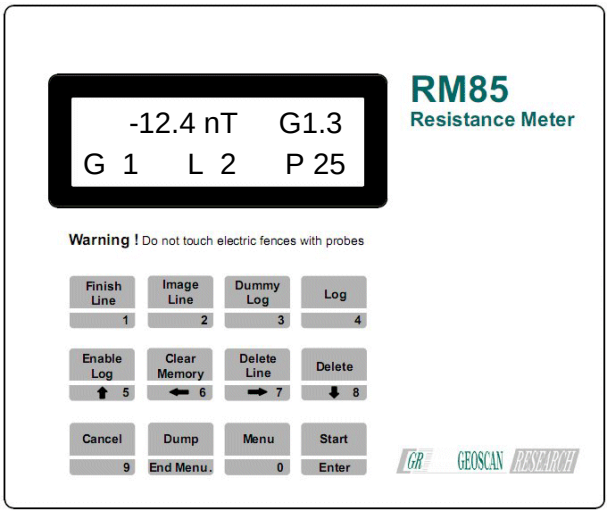
Prototype CF51 carry frame



Handheld survey, Lister Park 1904 Exhibition. 100m x 60m, sample interval 0.25m, 0.7s/m. Several responses correspond to documented exhibition features. Data plotted at +10 -15 nT

Data Logger

Readings are logged in a 164000 reading flash memory using square or rectangular grids of dimensions of 10, 20, 30, 40, 50, 60, 80 or 100m. The wide range of grid sizes allows you to tailor logging to your survey requirements. Sample and traverse intervals can be set to 1, 2, 4, 8 or 16 readings per metre. The data logger keeps track of survey position, displaying the current grid, line and position and provides audio feedback. Instead of menu systems, the front panel provides fast and direct access to logging functions using 8 dedicated keys. Readings and lines of readings can be deleted with one keystroke. A dummy reading or line of dummies can be inserted in place of physical obstacles with one keystroke. A mirror image dummy line completion key is also provided for zig-zag surveys when part of a standard grid cannot be surveyed. See keypad layout opposite. The memory is sufficient for 4 ha at 0.25m sample interval, including GPS (2 ha if measuring alpha and beta with an MSP25), allowing a full days data collection. Data is downloaded via USB or RS232 interface. Logged data can be inspected without having to download first, allowing the user to monitor data quality as the survey proceeds.

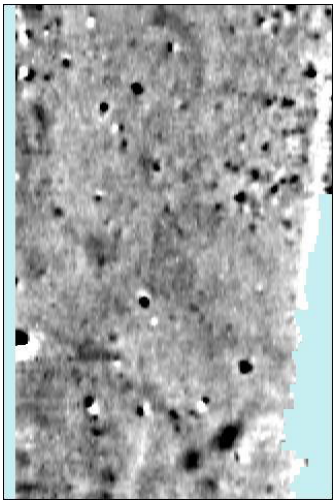


The RM85 keyboard has 8 dedicated logging keys for fast and direct access to logging functions for more efficient surveys. The display shows tracking, magnetic value and GPS HDOP.

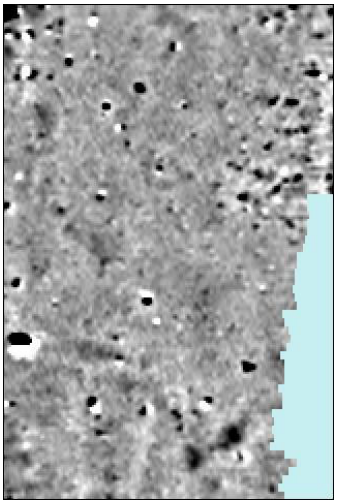
Measurements with an MSP25

In this mode an ADVANCED RM85 / EPIB1 / MSP25 collects high resolution square array resistance data as usual from the wheeled system but, with the addition of a FAB1 and SENSYS FGM650, the RM85 can also collect gradiometer data. The FAB1 is mounted on the MSP25 main platform and a gradiometer mounting frame is fitted to support the SENSYS FGM650 sensor tube which is cushioned against vibration. Data collection by the RM85 is initiated by Start/Stop switches on either handle. Position along a traverse is determined by an encoder in one wheel which triggers data collection at the chosen sample interval. Alternatively a timer can be used. All the data logging facilities described opposite are available. The cart has proven to be popular for community projects, being easier for some to use than the conventional Twin array frame; in the context of magnetic measurements, users who are too magnetic for normal handheld measurements can pull the cart at the side opposite to the sensor without affecting measurements.

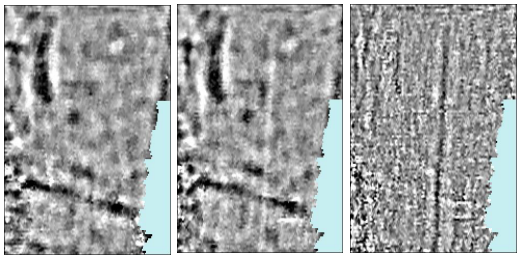
In the example shown below, photo opposite, an FM256 was also mounted on the cart for comparison and results with the FGM650 and FM256 are very comparable.



