

Mag658

Digital Three-Axis Magnetometer

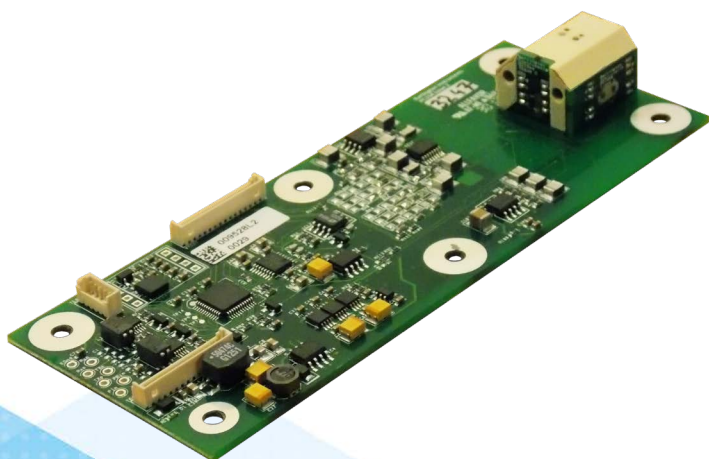


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1. About this Manual

This document describes the installation, operation and maintenance of the Mag658 Digital Three-Axis Magnetometer. It should be read in conjunction with product brochure [DS2841](#) and outline drawing [DR2841](#), which can be found on the product page on the Bartington Instruments website at www.bartington.com.

1.1. Symbols Glossary



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 paragraph in this format provides useful supporting information on how to make best 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.

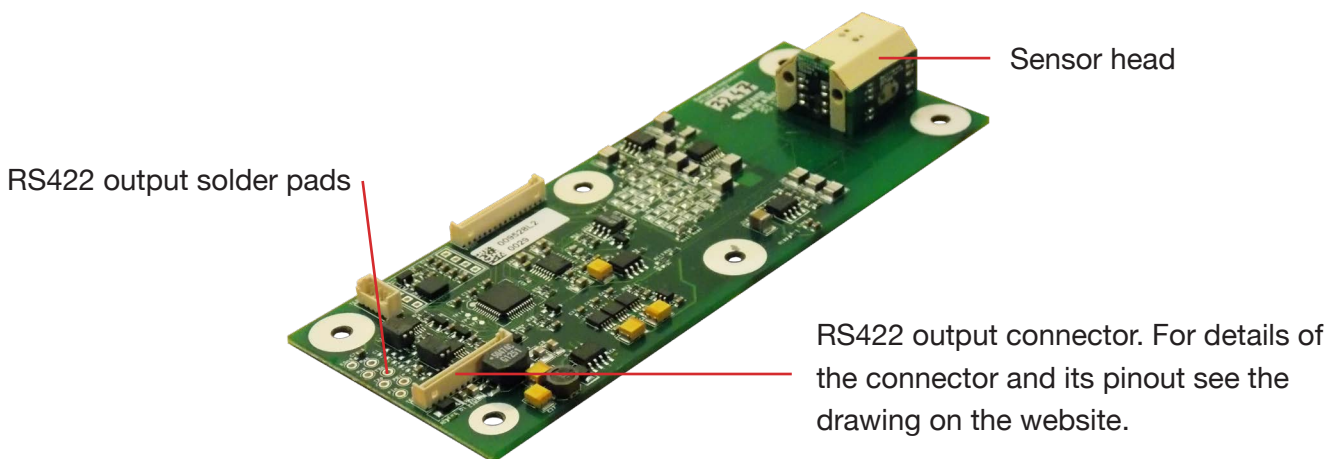
3. Introduction to the Mag658

The Mag658 includes a cluster of three feedback-stabilised fluxgate sensors arranged along the X, Y and Z axes, with a three-axis accelerometer that provides position and orientation information along the same axes. Data is transmitted from the sensor and controlled through a full-duplex RS422 data link.

The sensor is unpackaged and ideal for integration into customer specific systems. Its reliability also means it is ideal for permanent installations.

It is intended that you develop your own software for use with the Mag658. To help you with this, example software by Bartington Instruments is provided with the sensor.

3.1. Overview of the Mag658



The three orthogonal elements are positioned following the right-hand rule. See the axis positions on the outline drawing.

The Mag658 should be connected to power, and to a suitable unit to collect the output data. The output data connection may be made via the solder pads or the RS422 connector provided on the sensor's electronics. Ensure you connect to the correct connector; do not use the second connector on the electronics, which is used for testing. Also ensure that the ground is connected correctly.

