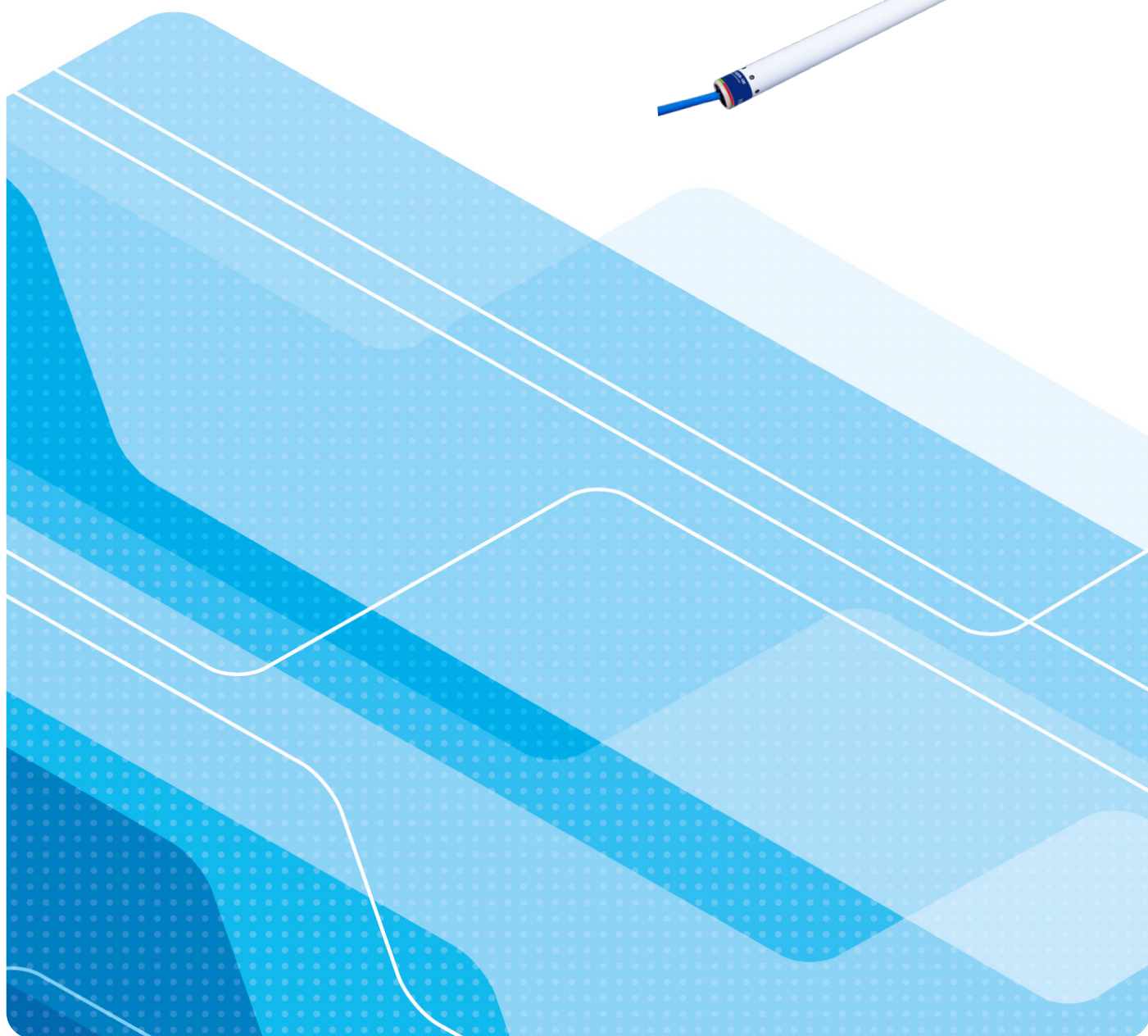
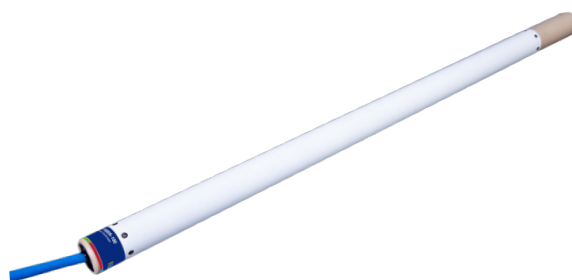


Grad-13[®]

