DATA SHEET
Issue 5

May 2017

MSP25

Mobile Sensor Platform

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MSP25 Features

- 0.75m wheel base Square Array
- Multiplexed alpha, beta, gamma measurements
- For use with Advanced RM85 Resistance Meter and Expansion Port Interface Box 1
- Optional GPS data logging with RM85
- Optional simultaneous Resistance and Magnetic measurements
  Gradiometer options: FAB1 + SENSYS FGM650 sensor or FM256, FM36, FM18
- Rapid large area surveying, hand pulled or towed - ***towed option coming soon***
- One hectare survey in about 2.5 to 3 hours, 1m traverse interval
- Survey at up to 0.3s/m whilst logging alpha and beta at 4 samples per metre
- Survey at up to 0.6s/m whilst logging alpha, beta, gamma, GPS at 4 samples per metre
- Detailed surveys : sample interval can be 1, 2, 4 or 8 samples /m
- Integral distance encoder wheel controls logging
- Sample trigger option for time based logging
- Square array avoids the remote probe cable of a Twin array allowing more rapid surveys
- Comparable detection depth to 0.5m Twin
- Standard Gridded surveys or Non-Gridded surveys with GPS positioning
- Interchangeable dog-tooth wheel plates for different ground conditions

GR GEOSCAN RESEARCH

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Introduction

The MSP25 Mobile Sensor Platform comprises a wheeled resistance square array, upon which a fluxgate gradiometer can also be mounted, providing fast, simultaneous, detailed resistance and magnetic surveys.

The platform comprises four dog-tooth plated wheels set 0.75m apart on a rugged aluminium and stainless steel frame. A Geoscan Research ADVANCED RM85 Resistance Meter and Expansion Port Interface Box 1 (EPIB1) (both supplied separately) are mounted centrally. Magnetometer options include: (1) SENSYS FGM650 gradiometer sensor with mounting bracket kit and Fluxgate Adapter Box 1 (FAB1), (2) FM256, FM36 or FM18 gradiometer with mounting bracket kit. An optional mounting pole for GPS is available for use with an RM85 fitted with the GPS logging option. Provision is made for attaching a towing system by a quad bike etc.

The platform pivots around its centre allowing the wheels to maintain contact with undulating ground. A pair of quick-release/latch handles allows steering along traverse lines and rapid traverse shift at grid edges when zigzag surveying. Logging can be controlled either by a sample trigger system or by an optical encoder system integral to one of the wheels. A towed option is available without handles, but including locking brackets for the rear wheels.

MSP25 fitted with optional SENSYS FGM650 gradiometer, and FAB1, FM256 gradiometer, plus GPS. Collecting alpha, beta, gamma data at 0.25m sample interval. Traverse speed 0.8 s/m. Fountains Abbey April 2017, National Trust

The RM85 can collect single or multiplexed Square array data : alpha, beta and gamma resistance measurements (alpha and beta data can provide important directional information - see below). GPS position can be logged with each reading. The RM85 is used to trigger and synchronise optional Geoscan gradiometers. Start/Stop control buttons are mounted on each handle to control the measurement system. Surveys are normally conducted in a regular gridded fashion; Non-Gridded surveys can be collected using GPS referenced data.

The system enables rapid resistance surveys to be made. For example alpha, beta, gamma and GPS can be logged at a sample interval of 0.25m at a rate of 0.6s/m, alpha, beta and GPS at 0.3s/m. Intensive surveys at a sample interval of 0.125m can provide very detailed information. Square array measurements avoid the trailing remote probe cable of a Twin array. Since a gradiometer mounted on the platform is at distance from the operator, the requirement for non-magnetic personnel is relaxed and allows use by less skilled operators. The cart has proven to be popular for community projects, being easier for some to use than the conventional Twin array frame.

