

Operation Manual for
Mag678 and Mag679
Low Power Single Axis Magnetic Field Sensors



Bartington[®]
Instruments

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1. About this Manual

This manual describes the installation, operation and maintenance of the Mag678 and Mag679 magnetic field sensors. It should be read in conjunction with the product brochure [DS2617](#), together with the [outline drawings](#) which can be found on the product page of the Bartington Instruments website at: www.bartington.com.

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

2. Safe Use



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



Caution: To prevent irreparable damage, electrostatic discharge (ESD) protection and precautions must be used when handling the unpackaged sensor electronics board.

3. Introduction to the Mag678 & Mag679 Series

The Mag678 & Mag679 are respectively single-axis variants of the Mag648 & Mag649 fluxgates, 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.

Both the Mag678 and Mag679 are suitable for battery powered operation, over both long and short cables, as the power supply is regulated internally.

The Mag679 offers a wider bandwidth than the standard Mag678.

4. Installing the Mag678 or Mag679

4.1. Siting the Magnetometer (Environment Recommendations)

Note: To avoid compromising measurements, the magnetometer should be sited several metres from any ferromagnetic objects that may be subjected to the effects of magnetic hysteresis, including base rock. 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.

4.2. 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.

Note: 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.

Note: 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.

4.3. 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 product brochure 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 product brochure for the required values.



Caution: Ensure the polarity is correct. Incorrect polarity is likely to irreparably damage the sensor.

Note: Bartington Instruments recommends the use of a current-limited power supply.

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 product brochure for warm-up times.
6. Confirm no magnetic objects are moving in the vicinity.
7. Connect a voltmeter to the axis sensor outputs.
8. Whilst monitoring the voltmeter readings, align the magnetometer with the terrestrial field until the maximum voltage value is determined.
9. 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.

4.4. Mounting Recommendations

Each magnetometer has a set of mounting holes to allow attachment to a stable base of fixture. Refer to the outline drawings available on the product page.



Caution: For the Mag678S and Mag679S only – take care to avoid damage to the connector or magnetometer by correctly aligning the cable to the connector. When aligned correctly, hand tighten the connector. Refer to the product brochure for detailed information.

The sensor can also be mounted on the Bartington Instruments Mag-TA Tripod Adaptor. See product brochure DS3140, available from Bartington Instruments, for instructions.

4.5. 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 product brochure for warm-up times.
3. Confirm no magnetic objects are moving in the vicinity.
4. Monitor the sensor output.
5. Confirm that the value of the measured magnetic field is similar to the expected local earth field.

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

5. Using the Mag678 and Mag679

5.1. Magnetic Hysteresis

Both the Mag678 and Mag679 are 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.

5.2. Environmental Precautions

Refer to the product brochure for maximum environmental electrical and mechanical ratings.



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

6. Troubleshooting

The sensor 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.

In the event of any apparent malfunction beyond those described in the table below, please email service@bartington.com, or telephone the Bartington Instruments service team on +44 (0)1993 706565.

Causes of failure	Solution
Power supply	Check the power supply as detailed in Pre-Installation Tests .
Cables	Check the cables as detailed in Pre-Installation Tests . In some cases damaged connectors can be replaced. Contact the Bartington Instruments helpdesk for further advice.
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 product brochure.
Physical damage to magnetometer (packaged)	Physical damage, or damage to the electronics of packaged Mag678 or Mag679 magnetometers is irreparable. Replace with a new unit. For information about disposal of the damaged unit, see End of Life Disposal .

Physical damage to magnetometer (unpacked)	Physical damage, or damage to the electronics of unpackaged Mag678 and Mag679 magnetometers can sometimes be repaired. Contact the Bartington Instruments helpdesk for further advice. If repair is not advised, replace with a new unit. For information about disposal of the damaged unit, refer to End of Life Disposal .
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7. Care and Maintenance

Unpackaged versions of the Mag678-MX and Mag679-MX magnetometers and damaged end connectors may be repairable; no other repair or servicing is possible. For further details refer to the section on [Troubleshooting](#).

7.1. Cleaning Mag678 and Mag679 Magnetometers

Use water and mild soap to remove grime only on packaged versions of the magnetometers.



Caution: Never use chemicals, such as solvents, when cleaning a Mag678 or Mag679.



Caution: Take particular care when cleaning around electrical connections. Bent or damaged pins may cause the magnetometer to malfunction.

7.2. Calibration

Return the Mag678 or Mag679 to Bartington Instruments for calibration at the recommended intervals. Refer to the Calibration Certificate for further details.

8. Storage & Transport

Your sensor is a precision electronic instrument and should be treated as such.



Caution: Avoid exposing this instrument to shocks or continuous vibration.



Caution: Store only within the temperature range specified in the product brochure.



Caution: Do not expose this instrument to strong magnetic fields while being stored.

9. End of Life Disposal

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

9.1. Waste Electrical and Electronic Equipment (WEEE) Regulations



This product (electrical and electronic equipment) should not be placed in municipal waste. Check local regulations for disposal of electronic products.



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