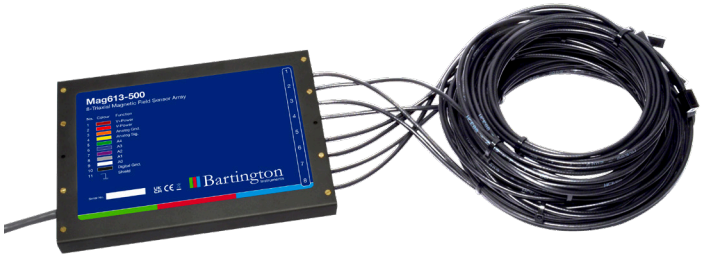
Operation Manual for

Mag613

Three-Axis Magnetometer Array



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1. Legal Notices

1.1 Warranty and Terms & Conditions

This document should be read in conjunction with the Terms & Conditions for the Supply of Goods and Services, which also describe the terms of warranty. They are available at www.bartington.com.

Bartington Instruments reserves the right to change any part of the design of these products without prior notice.

2. How to Use this Manual

This document describes the installation, function, testing, operation and maintenance of the Mag613 eight channel three-axis magnetometer array.

This manual should be read in conjunction with brochure DS1854, available from the product page on the Bartington Instruments website, which contains technical, mechanical, electrical, environmental and performance specifications for the product. A sensor outline drawing and electronics schematic are also available on this page.

Note that failure to follow the instructions in this manual may invalidate your product's warranty. If in doubt, do not hesitate to contact Bartington Instruments.

2.1 Symbols Glossary

The following symbols used within this manual call your attention to specific types of information:

WARNING: Indicates a situation in which serious bodily injury or death could result if the warning is ignored.

Caution: Indicates a situation in which bodily injury or damage to your instrument, or both, could result if the caution is ignored.

Identifies items that must be disposed of safely to prevent unnecessary damage to the environment.

Note: Provides useful supporting information on how to make better use of your purchase.

3. Safe Use

WARNING: These products are not qualified for use in explosive atmospheres or life support systems. Consult Bartington Instruments for advice.

4. Introduction to the Mag613

The Mag613 three-axis, eight-head fluxgate is designed to be particularly flexible in use. The main interface cable to the electronics module will not have been fitted with a connector. This allows the user to fit their preferred type, perhaps after the cable has been fitted through a bulkhead or other restricted space.

4.1 Vector Measurements and Conventions

Each of the eight magnetometer heads measures in three axes marked x, y and z. The z axis is in line with the connecting cable. Each axis produces a single, analogue output voltage in response to the magnitude of a magnetic field.

The cables connecting the sensor heads to the electronics module can be mounted in almost any configuration, giving maximum flexibility to the user.

5. Installing the Mag613

5.1 Siting the Magnetometer

Note: In whatever situation the Mag613 is to be installed, it is important to avoid or compensate for local magnetic effects. In general:

- The magnetometer should be sited several metres from any magnetic base rock to avoid compromising measurements.
- Site the magnetometer several tens of metres from very large ferromagnetic objects that could become magnetised and create fields that exceed the measuring range of the sensor.
- Avoid siting the sensor near any ferromagnetic objects that may be subjected to the effects of magnetic hysteresis, which would affect the sensor in an unpredictable manner.

Note: For these reasons, a magnetic evaluation of any proposed installation site should be conducted to establish that it is free from magnetic contaminants. It is recommended that such an evaluation be carried out using total field or resonance magnetometers.

5.2 Cable Recommendations

To connect your Mag613 to a data acquisition unit, a mating connector will usually be required. Refer to brochure DS1854 and the product label for wiring details.

Note: Cables are particularly prone to wear and damage if twisted, flexed beyond their design limits, or subjected to excessive or repeated movement. It is recommended that all cables are mounted securely in place. For further details refer to Section 5.4: Mounting Recommendations.

5.3 Pre-installation Tests

Prior to the installation of the system, the magnetometer, the cable and your power supply must be fully tested to ensure correct function as follows:

1. Check the interface cable for short circuits between the wires.

   Note: The two ground wires (analogue and digital) are connected internally. Continuity between these pins is normal and does not indicate a fault.

2. Check your power supply output voltage using a voltmeter. Refer to brochure DS1854 for the expected values.

3. Ensure correct connection of the interface cable to your power supply. Refer to brochure DS1854 for details.

4. Switch on the power supply.

5. For the output:

    a. Connect a voltmeter to the Mag613 output, i.e. across the analogue output signal and analogue ground.

    b. Select sensor head and channel by setting the digital address lines correctly. See 5.3.1 Multiplexing Addressing.

    c. Whilst monitoring the voltmeter readings, align the magnetometer with the terrestrial field.

    d. Confirm the measured readings approach the local geomagnetic field value.

    e. Address each monitor line (1 to 8) and verify the output is correct. See 5.3.1 Multiplexing Addressing.

Note: Geomagnetic field values can be provided by your local magnetic observatory. A margin of error due to local disturbance should be taken into account.

5.3.1 Multiplexing Addressing

The 24 analogue outputs from the magnetometers and the current monitors are multiplexed onto one output line. The five TTL/CMOS address lines select the signal to be output as follows, in which Logic 0 is a low state and Logic 1 is a high state.