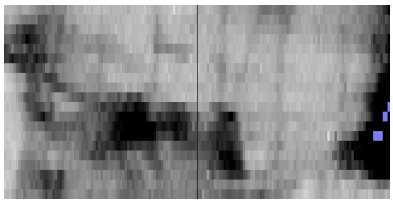
Interchangeable dog-tooth wheel plates are fitted instead of fixed 40mm spikes. Medium depth dog-tooth plates are supplied as standard and can be quickly interchanged with other sizes. Small dog-tooth plates make hand pulling easier, large dog-tooth plates offer deeper penetration in drier conditions. In damp conditions wheels with no plates fitted can give acceptable results. Spikes can be fitted if required.

Directional Information provided by Alpha and Beta

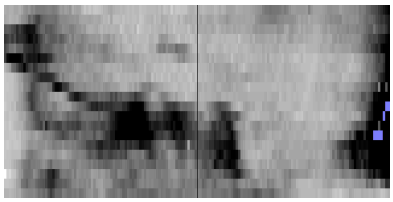
Alpha and beta measurements can provide important directional information. Comparative Square and 0.75m Twin array high resolution surveys were made with an MSP40 over a filled-in Victorian ornamental pond, Littlemoor Castle, W. Yorkshire (the MSP40 is the predecessor to the MSP25 and is identical in measurement geometry and function). Alpha and beta data were collected, both at 4 samples/m, followed by Twin-broadside and Twin-longitudinal, also at 4 samples/m.

The major responses are very similar for all arrays. However, field drains running N-S are most clearly visible in the alpha mode as high resistance features (see adjacent), whereas they appear in the beta and Twin-longitudinal as very faint low resistance features, probably as a result of multiple responses over near surface features that are small in comparison with the array size. The beta mode highlights a diagonal drain better, and so combining the alpha and beta results gives optimal directional information.

In general, the overall response of the combined alpha and beta measurements corresponds very well with a 0.5m Twin array and has comparable detection depth.



Square array - alpha. Sampling 4/m



Square array - beta. Sampling 4/m

Projected Survey Times for 1 hectare at 0.7 s/m

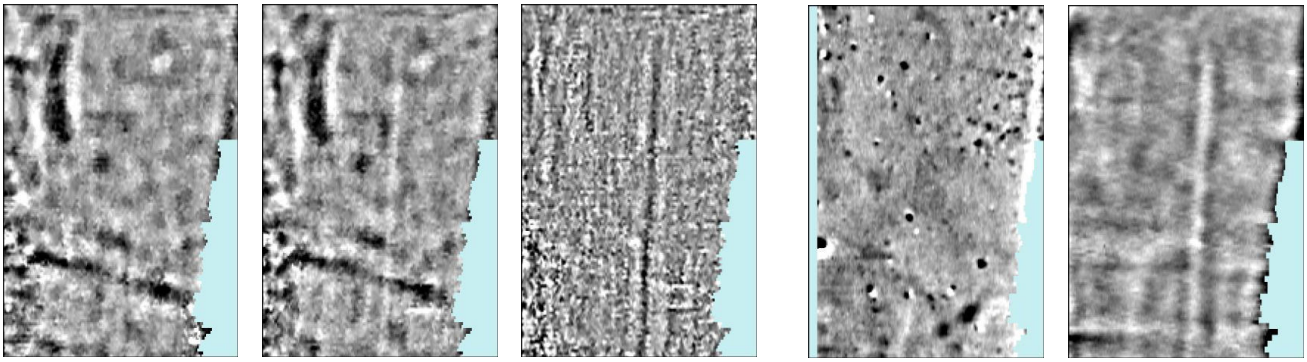
Grid Size	Time (alpha, beta, gamma, sample interval = 0.25m, traverse interval = 1m) (Including 8 second traverse direction change at the end of each traverse)	
20 m	3 hours	
30 m	2 hours 40 minutes	
40 m	2 hours 19 minutes	larger grid sizes reduce the time impact of the
50 m	2 hours 13 minutes	traverse direction change at the end of each line
100 m	2 hours 10 minutes	

Speed versus Configuration

Max Traverse Speed	Configuration (GPS can also be logged with no speed degradation)		
1.1 s/m	Alpha, Beta, Gamma	Sample Interval = 0.125m	
0.7 s/m	Alpha, Beta	Sample Interval = 0.125m	
0.6 s/m	Alpha, Beta, Gamma	Sample Interval = 0.25m	(typical use 0.7 - 0.8 s/m)
0.3 s/m	Alpha, Beta	Sample Interval = 0.25m	
0.2 s/m	Alpha	Sample Interval = 0.125m	
0.1 s/m	Alpha	Sample Interval = 0.25m	

