

Innovation in Magnetic Field Measuring Instruments

Mag-13[®]

Three-Axis Magnetic Field Sensors



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Bartington[®]
Instruments



Mag-13® Three-Axis Magnetic Field Sensors

The Mag-13® range of sensors provide high precision and low noise measurements of static and alternating magnetic fields. Different combinations of noise level, measuring range and enclosure make the sensors suitable for use in a wide range of applications, such as in physics, geophysics, bioelectromagnetics and mineral exploration.

Packaged Mag-13® sensors are environmentally sealed against dust and water ingress to a depth of at least 1 metre, and shielded from electrical interference.

All sensors have an integrated test coil that removes the need for a separate calibration unit, and a temperature sensor.



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Mag-13® is a registered trade mark of Bartington Instruments Limited in the United Kingdom.

Features

- Wide range of enclosures; unpackaged versions available
- Noise levels down to $<4\text{pTrms/VHz}$ at 1Hz
- Measuring ranges from $\pm 60\mu\text{T}$ to $\pm 1000\mu\text{T}$
- Bandwidth of 3kHz
- Environmentally sealed and shielded from electrical interference
- Integrated test coil and temperature sensor

Typical Applications

- Magnetic field monitoring
- Use as feedback sensors in active magnetic field shielding systems
- Site surveys prior to MRI or Electron Microscope
- Electromagnetic surveys



Product Identification

Product name	Package	Noise	Range in μT
Mag-13	MS = Square MC = Cylindrical MCD = Cylindrical, deep submersible U = Unpackaged	Standard = no code L = Low noise Q = Very low noise Z = Ultra Low Noise	± 60 ± 70 ± 100 $\pm 500^*$ $\pm 1000^*$

*Available in standard noise version only

Example: Mag-13MCL100 is a low noise 100 μT sensor in a cylindrical enclosure.

Mag-13 Specifications

Performance	
Number of axes	Three
Polarity	+ve non-inverting output when pointing North
Bandwidth (-3dB)	>3kHz (-11dB/octave roll-off)
Measurement noise floor: Standard L (low) Q (very low) Z (ultra low)	6 to $\leq 10\text{pTrms}/\sqrt{\text{Hz}}$ at 1Hz <6pTrms/ $\sqrt{\text{Hz}}$ at 1Hz <5pTrms/ $\sqrt{\text{Hz}}$ at 1Hz <4pTrms/ $\sqrt{\text{Hz}}$ at 1Hz
Start-up time	150 ms
Warm-up time	15 min to meet specifications for scaling <60min to meet noise specification
Scaling error	$\pm 0.5\%$
Orthogonality error between axes	$< \pm 0.1^\circ$
Alignment error (Z axis to reference face)	$< \pm 0.1^\circ$ (Mag-13MS only)
Linearity error	0.0015% (least squares fit)
Frequency response	DC to 1kHz ($\pm 5\%$)
Hysteresis	<2nT (1 x full scale, when powered)
Overload hysteresis	<2nT (2 x full scale, when powered)
Excitation breakthrough	<5 mV pk-pk at 15.625kHz typical
Mean Time Before Failure (MIL217F)	Target 12 years

Scaling Dependent Performance Parameters

Measuring range (μT)	± 60	± 70	± 100	± 500	± 1000
Scaling (mV/ μT)	166	143	100	20	10
Scaling Temperature coefficient ppm/ $^\circ\text{C}$	± 15		± 20	± 100	± 200
Offset in zero field (nT)	± 5 (0.83mV)	± 5 (0.71mV)	± 5 (0.5mV)	± 25 (0.5mV)	± 50 (0.5mV)
Offset temperature coefficient (nT/ $^\circ\text{C}$)	± 0.3 (17 $\mu\text{V}/^\circ\text{C}$)	± 0.3 (15 $\mu\text{V}/^\circ\text{C}$)	± 0.3 (10 $\mu\text{V}/^\circ\text{C}$)	± 1 (6.6 $\mu\text{V}/^\circ\text{C}$)	± 1 (6 $\mu\text{V}/^\circ\text{C}$)

