

Operation Manual for Mag612 and Mag612U Three-Axis Magnetic Field Probe

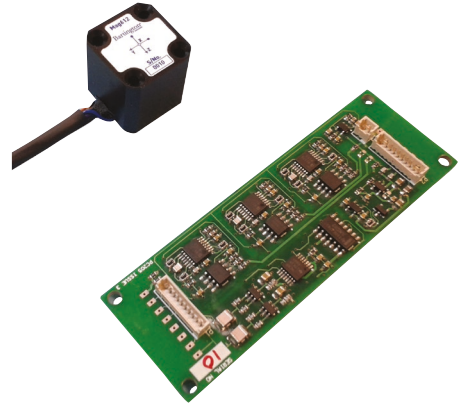


Table of Contents

1. About this Manual	3
1.1. Symbols Glossary	3
2. Safe Use	3
3. Introduction	4
4. General Description	4
4.1. Mag612 Sensor Head	4
4.2. Mag612U Electronics	5
4.3. Excitation synchronisation	5
5. Compatibility	5
6. Connections	6
6.1. Probe and Electronics wiring	6
6.2. Connection to Power Supply/Acquisition Unit	6
7. Probe Location and Mounting Recommendations	6
8. Cable Recommendations	7
9. Mag612 Operation	8
10. Electromagnetic Compatibility	8
11. Troubleshooting	8
12. Care and Maintenance	10
13. End of Life Disposal	10

1. About this Manual

This manual provides the information necessary to help customers connect, install and operate, the Mag612 Fluxgate Probe and Mag612U Miniature Three-Axis Fluxgate magnetometer.

Photographs of key components are included, labelled with numbers. A number in the text in square brackets [] refers to that label.

Technical specifications of the products, including power supply requirements and analogue output details, can be found in [DS3939](#), whilst outline drawings of both sensor head, electronics board and cable can be found on [product outline drawing page](#).

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.



Indicates a situation in which ESD protection should be used.



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

Note: A paragraph in this format provides useful supporting information on 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.



WARNING: Environmental and electrical specifications should not be exceeded.



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

Note: Do not expose to strong magnetic fields while being stored as this can magnetise the sensor and affect its offset performance.

3. Introduction

The Mag612 is a three-axis fluxgate probe with a separate electronics board. The probe is for use together with electronics to provide measurements of static and alternating magnetic fields in three orthogonal axes.

In addition to its compact sensor head and two-part construction, the Mag612 offers the possibility to synchronize the fluxgate's excitation clock. This feature is particularly useful when multiple sensor heads are to be placed in close proximity as it prevents detrimental interference, using the reference clock from a master sensor and sending that signal to other sensors in the chain.

The sensor can be provided with its dedicated electronics (Mag612U - see [Mag612 Electronics Board](#)) or be supplied as a probe only (Mag612), in which case a suitable magnetic field sensor circuit schematics and design note is available, at additional cost, from Bartington Instruments. If using the Mag612 probe with the RTUDE or RTPDE (Mag612E or Mag612P version), please refer to OM3222 for connection of the probe to the electronics which can be found on [Mag612U Operation Manuals](#) webpage.

Contact the Bartington Instruments sales team for more information on sales@bartington.com.

4. General Description

4.1. Mag612 Sensor Head

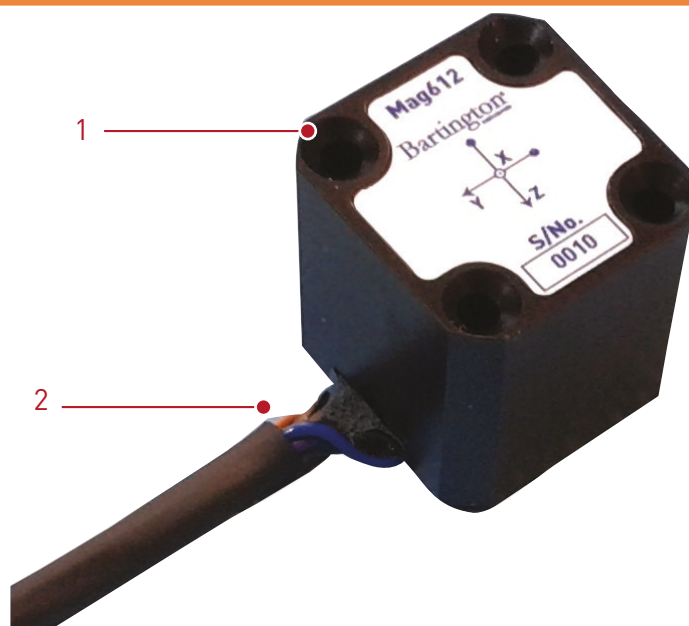


Figure 1. Mag612 Sensor Head

Key:

1. Mounting Holes

2. Mag612 cable

4.2. Mag612U Electronics

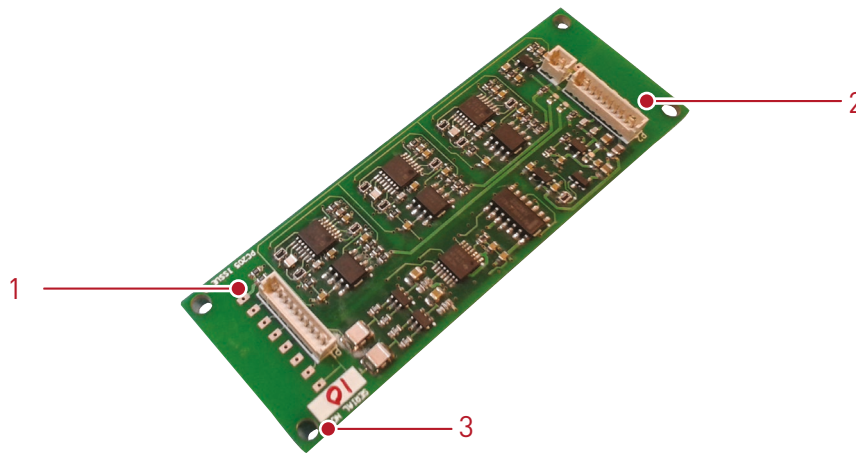


Figure 2. Mag612 Drive Electronics

Key:

1. PCB connector P1/solder pads for connection to Mag612 probe
2. PCB connector P2/solder pads for sensor's analogue output (refer to DR3434 for pin-out information)
3. Mounting Holes

4.3. Excitation synchronisation

The Mag612 provides the ability to synchronise multiple sensors to a master sensor's excitation clock. Two pins are provided on connector P2 (CLOCK_IN and CLOCK_OUT - see DR3434). The master sensor's CLOCK_OUT pin should be connected to the CLOCK_IN of the second sensor in the chain. Subsequent sensors are then daisy chained as illustrated in Figure 3.

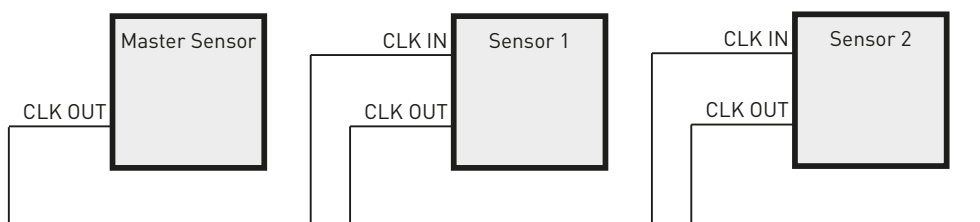


Figure 3. Mag612 Sensor Daisy Chain

5. Compatibility

The Mag612 is compatible with the range of Bartington power supplies and acquisition units. The complete [compatibility table](#) can be found on our website

6. Connections

6.1. Probe and Electronics wiring

First connect the sensor head to its electronics where applicable. When supplied as Mag612U (Probe + Electronics) the serial number of the electronics will be identical to that of the probe. These should be matched. Using unmatched probe and electronics will lead to deterioration in performances including orthogonality and scaling error.

Connection of the sensor head to the electronics can be done via the connectors supplied on the Mag612 cable and the connector P1 on the electronics or in soldering the Mag612 cable directly to the pads located near connector P1 (see DR3752).

Note: When wiring the probe, ensure you correctly identify Pin 1 of the connectors, shown on drawing DR3752.

6.2. Connection to Power Supply/Acquisition Unit



Caution: When providing your own power supply, do not exceed the voltage rating, provide sufficient current, and ensure correct polarity is respected see DS3939.



Caution: Connect the Mag612 electronics board before the supply is energized, as this prevents high surge currents which could cause damage.

Note: Apply the positive and negative supplies simultaneously, and avoid leaving the electronics board connected to one polarity only.

The analogue output of the sensors as well as the power supply are available on connector P2 on the electronics board. Alternatively these are also available on a set of pads near P2. Refer to the outline drawing DR3752.

