

The background of the entire page is a solid blue color. Overlaid on this background are several sets of thin, white, wavy lines that flow from the left side towards the right, creating a sense of motion and depth. These lines vary in frequency and amplitude, some being more pronounced than others.

Mag-03

Three-Axis Magnetic Field Sensors



Mag-03 Three-Axis Magnetic Field Sensors

These compact, high performance fluxgate sensors with integral electronics provide precision measurements of static and alternating magnetic fields in three axes. They are available with measuring ranges of ± 70 , ± 100 , ± 250 , ± 500 or $\pm 1000\mu\text{T}$ in a variety of enclosures. Powered from any $\pm 12\text{V}$ supply, outputs are in the form of three analogue voltages from 0 to $\pm 10\text{V}$, proportional to B_x , B_y and B_z .

The sensors are available with three levels of noise performance. The low noise version has a noise level of $< 6\text{pTrms}/\text{VHz}$ at 1Hz, the standard version between 6 and $\leq 10\text{pTrms}/\text{VHz}$ at 1Hz, and the basic version between > 10 and $20\text{pTrms}/\text{VHz}$ at 1Hz. The standard and basic versions can be supplied in all measuring ranges and enclosure types. The low noise version is available with a measuring range of $70\mu\text{T}$ or $100\mu\text{T}$, in all enclosure types.

These sensors have a wide range of applications in physics, bioelectromagnetics, geophysical exploration and defence.

Compatible data acquisition units, power units and accessories include:

- Spectramag-6 Data Acquisition Unit (six-channel spectrum analyser)
- SCU1 Signal Conditioning Unit
- PSU1 Power Supply Unit
- DecaPSU Power Supply Unit
- Mag-03-T Tripod
- Mag-03-TA Universal tripod adaptor

Calibration check units can be supplied for the complete range of sensors.

A full calibration service is also available.



Mag-03 Enclosures

To suit specific needs, Mag-03 sensors can be supplied in a wide range of enclosures. The sensors are illustrated on the Mag-03 product page on the Bartington Instruments website, at www.bartington.com/mag-03.html.

Sensor	Enclosure	Further Description
Mag-03MC	Cylindrical	Sensing elements and electronic circuitry housed in enclosure. Suitable for use in shallow boreholes but not sealed against ingress of water. Mounting bracket available as option.
Mag-03MCES	Cylindrical with environmentally sealed enclosure to IP64	Enclosure features rugged, seven way sealed connector.
Mag-03MCFL	Cylindrical with connections via flying leads	No connector. Seven way connecting cable moulded within enclosure with a strain relief grommet.
Mag-03MCT	Cylindrical with titanium shielded enclosure	Titanium enclosure providing electrical shielding
Mag-03MCUP	Unpackaged: moulded sensor and electronics block with flying leads	
Mag-03MCTP	Two-part construction: separate sensor and cylindrical electronics enclosure	
Mag-03MS	Square section	Sensing elements mounted with reference to the base which acts as a datum face.

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Mag-03MSES	Square section with environmentally sealed enclosure to IP64.	Rugged, seven way sealed connector. Sealing gasket may be required on base of the sensor.
Mag-03MSS	Square section submersible to 2000 metres. IP68 rated.	Pressure housing manufactured from polyacetal for minimum water absorption. Seven way marine type connector moulded to a seven way polyurethane jacketed marine cable. Cable supplied to customer requirement up to a length of 600 metres.
Mag-03IE	Sensor with the three sensing elements on flying leads.	Shortened cylindrical enclosure for electronics. Sensing elements individually potted and connected to electronics assembly with flying leads with standard length of 750mm so that user can position individual elements independently if required. Sensing elements can be arranged around a sensitive volume where space is restricted.
Mag-03IEv1	IE sensor with a 9-way 'D' type connector and cable from the electronics enclosure.	
Mag-03IEv2	IE sensor with a 25-way 'D' type connector and cable from the electronics enclosure.	
Mag-03IEHV	IE sensor suitable for use in a high vacuum chamber.	Independent elements enclosed in glass tubes with epoxy filling. Re-solderable terminal block in sensor element cables allows connection through a vacuum chamber bulkhead.

Mag-03 Product Identification

Products are specified as Mag-03 followed by the enclosure code (MC, MCES, MCFL, MS, MSES, MSS, IE, IEv1, IEv2, IEHV, MCT, MCUP, MCTP), followed by L for the low noise version or B for the basic version. If neither L nor B is specified then this indicates the standard version. The measuring range in μT (70, 100, 250, 500 or 1000) then follows.

