Operation Manual for

Magmeter-2 Power Supply and Display Unit

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Bartington® Instruments

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1. About this Manual

This manual provides the information necessary to help customers install and operate the Magmeter-2.

This manual should also be read in conjunction with the product brochure DS2520 and the unit's outline drawing DS3694 can also be found on the products page.

The Magmeter-2 is compatible with a wide range of Bartington Instruments' magnetometers. The datasheet and operation of the sensor(s) used should also be read.

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

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

2. Safe Use

WARNING: The Magmeter-2 is fitted with AA size NiMH (Nickel Metal Hydride) rechargeable batteries. Only AA size rechargeable batteries, which are specified as compatible in the relevant product brochure, can be used in this product.

WARNING: The fitting of non-approved battery cells may be dangerous. It could affect the safety of users, damage the equipment and also invalidate the terms and conditions of the Warranty.

WARNING: The Magmeter-2 can also be powered by mains electricity and contains uninsulated parts. Ensure that the unit is properly earthed at all times. Only properly trained personnel should open the unit.

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

Note: When operating the Magmeter-2 with the mains charger connected to the unit, it is necessary to add an inductor over the magnetometer cable to, ensure compliance with BS EN 55011.

A range of inductors suitable for all cable sizes is available from Bartington Instruments. The inductor should be positioned as close to the Magmeter-2 end of the cable as possible.

3. *Introduction to the Magmeter-2*

The Magmeter-2 provides a battery backed power supply of ±12V for most of Bartington Instruments range of single and three-axis fluxgate sensors. It incorporates three LCDs displaying the real-time DC field or AC field as an RMS value being measured by the connected sensor.

It also contains filters for the analogue outputs of the sensor. The analogue output are also available on the back panel of the Magmeter-2 on three BNC connectors for connection to a digital voltmeter or acquisition unit.

See product brochure DS2520 for the precise resolutions of the unit.

4. Magmeter-2 Features

4.1. Magmeter-2 Front Panel

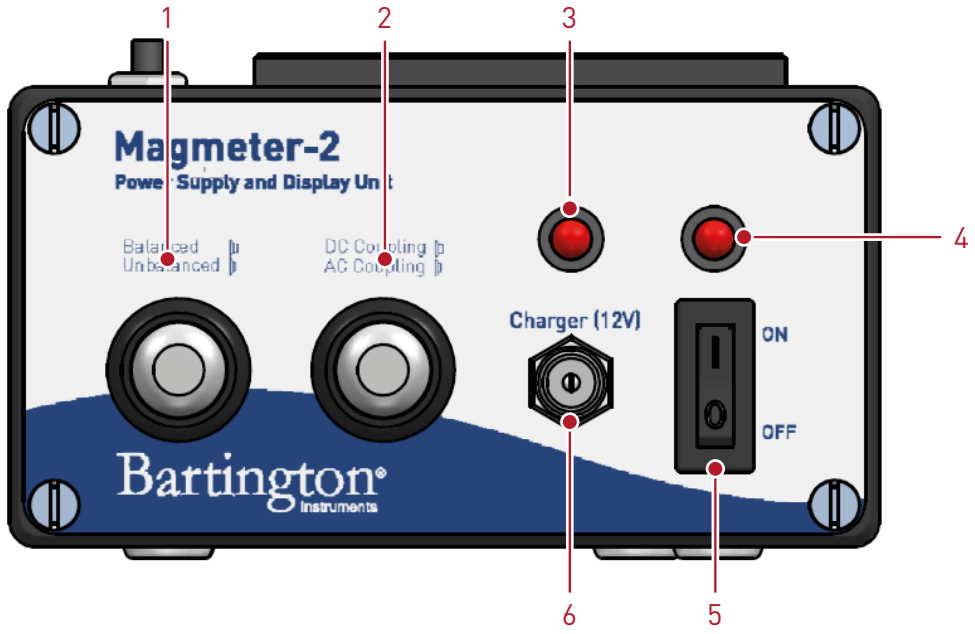


Figure 1. Magmeter-2 Front Panel

1. Magnetometer Output Type Selector Switch
   - Balanced (button out)
   - Unbalanced (button pressed in)

Caution: This switch must be set to match your magnetometer output type to ensure correct results. See the Product Compatibility Charts page on the website.

2. DC/AC Coupling (High Pass Filter (HPF) Control)
   - DC (button out)
   - AC (button pressed in)
3. Charge LED
4. On/Off LED
5. On/Off Switch
6. Socket for external charging adaptor