Environmental	
Operational temperature range	-40 to +70°C
Storage temperature range	-40 to +85°C
Humidity	Up to 90%, non condensing
Environmental protection / sealing MC MS MCD U	IP67 IP67 IP68 (5000m) N/A

Mechanical				
Package options	Cylindrical (MC)	Square (MS)	Cylindrical Deep Submersible (MCD)	Unpackaged (U)
Dimensions	Ø 25 x 225mm	32 x 32 x 225mm	Ø 60 x 286mm	19.5 x 149mm
Weight	83g	227g	950g	26g
Enclosure material	Acetal	Acetal	PEEK	n/a
Connector	Fischer DEU1031 A010-SR-11-11-G-12		Impulse XSJ-10-BCR (dry mateable)	Molex 53047-0810
Mating connector	Fischer S1031 A010-SR-11-11 with E3-1031.2/6.2		Impulse XSJ-10-CCP (dry mateable)	Molex Picoblade 51021-0800 and crimp terminal 50079-8000 with wire 26-28 AWG recommended
Fixing points	1 x M5 with 3 points	2 x M5	None	2 x M2

Electrical	
Supply voltage	±12 to ±17V DC
Current consumption	+65mA, -30mA ±1.4mA/100µT (typical)
Analogue output	±10V single-ended (0V = zero-field)
Output impedance	10Ω
Maximum load capacitance	>1µF
Maximum cable length	0.5km (with a minimum of ±12V supplied to the magnetometer)

Temperature Sensor	
Temperature sensor measurement range	-40 to + 85°C, subject to operational range stated above
Temperature sensor output type	Voltage
Temperature sensor offset	3.5V at 0°C
Temperature sensor scaling	-10mV/°C
Temperature accuracy	±4°C (over operating range), ±3°C at 25°C

Mating Connectors

Mating connectors for the Mag-13MCD and Mag-13U sensors can be purchased separately.

Connectors are supplied free of charge with all other models.

Cables

The standard cable length is 5m; alternative lengths are available. Please contact Bartington Instruments for further information.

All cables are terminated with a Hirose RM15TPD10S, suitable for connection to Bartington Instruments' range of data acquisition and power supply units.

Mag-13MC, Mag-13MS	
Conductors	7/0.2 PVC insulated conductors, overall braided screen and PVC sheath
Type no.	7-2-8C Black to Def Stan 61-12, part 4
Conductor resistance	0.092Ω/m
Capacitance	100pF/m core to core 170pF/m core to screen

Mag-13MCD submersible cable	
Conductors	3 pairs individually screened, with polyurethane sheath
Conductor resistance	0.034Ω/m
Weight	0.10kg/m (in air) / 0.026kg/m (in sea water)
Cable bending radius	77mm

Compatibility

The Mag-13 range is compatible with the following data acquisition and power supply units from Bartington Instruments:

- PSU1 Power Supply Unit
- Magmeter-2 Power Supply and Display Unit
- Spectramag-6 Data Acquisition Unit (adaptor cable required)
- SCU1 Signal Conditioning Unit
- Mag-03DAM Data Acquisition Module (adaptor cable required)
- Decaport Analogue Interface Module
- DAS1 Data Acquisition System
- DecaPSU Power Supply Unit

[Outputs for the test coil and temperature sensor are presently only available with the DecaPSU.]

Mounting Accessories

A range of mounting accessories are available:

Specification	
Mag-BR	Mounting bracket for use with the Mag-13MC
Mag-T	Tripod
Mag-TA	Tripod adaptor
Mag-LP	Levelling platform for use with the Mag-T, Mag-TA and Mag-MR
Mag-MR	Mounting rack for the installation of Mag-LP and Mag-13 sensors, available in lengths of 1 metre and multiples





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