For example:

- Mag-03MSL70 is a low noise sensor with a square section enclosure and a range of $\pm 70\mu\text{T}$.
- Mag-03MC1000 is a standard sensor with a cylindrical enclosure and a range of $\pm 1000\mu\text{T}$.
- Mag-03MSESB250 is a basic sensor with a square section enclosure environmentally sealed to IP64 and a range of $\pm 250\mu\text{T}$.

Note: For some Mag-03 magnetometers (Mag-03 MCFL, MCTP, MCUP, IE), it will be necessary to specify the lead lengths. For example, Mag-03MCFL250-1000 is a Mag-03MCFL with a range of $250\mu\text{T}$ and flying leads of 1000mm.



Mag-03 Specifications

Performance

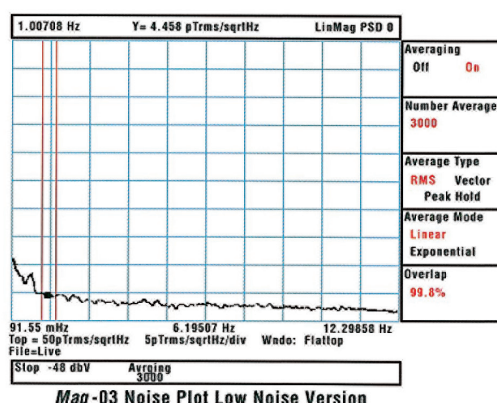
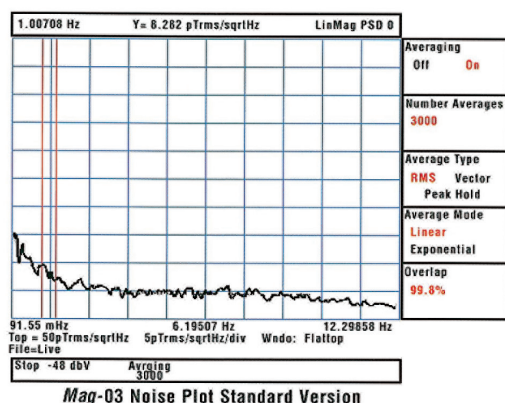
Number of axes	Three
Polarity	+ve non-inverting output when pointing North
Bandwidth	3kHz (5kHz for Mag-03IEv1&2 on request)
Internal noise: basic version standard version low noise version	>10 to 20pTrms/√Hz at 1Hz 6 to ≤10pTrms/√Hz at 1Hz <6pTrms/√Hz at 1Hz
Scaling error	<±0.5%
Orthogonality error	<0.5° (<0.1° for Mag-03MS and Mag-03MSES)
Alignment error (Z axis to reference face)	<0.1° (Mag-03MS and Mag-03MSES only)
Single sensor axis to body	<3.5° (Mag-03IE sensors only)
Linearity error	<0.0015%
Frequency response	0 to 1kHz maximally flat, ±5% maximum at 1kHz
Excitation breakthrough	<20mV pk-pk at 16kHz (3kHz bandwidth) <400mV pk-pk at 16kHz (5kHz bandwidth)

Electrical

Supply voltage	±12V to ±17V
Current consumption	+30mA, -10mA (+1.4mA per 100μT for each axis)
Power supply rejection ratio	5μV/V (-106dB)
Analogue output	±10V (±12V supply) swings to within 0.5V of supply voltage (unbalanced, single ended ref. 0V)
Output impedance	10 Ω

Scaling Dependent Parameters

Measuring range (μT) (low noise version has range of 70μT or 100μT only)	±70	±100	±250	±500	±1000
Scaling (mV/μT)	143	100	40	20	10
Scaling temperature coefficient (ppm/°C)	±15	±20	±50	±100	±200
Offset error (nT)	±5	±5	±12	±25	±50
Offset temperature coefficient (nT/°C)	±0.1	±0.1	±0.2	±0.33	±0.6



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	Mag-03MC	Mag-03MCES
Operating temperature range: continuous intermittent	-40°C to +70°C 40°C to +85°C	-40°C to +70°C -40°C to +85°C
Environmental protection	IP51	IP64
Dimensions (ø x L)	25 x 202mm	25 x 207mm
Weight	85g	100g
Enclosure material	Reinforced epoxy	Reinforced epoxy
Connector	Hirose RM15TRD10P	Amphenol 62GB-51T10-7P
Mating connector	Hirose RM15TPD10S	Amphenol 62GB-16J10-7S
Mounting	Mag-03MC-BR or TA available	Mag-03MC-BR or TA available