Measurements with an MSP25 Cart - Fountains Abbey 2017

The results below are of a combined resistance and gradiometer survey at Fountains Abbey, April 2017. The RM85 was configured to collect Alpha, Beta and Gamma measurements. The area measures 40m x 60m and was surveyed using 40m traverses, sample interval 0.25m, traverse interval 0.5m, moving at about 0.8s/m for rapid coverage. A FAB1 and SENSYS FGM650 sensor, plus FM256 were mounted on the MSP25 main platform, together with RTK GPS. Position along a traverse was determined by a wheel encoder. After processing the alpha and beta data sets were High Pass Filtered and show several features of interest; the gamma data shows an interesting correspondence with the GPS micro-topography results. The gradiometer data adds a further dimension to the data set.



Alpha | Beta | Gamma | FAB1 / FGM650 | GPS Micro-topography

Alpha and Beta High Pass Filtered, resistance data plotted at -2 + 3 SD

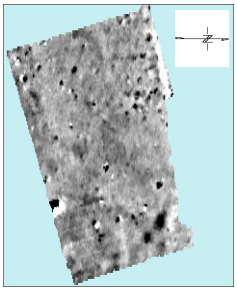
-3 to +5 nT

HPF, plot -0.1 to +0.15m

GPS Referenced Data Collection

GPS data can be logged simultaneously with the resistance and gradiometer data. A user supplied GPS unit connects either directly to the RM85 RS232 port or via a FAB1 RS232 port. If using a FAB1 the GPS stream is merged with the FGM650 measurements before being sent to the RM85 RS232 port. Note that GPS logging is only available with an RM85 that has the GPS logging option fitted.

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. Not only can data be GPS referenced but further processing in Geoplot 4.0 can reveal interesting micro-topography detail from the GPS data after High Pass Filtering (see above).



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

MSP25

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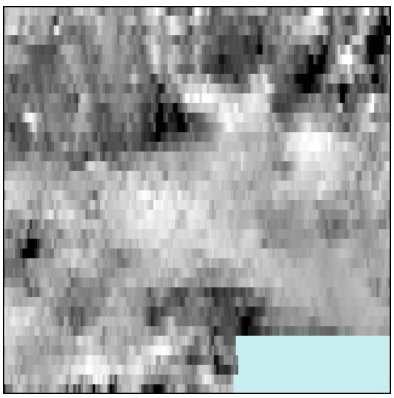
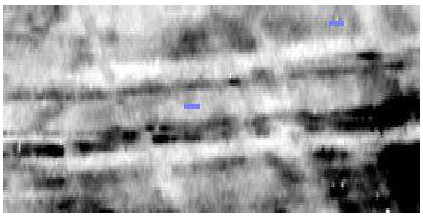
Measurements with an MSP25 on a variety of Terrains

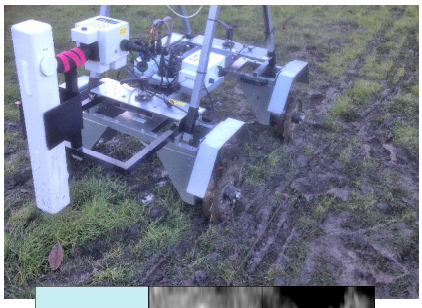
The MSP25 cart is able to cope with a variety of terrains. The results below (all alpha data sets) show a survey over rough moorland, survey over pasture with pronounced topography and survey in very muddy conditions. In dry conditions a higher proportion of noise spikes are to be expected but it is possible to process these out to recover usable data using Geoplot 4.0 functions and specialised macros.