For details about RS422 connections refer to **Appendix A. Connections**. Contact Bartington Instruments for information about the RS422 interface and associated data protocol.

To collect the data onto a computer, we recommend using commercially available RS422 converters. Bartington Instruments uses RS422 to USB converters from Brainboxes for testing.

4. Connecting Power



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



Caution: Connect the Mag658 electronics board before the power supply is switched on, 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.

5. Installing the Mag658

5.1. Siting the Magnetometer (Environment Recommendations)

Note: Site the magnetometer several metres from any magnetic base rock to avoid compromising measurements.

Note: Site the magnetometer several tens of metres from very large ferromagnetic objects that could become magnetised and create fields exceeding the measuring range of the sensor.

Note: 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.

A magnetic evaluation of any proposed installation site should be conducted to establish that it is free from the magnetic contaminants described above. The evaluation should be carried out using total field or resonance magnetometers.

6. Initial Testing

We recommend using Bartington Instruments' software and commercial RS422 to USB converters.

1. Connect the Mag658 to a switched off power supply.
2. Connect the Mag658 output to a computer running the acquisition software, by using an RS422 to USB converter.
3. Switch on the power supply and wait until the sensor has stabilized. Refer to the technical specification in the brochure for the warm-up time.
4. Confirm that no magnetic objects are moving in the vicinity.
5. Follow the software instructions to connect to the sensor.
6. Monitor the sensor's output.
7. Move the sensor to provoke a magnetic and accelerometer change.

7. Probe Location and Mounting Recommendations

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

The probe has six fixing holes for attachment to a stable base or fixture. For details of the mounting arrangements for the probe refer to drawing DR2841, available from Bartington Instruments.

Note: Avoid use of magnetic materials in the mounting arrangement. All mounting components should be checked before installation. To do this, introduce the component within the immediate vicinity of the sensing elements of a working magnetic field sensor, and observe any variation in the background field. Use of magnetic material may generate additional offsets.

The analogue output is positive for conventional flux direction, south to north, in the direction of the arrow shown on DR2841 for each axis. The maximum positive output will be obtained from any axis when the arrow points towards magnetic north along the total field vector.

8. Using the Mag658

8.1. Software Installation

1. The software zip file package includes an installer. Navigate to the root folder of the zip file, and then double-click the installer executable file.
2. At the prompt, specify a location to install the software.
3. If the the x86 Visual C++ Library is not already installed on the computer, double-click the x86 Visual C++ Library installer, and then follow the on-screen prompts.

Note: A virtual com port (USB to RS422) is also required for communication with the Mag658

8.2. Main Window

Before starting the software, make sure that the Mag658 has power and is connected to the computer.

On starting the software, the main window will appear, as shown in Figure 1.

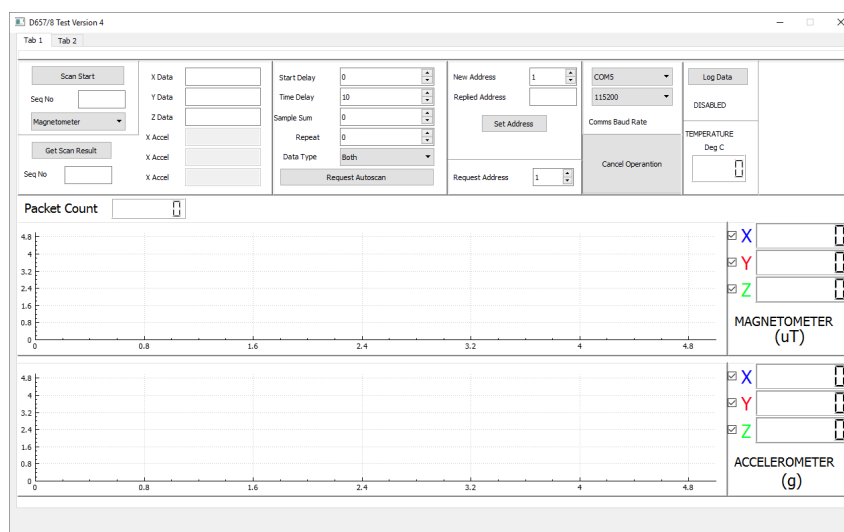


Figure 1: Main Window

Select the serial port used by the Mag658 in the **Comms Baud Rate** panel. Determine the correct port by using Windows Device Manager. The default Baud rate is 115200.

Select the sensor address in the Request Address field.