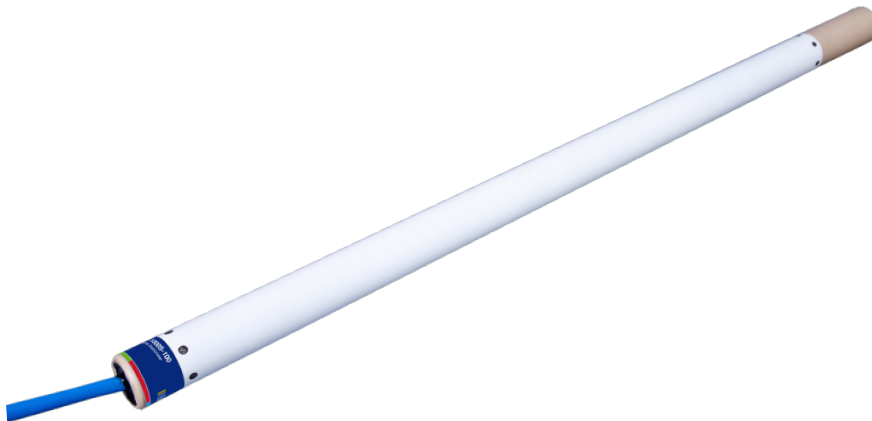
Digital Three-axis Gradiometer





Grad-13® Digital Three-Axis Gradiometer

The Grad-13 provides high resolution vector measurements of the strength and direction of magnetic fields on land or in water (submersible to 200m). The small orthogonality error and digital correction allow for scalar measurements to be made. It can be integrated into multi-sensor arrays, or used singly for applications such as geophysical surveying, locating pipes and cables, and downhole surveys.



Grad-13 is a registered trade mark of Bartington Holdings Limited in the following territories: Germany, United Kingdom, and United States of America.

Grad-13 is used under licence by Bartington Instruments Limited.

Bartington® is a registered trade mark of Bartington Holdings Limited in the following territories: Argentina, Australia, Brazil, Canada, Chile, China, European Union, Hong Kong, Iceland, India, Israel, Japan, Malaysia, Mexico, New Zealand, Norway, Russia, Singapore, South Africa, Switzerland, Taiwan, Turkey, United Kingdom, United States of America, and Vietnam.

Features

- Baselines from 500mm to 1000mm.
- Land and submersible (200m) versions.
- Measuring range of ± 70 or $\pm 100 \mu\text{T}$.
- Integral three-axis accelerometer with $\pm 2\text{g}$ range.
- Individual sensor and gradient outputs.
- Gradiometer can be connected to a computer using readily available RS422 to USB or Ethernet converters.
- Gradient noise $< 25 \text{ pTrms}/\sqrt{\text{Hz/m}}$ at 1Hz with 500mm baseline.

Typical Applications

- Detection of buried magnetic anomalies such as unexploded ordnance (UXO) by surface or downhole surveys.
- Geophysical surveys for archaeology and mineral exploration.
- Pipe and cable location.



Product Identification

Product name	Baseline in mm	Package
Grad-13	500 750 1000	L = Land S = Submersible to 200m

Example: Grad-13-500S is a gradiometer with a 500mm baseline, submersible to 200m.

Grad-13® Specifications

Performance	
Output generated	Digital RS422 output includes: 3-axis magnetic field gradient data 3-axis magnetic field sensor data 3-axis accelerometer data Data protocol DP2629 is available from Bartington Instruments
Digital Resolution	24-bit oversampled
Number of axes	Three (for each sensor)
Baselines	500mm, 750mm or 1000mm
Polarity	+ve output when pointing north
Full scale magnetometer measuring range	$\pm 70\mu\text{T}$ or $\pm 100\mu\text{T}$
Full scale gradient measuring range	2 x Measuring range
Sensor Scaling Error	$< \pm 0.1\%$
Sensor Cross-axis Scaling Error	$< \pm 0.05\%$
Total Field Scaling Error (Sensor)	$< \pm 0.4\%$
Total Field Scaling Error (Gradient)	$< \pm 0.3\%$
Scaling Temperature Coefficient	$< 35\text{ppm}/^\circ\text{C}$
Linearity Error	$< 0.0015\%$
Bandwidth at -3dB*	$> 1\text{kHz}$
Sensor Noise*	$< 12\text{pTrms}/\sqrt{\text{Hz}}$
Gradient Noise*	$< 25\text{pTrms}/\sqrt{\text{Hz/m}}$
Zero Field Offset (Sensor)	$< \pm 10\text{nT}$
Offset Temperature Coefficient	$0.4\text{nT}/^\circ\text{C}$
Perming (Magnetisation Hysteresis)	$< 1\text{nT}$ in $\pm 100\mu\text{T}$
Orthogonality error between axes	$< \pm 0.03^\circ$
Start-up/Settling time	15 minutes
Sample Rate	See DP2629, Sample Sum Count, for more details

*Dependent on Sample Sum Count used.