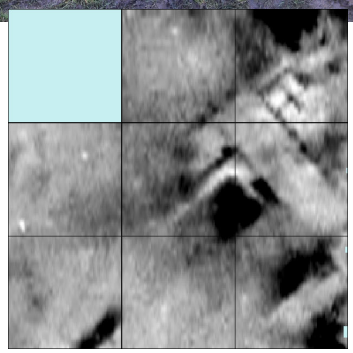


Moorland, 40m x 40m, HPF +/-2.5 SD
Castleshaw Roman Fort



Pasture with earthworks, 40m x 80m +/ 2 SD
Markenfield Hall Medieval Landscape

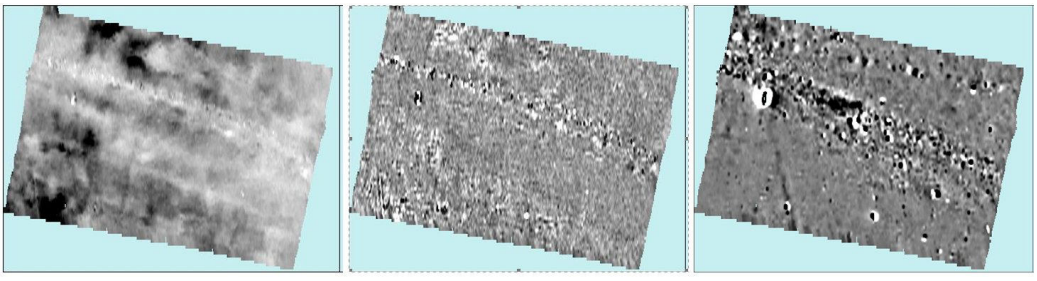




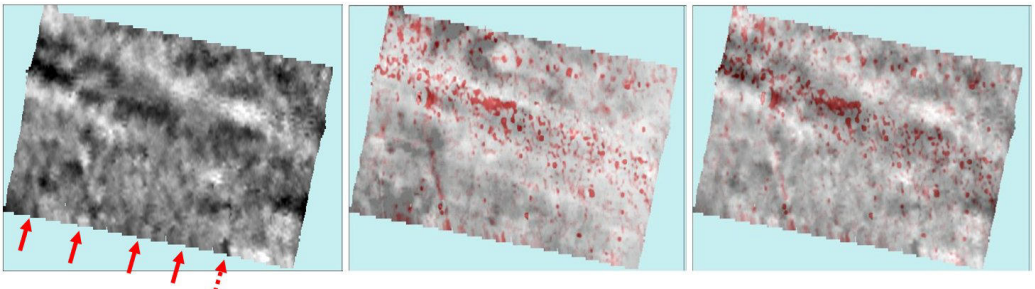
Muddy conditions, 60m x 60m +/- 2SD
Lister Park Swimming Baths

Temple Newsam Survey March 2016

The results below are of a combined resistance and gradiometer survey at Temple Newsam. Survey area was 100m x 70m, 100m traverses, sample interval 0.25m, traverse interval 1m, speed about 0.85s/m. Survey time was a little over 2 hours not including setting up and breaks. Mounted on the cart were a SENSYS FGM650 sensor, FM256 and RTK GPS. Data sets for alpha, gamma, gradiometer and micro-topography are shown below with overlays made using the Geoplot 4.0 Animation facility – all show distinctive and complimentary features. The results shows high resistance structures at the top (west) cut into by a service line shown on the gradiometer plot. There are indications of further structures to the east along with service lines / water feeds which may be associated with a lake depicted in an early painting and other garden features depicted in a Jan Kip engraving.