SENSOR DETAILS	
Device Type:	D657_8
Firmware Ver:	4
Protocol Ver:	7
Serial Number:	f6-eb-af-53-30-32-30-0 13-43-42-59-f5-f5-1c-26

Request Sensor Details

Request Serial Number

New Address

Replied Address

Set Address

Request Address

Figure 3: Setting the Sensor Address

The sensor address may also be changed. To do this the software needs to know the sensor serial number. In Tab 2 select Request Serial Number. The serial number will appear in the field above.

Return to Tab 1, set the new address by entering it in the New Address field, and then click Set Address. Check that the Replied Address matches the current sensor address.

8.3. Axis Orientation

The axis orientation may be set in Tab 2. Two modes may be used, depending on the orientation of the axes of the sensor being used, as shown in Figure 4.

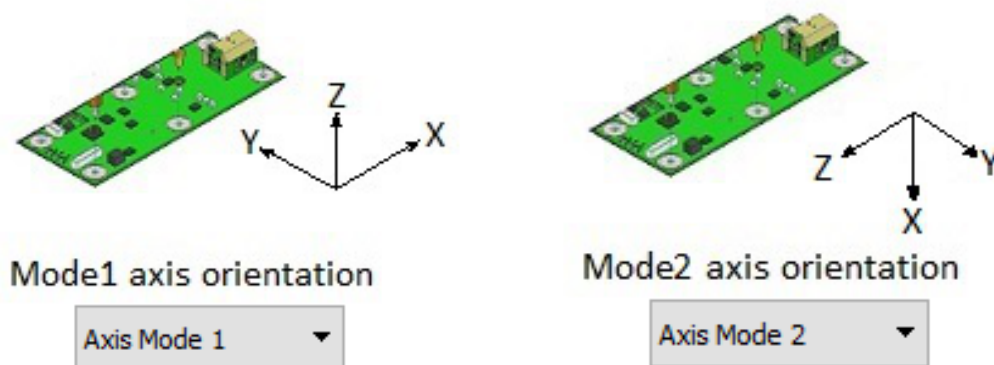


Figure 4: Setting Axis Orientation

8.4. Single Scan

Click Scan Start at the top left to take a single measurement, as shown in Figure 5.

Figure 5: Single Scan

Scan Start stores the current measurement under the Sequence Number specified in the Seq No field box. It will store either the current magnetic reading, or the accelerometer reading, depending on which one has been selected.

The results may be retrieved and displayed in the fields on the right by entering the sequence number in the second Seq No field box below, and then clicking Get Scan Result.

8.5. Multiple Point Scan

Multiple readings may be carried out and displayed on graphs at the bottom of the main window, using the Request Autoscan function.

Figure 6: Multiple Point Scan

Enter the scan settings in the relevant fields, as shown in Figure 6.

Start Delay is the delay before the scan begins. It may be set between 10 and 3600000 ms.

Time Delay is the delay between each reading. It may be set between 10 and 3600000 ms.

Average is the averaging value. It may be set between 1 and 256. The sensor takes a number of readings equal to the average, and returns their mean value. Larger averaging increases measurement time.

Repeat is the number of measurements to be taken.

Data Type specifies whether to display data from the magnetometer, accelerometer, or both.

Request Autoscan starts the scan.

Cancel Operation stops the scan.

Measurements are displayed on graphs in the main window during the scan. The number of measurements remaining is equivalent to the Packet Count displayed at the top left. The current measurement in each axis is displayed on the right, and the current temperature is displayed in the top right. X is shown in blue, Y in red, and Z in green. The graphs cannot be edited.

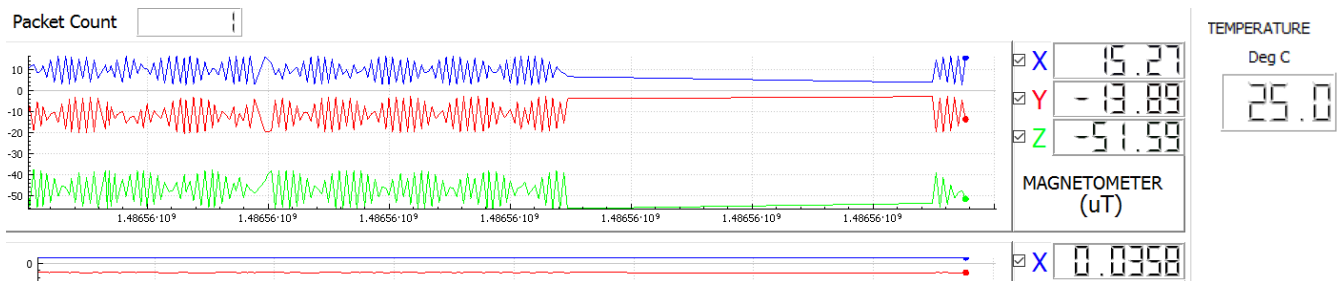


Figure 8: Graphical Displays

The top graph displays readings from the magnetometer. The bottom graph displays readings from the inbuilt accelerometer.

