



Operation Manual for Mag670 Single Axis Magnetic Field Sensor

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Table of Contents

How to use this Manual	3
Symbols Glossary	3
Waste Electrical and Electronic Equipment (WEEE) Regulations.....	3
Introduction to the Mag670.....	4
Installing the Mag670.....	5
Siting the Magnetometer (Environment Recommendations).....	5
Cable Recommendations.....	5
Pre-Installation Tests	6
Mounting Recommendations.....	7
Post Installation Testing	7
Using the Mag670	8
Magnetic Hysteresis	8
Environmental Precautions	8
Troubleshooting	9
Care and Maintenance	10
Cleaning Mag670 Magnetometers.....	10
Calibration	10
End of Life Disposal	10

How to use this Manual

This document describes the installation, operation and maintenance of Mag678 and Mag679 magnetic field sensors.

Take the time to get well acquainted with your purchase(s) by reading this manual. Knowing and understanding your sensors will ensure you experience the most reliable operation.

When service or maintenance is required, contact the Bartington Instruments helpdesk.

Technical specifications for this product can be found in the appropriate datasheets. Details can be found on the [Bartington website](#).

Visit the Bartington Instruments website regularly for more information about any changes to our product range, for software downloads, datasheets and for support details. You can access all the information you need about your specific sensor, including service information at <http://www.bartington.com/>.

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.



This symbol identifies items that must be disposed of safely to prevent unnecessary damage to the environment.

Note: A note provides useful supporting information and sometimes suggests how to make better use of your purchase.

Waste Electrical and Electronic Equipment (WEEE) Regulations



Both the Mag678 and Mag679 comply fully with Reduction of Hazardous Substances (RoHS) legislation current at the time of printing. However, electronic equipment should never be disposed of in normal waste. For information about disposing of your magnetometer safely refer to the section on [End of Life Disposal](#).

Introduction to the Mag670

The Mag670 is a single-axis variant of the Mag647 fluxgate and provide the same, highly linear magnetic response with low hysteresis. Each instrument consists of a single, feedback stabilised, fluxgate sensor arranged along the length of the enclosure, which is orientated to point away from the unit's connector.

Regulating the power supply internally ensures that the Mag670 is suitable for battery powered operation, over both long and short cables.

Installing the Mag670

Siting the Magnetometer (Environment Recommendations)

- The magnetometer should be sited several meters from any magnetic base rock to avoid compromising measurements
- Site the magnetometer several tens of meters from very large ferromagnetic object that could become magnetised and create fields exceeding 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

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.

Cable Recommendations

The standard magnetometer provides differential output lines for analogue signal transmission. The advantages of this differential arrangement are very high common-mode noise rejection and the suitability of readily available cable types. Each of the two anti-phase output lines has low output impedance at the signal source, damping the lines and preventing ringing. Cable inductance and capacitance considerations require the cable to be terminated with a differential amplifier having a circa 50k Ω input impedance. This arrangement will provide some damping to high frequencies but will attenuate the signals over the frequency range of the sensor.

Due to these effects:

- The cable pair loop resistance should not exceed 0.1 ohms per metre
- The pair loop inductance should not exceed 0.5 micro-Henry per metre
- The capacitance between should not exceed 52pF per metre
- The capacitance between conductors and shield should not exceed 120pF per metre

To optimise operational life of underwater cables and avoid physical damage to the joint during handling:

1. Use a water-blocked cable.
2. Reduce the risk of stress on the soldering by ensuring there is adequate slack in the wire between the cable and the wire terminations.
3. Brace the slack with epoxy resin before moulding the cable to the connector.
4. Fit additional protection in the form of a plastic hose, or sleeve, around the cable(s) at the emergence point.

Note: Cables are particularly prone to wear and damage at the point where they emerge at the surface of the ground, or sea.

Pre-Installation Tests

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



Caution: Take care to avoid bending, or otherwise damaging the contacts whilst conducting the tests.

1. Test the cables for continuity (using an electrical continuity tester or ohmmeter).
 - a. Test the cables end to end at the connectors to ensure the correct pins have been allocated to the conductors and there are no open, or high resistance circuits.

Note: Cable resistance will vary; refer to the appropriate datasheet for the expected values.

- b. Test the cables at the connectors to ensure there are no short circuits between the conductors.
2. Check the power supply output voltage using a voltmeter. Refer to the appropriate datasheet for the expected values.
3. Connect the magnetometer to the cable connector.
4. Connect the power supply to the other cable connector.
5. Switch on the power supply and wait until the magnetometer has stabilised. Refer to the appropriate datasheet for warm-up times.
6. Confirm no magnetic objects are moving in the vicinity.
7. For each of the three (X, Y and Z) axes in turn:
 - a. Connect a voltmeter to the axis sensor outputs, i.e. across +Z and -Z.
 - b. Whilst monitoring the voltmeter readings, align the magnetometer with the terrestrial field until the maximum voltage value is determined.
 - c. Confirm the measured reading approaches the local geomagnetic field value.

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.

Mounting Recommendations

Each magnetometer has a set of mounting holes to allow attachment to a stable base of fixture. Refer to the appropriate datasheet for further information as shown in the mechanical drawings.

Post Installation Testing

1. Site the magnetometer, and install the power supply and cabling.
2. Switch on the power supply and wait until the magnetometer has stabilised. Refer to the appropriate datasheet for warm-up times.
3. Confirm no magnetic objects are moving in the vicinity.
4. Monitor the sensor output.
5. Confirm that 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 the appropriate datasheet for the expected values.

Using the Mag670

Magnetic Hysteresis

The Mag670 is designed to have an extremely low magnetic hysteresis. However, Bartington Instruments recommends your magnetometer is not subjected 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. Degaussing the magnetometer can reverse such an effect.

Environmental Precautions

Refer to the datasheet for maximum environmental electrical and mechanical ratings.



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

Troubleshooting

Your magnetometer is unlikely to suffer any defects in normal use: no internal components are serviceable. 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 Pre-Installation Tests Check the power.
Cables	Check the cables as detailed in Pre-Installation Tests Test the cables.
Power Input	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 the datasheet
Magnetometer	No physical damage to the Mag670 magnetometers can be repaired. Replace with a new unit. For information about disposal of the damaged unit, refer to End of Life Disposal.

Care and Maintenance

No servicing is normally required. No repair is possible. For further details refer to the section on [Troubleshooting](#).

Cleaning Mag670 Magnetometers

Use water and mild soap to remove grime



Caution: To clean an unenclosed variant of the Mag670 use an air duster to blow out dust and debris if required. Use appropriate PPE, such as eye protection, when carrying out this task.



Caution: Avoid using chemicals, such as solvents, when cleaning the Mag670. Use a damp cloth to remove grime from enclosures.



Caution: Take particular care when cleaning around electrical connections. Bent or damaged pins may cause the magnetometer to malfunction. The pins **ONLY** may be gently cleaned using a soft material dipped in Isopropanol (IPA). Avoid any contact with the rest of the sensor as this is likely to cause damage. Refer to the manufacturer's Material Safety Data Sheet (MSDS) for information on using this chemical safely.

Calibration

Return the Mag670 to Bartington Instruments for calibration at the recommended intervals. Refer to the Calibration Certificate for further details.

End of Life Disposal



This symbol of the crossed-out wheeled bin indicates that the product (electrical and electronic equipment) should not be placed in municipal waste. Check local regulations for disposal of electronic products.

For details of when to dispose of your magnetometer refer to the section on [Troubleshooting](#).

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