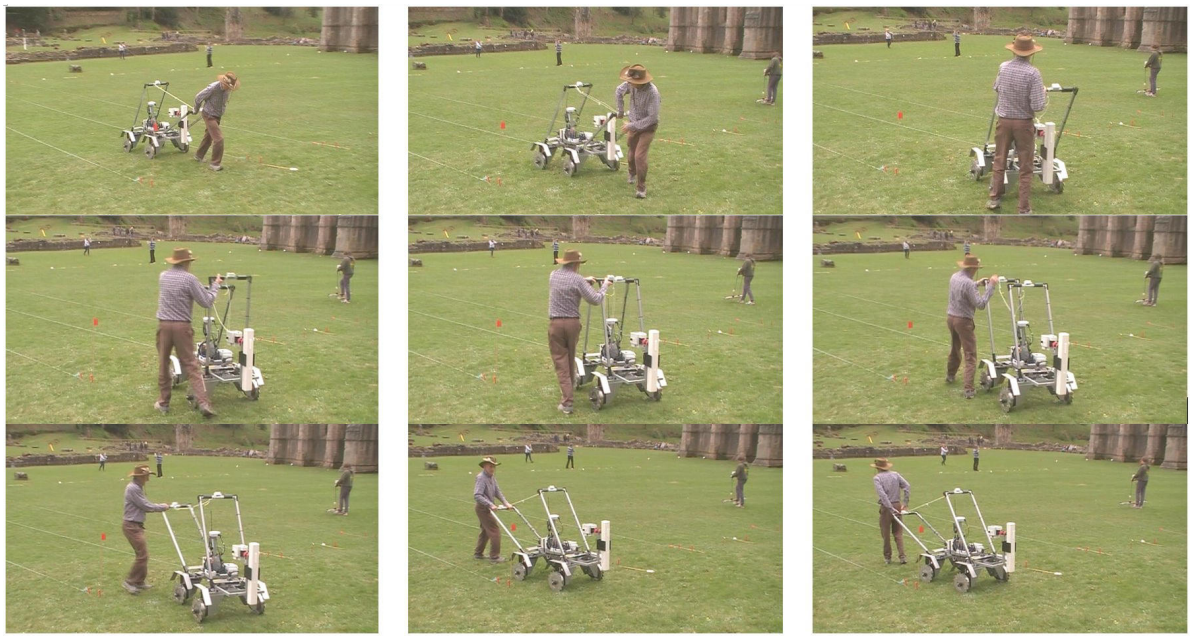


Alpha (-2/+3SD) Gamma (-2/+3SD) Gradiometer (+/-20nT)



Micro- topography HPF (+/- 0.1m) Red FGM650 over grey Alpha Grey Topography over red FGM650

MSP25 Traverse Direction Change - typically 8 seconds

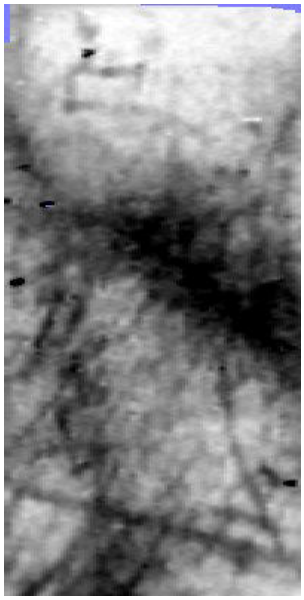


Note that the MSP25 cart does not turn around, just the pulling handle is swopped – this maintains a consistent probe configuration geometry and same heading direction for a mounted gradiometer. The upward rear handle locks the rear wheel pair in place.

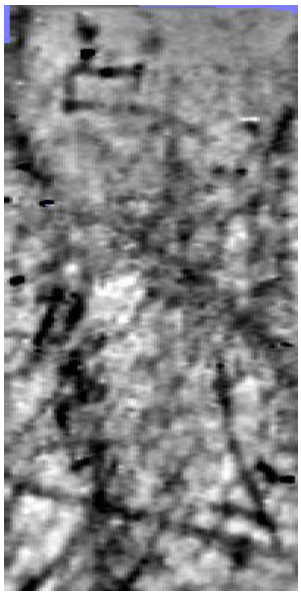
Marton Survey March 2014

A large area survey (100m by 50m) by BCAP at Marton village, looking for a hall and its boundaries. The gradiometer results indicate a ditch and some strong magnetic anomalies, though much of the response is magnetically noisy. A resistance survey using a prototype MSP25 was undertaken to try and add more information. Sample interval was 0.25m, traverse interval 1m and alpha, beta and gamma readings were collected, along with RTK GPS, moving at rate of approximately 1s/m

