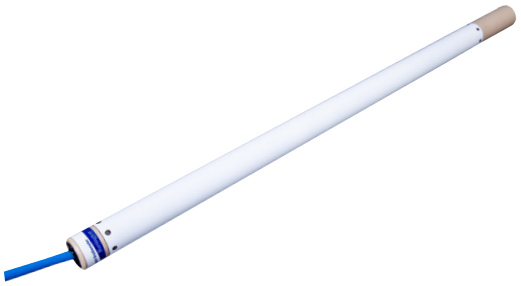
Grad-13 Digital Three-Axis Gradiometer

This digital three-axis gradiometer sensor provides high resolution vector measurements of magnetic fields on land or in water. The small orthogonality error also makes scalar measurement possible. It can be integrated into multi-sensor arrays or used singly for applications such as geophysical surveying, locating pipes and cables, and downhole surveys.



The instrument is available in land, shallow and deep submersible versions. An inbuilt sensor provides temperature data and an integrated accelerometer enables accurate positioning of the sensor.

Features

- Baselines from 500mm to 1000mm
- Land and submersible (200m and 5000m) versions
- Integral three-axis accelerometer with ±2g range per sensor and resolution of 1mg
- Individual sensor and gradient outputs
- Gradiometer can be connected to a computer using readily available RS485 to USB or Ethernet converters
- Noise <70pTrms/√Hz/m at 1Hz with 500mm baseline

Typical Applications

- Geophysical survey for archaeology and mineral exploration
- Pipe and cable location
- Detection of buried magnetic anomalies by surface or downhole surveys

Product Identification

Baseline in mm	Package
500 750 1000	L = Land S = Submersible to 200m D = Submersible to 5000m

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

Grad-13 Specifications

Gradiometer Performance	
Output generated	Digital RS485 output includes: • 3-axis magnetic field gradient data • 3-axis magnetic field sensor data • 3-axis accelerometer data • temperature data (Data protocol DP2629 is available from the Bartington Instruments website)
Number of axes	Three (for each of two sensing elements)
Baseline between sensors	500, 750 or 1000mm
Bandwidth at -3dB	200Hz
Measurement noise floor	<70pTrms/√Hz/m at 1Hz with 500mm baseline
Scaling error	Down to noise level after balancing
Scaling (total field)	10µT/V
Temperature coefficient of scale factor	<70ppm/°C
Offset error	Down to noise level after balancing
Temperature coefficient of offset error	±0.4nT/°C
Settling time at power up	<10mins
Orthogonality error	<0.01°
Linearity error	<0.0015%
Hysteresis	<1nT in 1mT

Magnetic Field Sensing Element Performance	
Number of axes	Three
Bandwidth at -3dB	250Hz
Noise	Down to <10pTrms/√Hz at 1Hz
Scaling error	±0.5%
Offset error	<5nT in zero field
Temperature coefficient of scale factor	<35ppm/°C
Temperature coefficient of offset error	±0.2nT/°C
Settling time at power up	<10mins
Orthogonality error	<0.01°
Linearity error	<0.0015%
Hysteresis	<1nT in 100µT

Scaling Dependent Parameters				
Range per sensor	±70µT	±100µT	±500µT	±1000µT
Maximum gradient	140µT	200µT	1000µT	2000µT

Accelerometer Performance	
Number of axes	Three
Range per sensor	±2g
Update rate	50Hz
Resolution	1mg
Offset error	±70mg
Scaling error	<±2%
Temperature coefficient of offset error	±0.2mg/°C
Temperature coefficient of scale factor	±0.025%/°C
Orthogonality error	±2°

Temperature Sensor Performance	
Range	-40°C to +85°C
Resolution	0.25°C
Temperature accuracy	±1°C (max)
Scaling error	<±2%
Temperature coefficient of offset error	±0.2mg/°C
Temperature coefficient of scale factor	±0.025%/°C
Orthogonality error	±2°

Environmental	
Operating temperature range	-30°C to +70°C
Storage temperature range	-40°C to +70°C
Environmental protection Grad-13D Grad-13S Grad-13L	 Submersible to 5000m Submersible to 200m Waterproof

Mechanical			
	Grad-13L	**Grad-13S**	**Grad-13D**
Dimensions (excl. cable tail) for 500mm baseline for 750mm baseline for 1000mm baseline	 ø35 x 670mm ø35 x 920mm ø35 x 1170mm	 ø35 x 755mm ø35 x 1005mm ø35 x 1255mm	TBA
Weight (incl. cable tail)	1.2kg	1.5kg in air Sinking in sea water	TBA
Enclosure material	Carbon fibre & PEEK	Carbon fibre & PEEK	Carbon fibre & PEEK
Connector and tail	5m long tail with 14-way Amphenol 62GB-16J12-08PN	5m long tail with 14-way Impulse MSAJ14CCP	TBA
Mating connector	TBA	14-way Impulse MSAJ14CCR	TBA

Electrical	
Voltage input	+9V DC min, +32V DC max
Power consumption	<5W
Digital output standard	RS485 full duplex