Environmental

Operating temperature range	-30°C to +85°C
Storage temperature range	-40°C to +85°C
IP Rating Grad-13L Grad-13S	IP67 IP68 submersible to 200m
Compliance	EMC BS EN 61326 & RoHS
MTBF	60,000 hours

Mechanical

Construction	Single-part with potted 5m cable tail Custom tail lengths available, up to 25m max.
Enclosure material	Carbon fibre body, enamel-painted, enclosure with acetal and irridite-plated aluminium alloy end caps
Dimensions	Grad-13-500L = ø35 x 677mm + cable Grad-13-750L = ø35 x 927mm + cable Grad-13-1000L = ø35 x 1177mm + cable Grad-13-500S = ø38 x 677mm + cable Grad-13-750S = ø38 x 927mm + cable Grad-13-1000S = ø38 x 1177mm + cable
Weight (with standard 5m cable)	Grad-13-500L & S = 1.4kg Grad-13-750L & S = 1.7kg Grad-13-1000L & S = 2.0kg Custom tail lengths increase weight
Connector	L = Amphenol 62GB-16J12-08PN S = SUBCONN MCOM8M

Electrical

Supply voltage	9VDC min, 32VDC max
Power consumption	<5W typical
Output standard	RS422 full duplex
Baud rates	115.2Kb/s, 460.8Kb/s, 921.6Kb/s

Performance - Accelerometer

Axis and orthogonality	Three Axis Aligned within 2° of each magnetic axis
Cross-axis Sensitivity	@ FS ±2g, @ 25°C ±0.4
Scaling Error	±10%
Full Scale Range	±2g
Sensitivity change vs. temperature	±0.01 %/°C
Zero-g level offset accuracy @ 25 °C	±20mg
Temp Coeff' of zero offset	0.2mg/°C
Accelerometer update rate	50Hz
Resolution	≥10bits

Grad-13® Battery Box

A lithium-Ion battery contained within a plastic IP67 enclosure; used to power two Grad-13 Sensors for up to 10 hours. Included is a USB cable for interfacing with a PC or laptop.

Performance	
Number of channels	2
Battery	25.55V 2.85Ah Li-Ion 73Wh FRIWO 550006 (UN38.3 Approved)
Battery Life (1 x Grad-13)	20 hours with 5m cable at room temperature
Battery Life (2 x Grad-13)	10 Hours with 5m cables at room temperature
Maximum Cable length (1 x Grad-13) Grad-13 Baud Rate: 115,200kbaud 460,800kbaud 921,600kbaud	(Longer cables will reduce battery life by up to 30%, depending on cable resistance, length and ambient temperature) 360m 225m 135m
Fuse/Protective Devices	Internal Fuse on Battery 2.5A
Indicators	Power ON LED which flashes when battery voltage is low
Interface	USB 2.0
Battery Charging Time	2 - 3 hours
Battery Charger	FRIWO EDV-1897026 1700mA
Battery Charger Indicators	Three colour LEDs for Charging/Full/Fault status

Compatible Products

All Grad-13 Sensors (Grad-13S Sensors will need an adaptor cable)

Environmental

Operating temperature range (limited by battery)	Normal Use: -20°C to +60°C Charging: 0°C to +45°C
Storage temperature range (limited by battery)	1 Year: -20°C to +25°C 3 months: -20°C to +45°C
IP Rating	IP67
EMC Approvals	BS EN 61326-1 (CE Marking)

Mechanical

Enclosure	Rolec Technoplus 290.132.000
Enclosure Material	Luran 778T
Dimensions	230 x 130 x 120mm
Weight	1.4kg
Connectors	Amphenol 62GB Range

Optional Accessories

Grad-13L	Grad-13S
Dual port battery box with USB output Charger for battery box USB lead 8-port multiplexing box with Ethernet output Charger for multiplexing box 5m extension cable (other lengths available on request) Non-Magnetic Cart (see DS3142 from Bartington Instruments)	5m gradiometer underwater extension cable (other lengths available on request) 5m gradiometer underwater-to-land cable (other lengths available on request): connects to land battery box or land multiplexing box
Gradiometer acquisition software (Microsoft Windows only)	



The specifications of the products described in this brochure are subject to change without prior notice.

Bartington Instruments Ltd
5, 8, 10, 11, 12 & 16 Thorney Leys Business Park
Witney, Oxford OX28 4GE. England

Telephone: +44 (0)1993 706565
Email: sales@bartington.com

 **Bartington**[®]
Instruments