FGM650



FM256



Alpha Beta Gamma

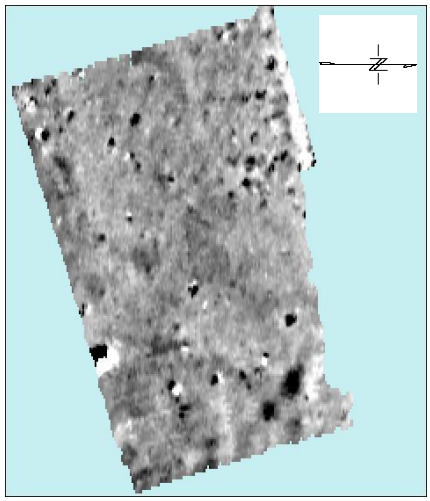
Resistance data plotted at -2 + 3 SD

MSP25 cart survey at Fountains Abbey (National Trust), April, 2017. Combined resistance, magnetic and GPS measurements. 60m x 40m, sample interval 0.25m, 40m traverses at 0.8s/m. Data plotted at -3 +5 nT

GPS Referenced Data Collection

GPS data can be logged simultaneously with the gradiometer and resistance data. A user supplied GPS unit connects to an RS232 port on the FAB1 and the GPS data stream is merged with the FGM650 measurements before being sent to the RM85 RS232 port. GPS logging is only available with an RM85 that has the GPS logging option fitted. The GPS unit should have an update rate of 10-20 Hz for optimum data sampling and should have a small magnetic signature when used with the handheld system, though this requirement is considerably relaxed when mounted on the MSP25 cart.

The data collected at Fountains Abbey, and processed in gridded format (see above), can be also plotted as GPS referenced data using Geoplot 4.0 as shown opposite.



GPS referenced data, processed and plotted in Geoplot 4.0 (see gridded data set above). Data plotted at -3 +5 nT

Power System

The FAB1 requires a standard LiPo power bank battery (not supplied) which should be fitted inside the case. Such power banks are typically used for charging mobile phones, tablets etc and are commonly available worldwide. The RM85 is powered by its internal NiMH battery but in handheld mode the RM85 battery life is extended to about 12 h since circuitry for resistance measurements can be powered down. When mounted on the cart it is recommended the RM85 has a spare battery pack available. Alternatively an External Power Adapter can be used, with either a LiPo power bank or lead-acid battery pack (not supplied), to give extended operation time and maintenance of maximum output voltage at all times.

RM85 / FAB1

Gradiometer Data Logging System

RM85 / FAB1

Gradiometer Data Logging System - Handheld or with MSP25

Typical Specifications

GRADIOMETER	
FGM650/3 Sensor Separation	650 mm
FGM650/3 Operating Field Range	+/- 75 uT
FGM650/3 Resolution	< 0.2 nT
FGM650/3 Bandwidth	20 Hz (50 ms response time)
FGM650/3 Temperature Drift	<0.3 nT/K
FGM650/3 Operating Temperature	-20 to + 70 degrees C
Web link to SENSYS FGM650/3	www.sensysmagnetometer.com/en/fgm650.html
FAB1 Measuring Range	+/- 1000.00 nT linear, +/-2800.00 nT approx. with compression
FAB1 A/D Conversion Time	<10 ms
FAB1 A/D Averaging Cycles	Off, 2, 3, 4, 5, 6, 7, 8, 9
Logged Resolution	0.08 nT
Display Resolution	0.1 nT
Display Update Rate	3 readings /s
LOGGER (RM85)	
Memory Capacity (Advanced or Basic, Gradiometer Mode)	164000 readings (with/without GPS)
Memory Type	Flash
Grid Dimensions (length and width independent)	10, 20, 30, 40, 50, 60, 80, 100 m
Sample and Traverse Intervals (independent)	0.0625 (SI only) , 0.125, 0.25, 0.5, 1, 2 m
Communications (data dump)	USB (2.0) and RS232 at up to 115200 baud
GPS (FAB1)	
FAB1 GPS Communications	RS232 only, 4800, 9600, 14400, 19200, baud
GENERAL	
FAB1 box dimensions	80 x 55 x 160 mm
FAB1 box weight (not including Power Bank)	0.35 Kg
Typical Power Bank weight (e.g. Ansmann 2600 or 5200 mAh)	0.1 - 0.2 Kg
Maximum allowable power bank dimensions	95 x 71 x 23 mm
FAB1 operating time (5200mAh power bank)	14 hours approx.
RM85 operating time in Gradiometer Mode	12 hours approx.
Environmental rating and Operating Temperature	IP65 or better, 0 to +50 degrees C
Total Handheld System weight	2.9 Kg
(RM85, FAB1, CF51, SENSYS FGM650 but not including power bank)	

RM85's will require a firmware upgrade for operation in gradiometer mode. An RM85 with firmware earlier than Version 6.01 will require a new microprocessor PCB fitting.

All specifications subject to change without prior notice.

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