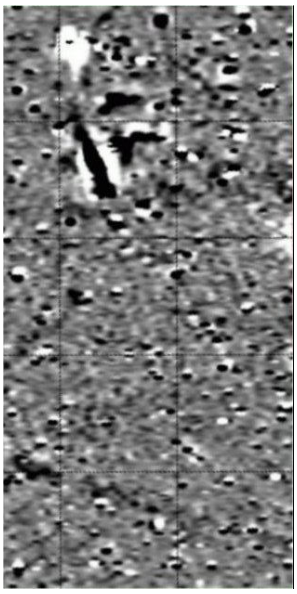
The ditch located in the south of the gradiometer plot shows more clearly in the resistance response (though as a high resistance anomaly in this case), whilst there is the possibility of a further arc shaped ditch to the east. Whilst there is a noticeable geological response (evident also in a smaller scale Twin survey) a possible rectangular building was located to the north. The beta data set gave similar results in this survey whilst gamma data did not add any further information.



Alpha : +/- 2SD



Alpha (HPF) : +/- 2SD



Gradiometer : +/- 2nT

Data reproduced courtesy of the Marton project and BCAP

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RM85 Power Supply

When mounted on the cart it is recommended the RM85 has a spare battery pack available or, even better, an External Power Adapter 2 is used, together with either a LiPo power bank or lead-acid battery pack, to give extended operation times and maintenance of maximum output voltage at all times.

Typical Specifications

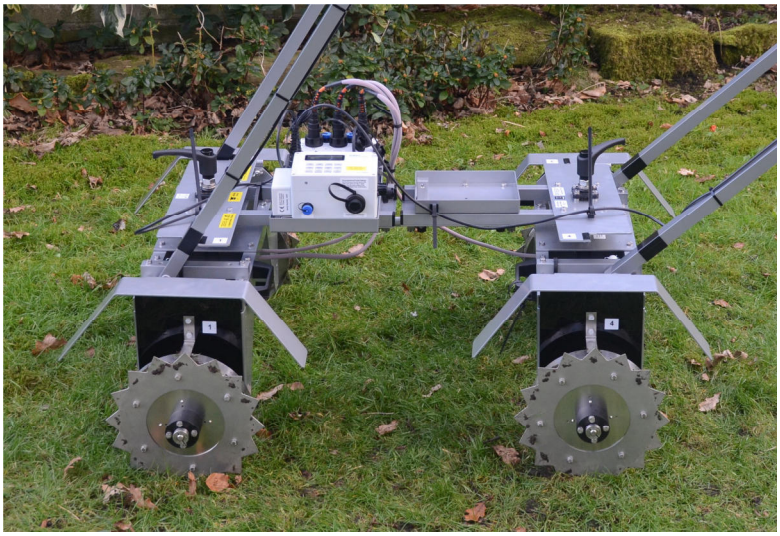
All specifications subject to change without prior notice

Rugged aluminium and stainless steel platform
Integral encoder wheel for position based logging
Sample Trigger option for time based logging
Medium dog-tooth wheel plate penetration depth: 40mm
Toolkit supplied
Weight (Hand pulled MSP25) : 35 Kg
Weight (Towed MSP25) : 32 Kg

Please note that RM85, EPIB1, FM256, FM18, FM36 , FGM650, FAB1, GPS or software are not included with the MSP25

Accessories

Advanced RM85 Resistance Meter (with or without GPS option)
External Power Supply Adapter 2 for RM85
Expansion Interface Box 1 (EPIB1)
Fluxgate Adapter Box 1 (FAB1)
SENSYS FGM650 Fluxgate Gradiometer and cabling
GPS mounting pole and support bracket
Mounting bracket kit for Gradiometer (specify FM18, FM36, FM256 or FGM650)
Small dog-tooth plates (25mm soil penetration) and large dog-tooth plates (60mm soil penetration)
Geoplot 4.0 software



Standard MSP25 shown with optional small dog-tooth wheel plates fitted (Medium dog-tooth plates are fitted as standard).

The RM85 and Expansion Port Interface Box 1 are accessories. Other optional accessories include GPS mounting kit, gradiometer mounting kit, large dog-tooth wheel plates, Fluxgate Adapter Box 1 (FAB1), SENSYS FGM650 Fluxgate Gradiometer and cabling.

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