	Mag-03MCFL	Mag-03MCT
Operating temperature range: continuous intermittent	-40°C to +70°C -40°C to +85°C	-40°C to +70°C -40°C to +85°C
Environmental protection	IP51	IP51
Dimensions (ø x L)	25 x 211mm	25 x 202mm
Weight	80g	95g
Enclosure material	Reinforced epoxy	Titanium
Connector	Flying leads 500mm length ^{2,3} (Up to 5000mm length to order)	Hirose RM15TRD10P
Mating connector		Hirose RM15TPD10S
Mounting	Mag-03MC-BR or TA available	Mag-03MC-BR or TA available

	Mag-03MCTP	Mag-03MCUP
Operating temperature range: continuous intermittent	-40°C to +70°C -40°C to +85°C	-40°C to +70°C -40°C to +85°C
Environmental protection	IP51	Unpackaged conformal coating
Dimensions (mm)	Electronics: ø25 x 115 length Sensor: ø20 x 54 length Sensor-electronics cable: 1000 length ³ (up to 5000 length to order)	Electronics (WHL): 21 x 12 x 80 Sensor: ø20.9 x 56 length Sensor-electronics cable: 610 length ³ (up to 5000 length to order)
Weight	80g	80g
Enclosure material	Sensor: reinforced epoxy Electronics: aluminium alloy	Sensor: reinforced epoxy Electronics: conformal coating
Connector	Hirose RM15TRD10P	Flying leads 500mm length ^{2,3} (up to 5000mm length to order)
Mating connector	Hirose RM15TPD10S	
Mounting	Mag-03MC-BR or TA available ¹	

	Mag-03MS	Mag-03MSES
Operating temperature range	-40°C to +70°C	-40°C to +70°C
Environmental protection	IP51	IP64
Dimensions (W x H x L) (mm)	32 x 32 x 152	32 x 32 x 166
Weight	160g	160g
Enclosure material	Reinforced epoxy	Reinforced epoxy
Connector	ITT Cannon DEM-9P-NMB	Amphenol 62GB-12E10-7P
Mating connector	ITT Cannon DEM-9S-NMB	Amphenol 62GB-16J10-7S ⁴
Mounting	2 x M5 fixing holes. Tripod adapter available	2 x M5 fixing holes. Tripod adapter available

See the Mag-03 product page at www.bartington.com/mag-03.html for sensor outline drawings of these enclosure types.

	Mag-03IE	Mag-03IEHV
Operating temperature range: continuous intermittent	-40°C to +70°C -40°C to +85°C	-40°C to +70°C -40°C to +85°C
Environmental protection	IP51	For use in high vacuum chambers
Dimensions (mm)	Electronics: ø25 x 115 length Sensor: ø8 x 30 length Sensor-electronics cable: 750 ^{2,3} length (up to 5000 length to order)	Electronics: ø25 x 115 length Sensor: ø6.5 x 30 length Inner cable: 1100 ^{2,3} length (up to 5000 length to order) Outer cable: 140 length Inner and outer cable joined by re-solderable terminal block
Weight	80g	80g
Enclosure material	Sensors: alumina cylinder Electronics: aluminium alloy	Sensors: glass tube with epoxy filling Electronics: aluminium alloy
Connector	Hirose RM15TRD10P	Hirose RM15TRD10P
Mating connector	Hirose RM15TPD10S	Hirose RM15TPD10S
Mounting	Mag-03MC-BR or TA available ¹	Mag-03MC-BR or TA available ¹

	Mag-03IEv1	Mag-03IEv2
Operating temperature range: continuous intermittent	-40°C to +70°C -40°C to +85°C	-40°C to +70°C -40°C to +85°C
Environmental protection	IP51	IP51
Dimensions (mm)	Electronics: ø25 x 105 length Sensor: ø8 x 30 length Sensor-electronics cable: 750 length ^{2,3} (up to 5000 length to order)	Electronics: ø25 x 105 length Sensor: ø8 x 30 length Sensor-electronics cable: 750 length ^{2,3} (up to 5000 length to order)
Weight	80g	80g
Enclosure material	Sensors: alumina cylinder Electronics: aluminium alloy	Sensors: alumina cylinder Electronics: aluminium alloy
Connector	9-way 'D' type on a 5m cable	25-way 'D' type on a 5m cable
Mating connector	9-way 'D' type	25-way 'D' type
Mounting	Mag-03MC-BR or TA available ¹	Mag-03MC-BR or TA available ¹