8.6. Logging Data

Data may be logged and saved in a .csv file. To do this, click the Log Data toggle button at the top right. Data will not be displayed in the graphs when logging is enabled.

When logging is enabled, data will be logged to the local User\Documents folder as D657_8_LogFile.csv. The file will be overwritten on successive scans, so if the data needs to be retained, make a copy of the file elsewhere, or rename the file, before beginning a new scan.

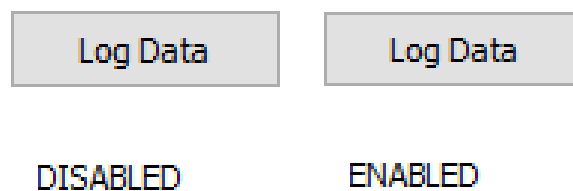


Figure 9: Log data

8.7. Second Window (Tab 2)

Use the second tab to set the axis mode, request sensor details, activate the test coil, and update the firmware of the sensor.

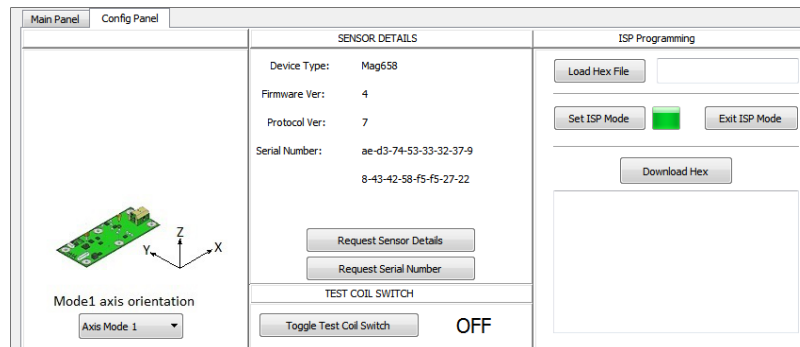


Figure 10: Second Window

8.8. Sensor Details

Click **Request Sensor Details** to display the **Device Type**, **Firmware Version**, and **Protocol Version** of the sensor.

Click **Request Serial Number** to display the **Serial Number**. This is necessary if the sensor address or firmware need to be changed.

SENSOR DETAILS	
Device Type:	D657_8
Firmware Ver:	4
Protocol Ver:	7
Serial Number:	f6-eb-af-53-30-32-30-0 13-43-42-59-f5-f5-1c-26

Figure 11: Sensor Details

8.9. Test Coil

Click **Toggle Test Coil Switch** to switch the sensor's inbuilt test coil on or off.

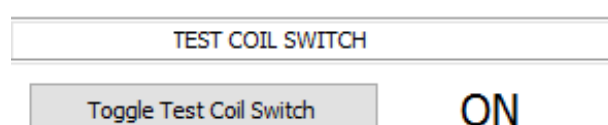


Figure 12: Test Coil Switch

8.10. ISP Programming

Note: Before ISP performing programming, Flash Magic software must be installed, and the path to FM.exe must be included in the Windows path environment variable. (System -> Advanced System Settings -> Advanced -> Environmental Variables -> "Path" System Variable)

This may be used to update or change the firmware on the sensor. Before doing this, you must request the sensor information and serial number.

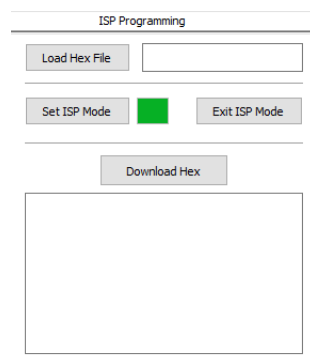


Figure 13: ISP Programming

To load the hex file to be sent to the sensor, click **Load Hex File**, and then select the file to load.

Set the sensor to ISP mode. To do this, click **Set ISP Mode**. The green box will flash after a few seconds, indicating that a Set IPS Mode command has been sent.