Where no Bartington power supply or acquisition unit is used, some basic recommendation for integration of the sensor are available in [AN0042](#).

7. Probe Location and Mounting Recommendations

The probe should be located away from large sources of magnetic fields that may over-range the sensor or interfere with the field being measured. The probe should not be mounted on an electrically conductive surface, as this may trigger some apparent offsets.

The probe has four fixing holes, for screw attachment to a stable base or fixture. The wires extending from the rear of the probe should not be bent excessively. To allow for this, the mounting arrangement should include space for the wires to extend straight from the probe.

For details of the mounting arrangements for the probe refer to drawing DR3752.

Note: The use of magnetic materials in the mounting arrangement must be avoided. All mounting components should be checked before installation, by introducing the component within the immediate vicinity of the sensing elements of a working magnetic field sensor, and observing any variation in the background field. Use of magnetic material may generate some additional offsets.

The analogue output is positive for conventional flux direction, South to North, in the direction of the arrow shown on DR3434 for each axis; i.e. the maximum positive output will be obtained from any axis when the arrow points towards magnetic north along the total field vector.

8. *Cable Recommendations*

The Mag612 electronics board provides unbalanced output lines for analogue signal transmission. Suitable shielded cables can be supplied.

Cables are particularly prone to wear and damage if twisted, flexed beyond their design limits, or subjected to excessive or repeated movement. All cables should be mounted securely in place.

When designing their own cable, the following recommendation should be followed:

- ensure that the cables are shielded to prevent them picking up electromagnetic interference.
- the connecting cable to the electronics board output connector should have at least 7 cores - see DR4299.
- the cable shield should be connected to power supply ground at the power supply end (either through the connector body, or by connecting the shield to the power ground wire).
- shielding of the wires connecting the sensor head to the electronics is strongly recommended.

9. *Mag612 Operation*

Once the electronics is fully connected to both sensor head and power supply/acquisition unit, the supply can be switched on. The sensor will provide an analogue output which is proportional to the field measured. Please refer to DS3939 for the sensor's scaling factor.

Testing of the sensor's response can be done, as an example, by moving the sensor in the Earth's field and ensuring that the signal vary in relation to their orientation. In the horizontal plane, a minimum value is obtained when the axis is in the magnetic East-West direction, and maximum when pointing Magnetic North.

10. *Electromagnetic Compatibility*

Note: The Mag612 probe and electronics board are not shielded for immunity from, or emission of, electromagnetic fields.

Note: The Mag612 is intended for integration into other systems. Ensure these meet the appropriate level of shielding.

11. *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.

Problem	Cause	Solution
There are no analogue outputs present in X, Y or Z	Sensor head not connected	Ensure that the sensor head and electronics are connected as per Probe and Electronics wiring .
	Power supply not connected or not sufficient to power the sensor	Check that the power supply meets the requirement provided in DS3939 and that the connection is as per Connection to Power Supply/Acquisition Unit .
	Broken coil	If only one or two axes is (are) not responding, one of the fluxgate coil can be damaged. Please return the unit to us for assessment.
	Component damage	If only one or two axes is (are) not responding, one component can be damaged. Please return the unit to us for assessment.
There is an abnormal current draw on the sensor	Faulty component	A faulty component can lead to an abnormal current draw before it fails. Please return the unit to us for assessment.
The amplitude of the Earth's field is abnormal	Erroneous scaling factor	If the scaling factor applied to convert volts into field amplitude is erroneous, the field reading will appear either systematically high or low depending on the error on the scaling factor. Please check the conversion rate used in the acquisition software.
The noise on the output is much higher than the specified noise at low frequency	Ambient environment is noisy	A noisy environment will be picked up by the sensor. Noise tests should be carried out in a shielded environment.
	Sensor breakthrough not filtered properly	The sensor has a high frequency noise component referred to as breakthrough in the datasheet. This signal at the excitation frequency of the sensor, if unfiltered can be aliased creating an apparent low frequency noise. Check that a suitable low pass filter is used or that the signal is sampled at a suitable frequency (at least twice the breakthrough frequency).

12. Care and Maintenance



Surface dirt contamination on the Mag612 probe should be removed using a mild detergent solution only. Electronics should be cleaned with an antistatic cloth only. ESD protection should be used when handling the Mag612 electronics board, to prevent irreparable damage.



The Mag612 electronics board should be treated subject to ESD precautions.

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

Note: Do not expose to strong magnetic fields while being stored as this can magnetise the sensor and affect its offset performance.

13. End of Life Disposal



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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