	Mag-03MSS
Operating temperature range	-10°C to +50°C
Environmental protection	IP68 (submersible to 2000m)
Dimensions (mm)	30 x 30 x 208
Weight	185g
Enclosure material	Polyacetal
Connector	Impulse IE XSJ-7-BCR
Mating connector	Impulse IE XSJ-7-CCP ⁴
Mounting	3 x M3 clearance holes

See the Mag-03 product page at www.bartington.com/mag-03.html for sensor outline drawings of these enclosure types.

Footnotes to sensor specifications

¹ Bracket or Tripod Adaptor is only suitable for the electronics enclosure.

² Flying leads and independent elements wires are susceptible to EM interference and should be screened wherever possible.

³ Standard length if not specified in order.

⁴ Modified to be non-magnetic.

Mag-03 Mating Connectors

With the exception of the Mag-03MSS, non-magnetic mating connectors are provided free of charge for all Mag-03 sensors purchased without cables.

Mag-03 Cables

Cables can be supplied for most Mag-03 sensor versions. The standard cable length is 5m. Other lengths up to 600m can be supplied on request. All cables terminate with a Hirose RM15TPD10S, suitable for connection to Bartington Instruments' range of data acquisition and power supply units.

Mag-03MS, Mag-03MSES, Mag-03IE, Mag-03MC, Mag-03MCES, Mag-03MCT, Mag-03MCTP	
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-03MSS 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

Cable connections

SIGNAL	SUPPLY END	SENSOR END					
		Mag-03MS	Mag-03MC Mag-03IE Mag-03IEHV Mag-03MCTP Mag-03MCT	Mag-03MCES Mag-03MSES	Mag-03MSS	Mag-03IEv1	Mag-03IEv2
X out	1	6	1	A	1	1	5
Y out	2	8	2	B	2	2	6
Z out	3	5	3	C	3	3	7
Signal/Power ground	4	4	4	D	4	6,7,8	17,18,19
Signal/Power ground	5	3	5	E	5	9	12
+12V supply	6	1	6	F	6	4	11
-12V supply	7	2	7	G	7	5	13
NC	8,9,10	7,9	8,9,10		8,9,10		1,2,3,4,8,9, 10,14,15

For details of cable colours see the figure showing the relevant cable on the Bartington Instruments website.

Mag-03 Mounting Accessories

A range of accessories are available:

Specification	
Mag-03MC-BR	Mounting bracket for use with the cylindrical range of Mag-03 sensors
Mag-03-T	Tripod
Mag-03-TA	Tripod adaptor for mounting the Mag-03 sensor (not including Mag-03MSS)
Mag-03-LP	Levelling platform for use with the Mag-03TA, Mag-03-T and Mag-03MR mounting rack
Mag-03-MR	Mounting rack for the installation of Mag-03LP and Mag-03 sensors, available in lengths of 1 metre and multiples

Mag-03 Calibration Unit

These units provide a fast and convenient facility to test the accuracy and functionality of a Mag-03 sensor. They consist of a battery powered Helmholtz coil generating an alternating magnetic field, with guides to align each of the sensor axes in turn.

Note that these units are not intended as a full calibration facility. It is recommended that sensors are returned to Bartington Instruments for full recalibration.

Specification	
Sinewave magnitude	50 μ T p-p (17.5 μ T rms) $\pm$ 1% (distortion 5% typical)
Frequency	190Hz $\pm$ 2%
Environmental	IP60 not suitable for use in wet conditions
Dimensions (mm)	$\varnothing$ 100 x 125 length
Weight	990g
Enclosure material	Polyethylene terephthalate
Battery	PP3 9V alkaline or lithium dioxide (20 hours' continuous use) with tri-colour LED indicator

Ordering code:	Suitable for use with:
Mag-03MS-CU	Mag-03MS, Mag-03MSES
Mag-03MSS-CU	Mag-03MSS
Mag-03MC-CU	Mag-03MC, Mag-03MCES, Mag-03MCFL, Mag-03MCT, Mag-03MCUP, Mag-03MCTP
Mag-03IE-CU	Mag-03IE





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Instruments

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