A4	A3	A2	A1	A0	Output
0	0	0	0	0	X1
0	0	0	0	1	Y1
0	0	0	1	0	Z1
0	0	0	1	1	X2
0	0	1	0	0	Y2
0	0	1	0	1	Z2
0	0	1	1	0	X3
0	0	1	1	1	Y3
0	1	0	0	0	Z3
0	1	0	0	1	X4
0	1	0	1	0	Y4
0	1	0	1	1	Z4
0	1	1	0	0	X5
0	1	1	0	1	Y5
0	1	1	1	0	Z5
0	1	1	1	1	X6
1	0	0	0	0	Y6
1	0	0	0	1	Z6
1	0	0	1	0	X7
1	0	0	1	1	Y7
1	0	1	0	0	Z7
1	0	1	0	1	X8
1	0	1	1	0	Y8
1	0	1	1	1	Z8
1	1	0	0	0	Monitor1
1	1	0	0	1	Monitor2
1	1	0	1	0	Monitor3
1	1	0	1	1	Monitor4
1	1	1	0	0	Monitor5
1	1	1	0	1	Monitor6
1	1	1	1	0	Monitor7
1	1	1	1	1	Monitor8

5.4 Mounting Recommendations

Each electronics module has a set of mounting holes to allow attachment to a stable base of fixture. Refer to sensor outline drawing DR2512 on the product page for further information.

Note: Ensure the main cable is routed through any restricted spaces before connecting to the power supply/data acquisition module.

5.5 Post-installation Testing

1. Confirm no magnetic objects are moving in the vicinity.
2. Monitor the sensor output.
3. Confirm that the sum of the measured magnetic field vector is similar to the expected local earth field.

Note: The outputs from the sensor should remain stable to within the quoted noise limits. Refer to brochure DS1854 for the expected values.

6. Using the Mag613

6.1 Magnetic Hysteresis

Note: Do not subject your magnetometer to magnetic fields greater than their stated measuring range for extended periods as this could alter the DC offset. If this occurs, the offset will exhibit drift as it returns to its original offset specification.

Caution: Subjecting the magnetometer to fields in excess of 2 x the nominal range may cause inaccuracy in future measurements.

6.2 Environmental Precautions

Refer to brochure DS1854 for maximum environmental electrical and mechanical ratings.

Caution: Exceeding the maximum environmental ratings may cause irreparable damage to your sensor.

7. Troubleshooting

Your Mag613 is unlikely to suffer any defects in normal use and it is not user serviceable.

> **Note:** Attempting to open any part of the instrument, for any reason, will invalidate your warranty. If you are experiencing problems with your Mag613, which cannot be corrected by following the instructions in the table below, contact the Bartington Instruments Helpdesk.

The most likely causes of failure, and their solutions, are detailed in the following table:

Cause	Solution
Power supply	Check the power supply, as detailed in Section 5.3: Pre-installation Tests.
Cables	Check the power supply/data acquisition cable, as detailed in Section 5.3: Pre-installation Tests.
Power voltage drop	If no fault can be found in the power supply or cables, ensure the cable length is not too long, causing excessive voltage drop between the power supply and magnetometer. Refer to the specifications defined in brochure DS1854.
Damaged sensor	If any physical damage is apparent to the module and / or the casing then the sensor may need to be repaired or replaced. Return the unit to Bartington Instruments for repair and / or calibration. For information about disposal of a damaged unit, refer to Section 9: End of Life Disposal.
Inaccurate measurements after being subjected to high magnetic fields	Degauss the magnetometer to reverse the effect. Contact Bartington Instruments for advice if needed.
Damaged or malfunctioning sensor head	Sensor heads are independent. Failure of one will not affect the correct operation of the other sensor heads. However, if sensor head repair is required then return the whole instrument to Bartington Instruments for repair or replacement.

8. Care and Maintenance

No user repair or servicing is possible beyond the steps listed below and in Section 7: Troubleshooting.

Note: The Mag613 contains no user serviceable parts. Attempts to dismantle, modify or repair the magnetometer will invalidate the Warranty.

8.1 Cleaning

Caution: Avoid using chemicals, such as solvents, when cleaning the Mag613. Use a cloth wetted with soap and water to remove grime from enclosures.

8.2 Calibration

Periodic calibration of the Mag613 is not required. If a fault is suspected, the sensor should be returned to Bartington Instruments for inspection and repair or replacement.

8.3 Storage

Caution: Do not store the Mag613 in temperatures outside the range specified in brochure DS1854.

Caution: Avoid storing the Mag613 in areas with magnetic fields above the range of the magnetometer (refer to brochure DS1854).

Caution: Avoid storing the Mag613 with abrasives, corrosive chemicals or solvents.

8.4 Transport

The Mag613 system is a precision electronic instrument and should be treated as such.

Note: Bartington Instruments supplies its products in appropriate packaging for transporting. This packaging should be used for any future transport.

Note: Avoid bending cables through angles greater than the minimum bend radius as specified in brochure DS1854.

Note: Avoid excessive exposure to high temperatures, vibration or shocks.

9. End of Life Disposal

This product should not be disposed of in domestic or municipal waste. For information about disposing of this product safely, check local regulations for disposal of electrical / electronic products.

9.1 Waste Electrical and Electronic Equipment (WEEE) Regulations

This product complies fully with Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) and WEEE Regulations current at the time of printing.

10. Contacts

Details of how to contact Bartington Instruments Ltd. for aftersales support, technical queries, etc. can be found on the Bartington Instruments website at www.bartington.com.

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