Click **Download Hex** to download the hex file to the sensor. Allow up to 10 seconds for the download to complete.

When ISP download has completed, the text box will appear, as shown in the Figure 14.

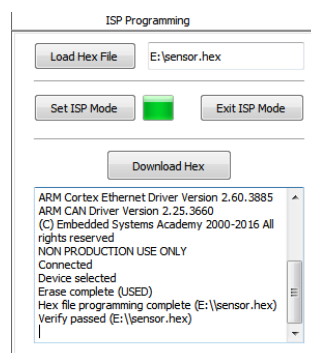


Figure 14: Loading a Hex File

Click **Exit ISP Mode** to return the sensor to its standard mode.

9. Electromagnetic Compatibility

Note: The Mag658 probe and electronics board are not shielded for immunity from, or emission of, electromagnetic fields.

Note: The Mag658 is intended for integration into other systems. Ensure these meet the appropriate level of shielding.

10. Troubleshooting

If the sensor fails to respond, try restarting the software. Refer to the Mag658 Data Protocol document for further details.

If the fault is persistent, return the sensor to Bartington Instruments for servicing. To discuss solutions and repair procedures, email: service@bartington.com or telephone the Bartington Instruments service team on +44 (0)1993 706565.

10.1. Care and Maintenance



Surface dirt contamination on the Mag658 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 Mag658 electronics board, to prevent irreparable damage.



The Mag658 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.

11. 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.

11.1. Waste Electrical and Electronic Equipment (WEEE) Regulations



The Mag658 is exempt from RoHS (Reduction of Hazardous Substances) and WEEE legislation current at the time of printing as it is made specifically for defence use and is assembled with tin-lead solder. However, electronic equipment should never be disposed of in normal waste. For information about disposing of your magnetometer safely, consult your local civic authority.

12. Legal Notices

12.1 Copyright

The copyright in this document is the property of Bartington Instruments Limited.

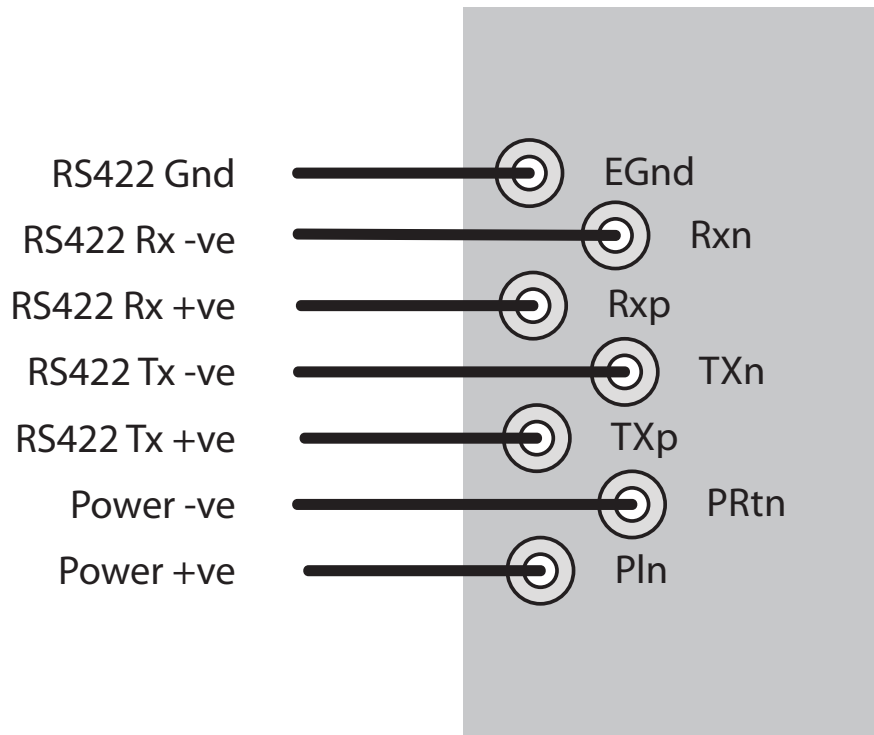
12.2. Trademarks

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Bartington is used under licence by Bartington Instruments Limited.

Appendix A. Connections

The connections for the Mag658 are shown below.



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The specifications of the products described in this brochure are subject to change without prior notice.

Bartington Instruments Ltd
5, 8, 10, 11 & 12 Thorney Leys Business Park
Witney, Oxford OX28 4GE. England

Telephone: +44 (0)1993 706565

Email: sales@bartington.com