4.2. *Magmeter-2 Back Panel*

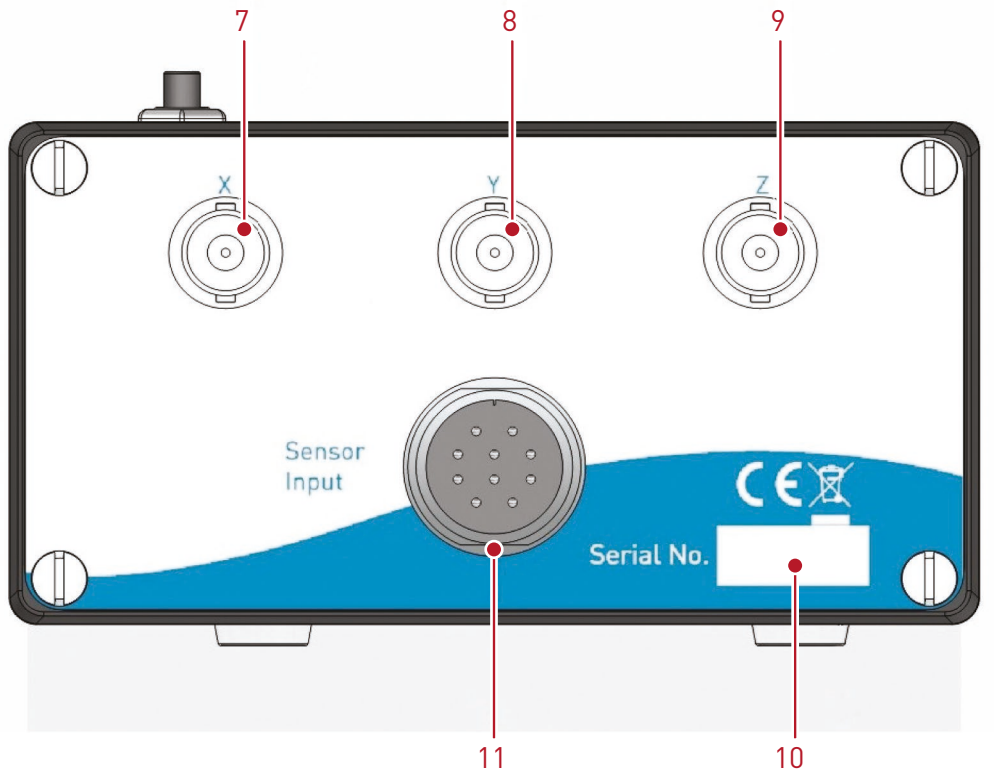


Figure 2. Magmeter-2 Back Panel

7. X Signal Conditioned Output (BNC connector)
8. Y Signal Conditioned Output (BNC connector)
9. Z Signal Conditioned Output (BNC connector)

The three BNC connectors carry the conditioned analogue output voltages. The conditioned outputs are the magnetometer X,Y and Z signals after they have been modified by the low/high-pass filters.

10. Space for unique serial number
11. Magnetometer socket for the connection of the magnetometer cable

Note: Ensure correct orientation of the connector (indicated by the cut-out on the connector body aligning with the notch in the socket).

4.3. *Magmeter-2 Top Panel*

Figure 3. Magmeter-2 Top Panel

12. X Signal Value Display
13. Y Signal Value Display
14. Z Signal Value Display

Note: The displays output the RMS value of the analogue output voltages if in AC mode. If the device is in DC mode, output is given in DC voltage.

15. Scaling Selection Switch

Caution: This switch must be set to the scaling corresponding to your magnetometer output type to ensure correct results. Refer to the magnetometer datasheet.

16. Backlight

Note: The button must be pressed and held to enable screen illumination.

Caution: Prolonged use of the backlight will increase rate of battery discharge.

Note: Ensure correct orientation of the connector (indicated by the cut-out on the connector body aligning with the notch in the socket).

5. Compatibility

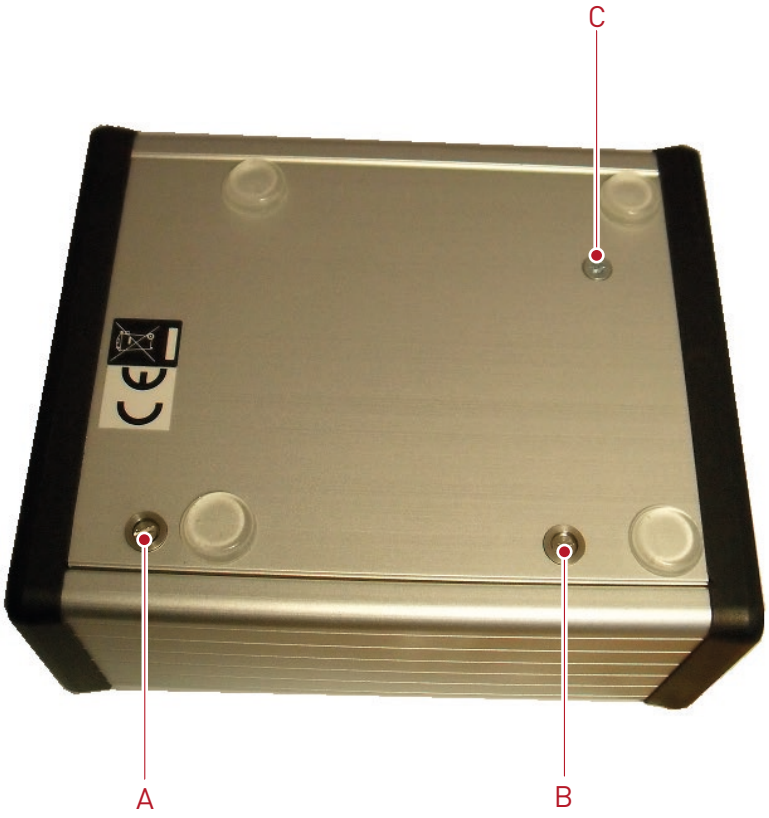
The Magmeter-2 can operate with the majority of Bartington Instruments single and three-axis fluxgate magnetometers. The complete list of compatible sensors is available here.

Please note that where the sensors are unpackaged, suitable cables for connection to the Magmeter-2 may not be available. Please contact sales@bartington.com for further details.

6. Magmeter-2 Operation

6.1. Installing and Replacing the Internal Batteries

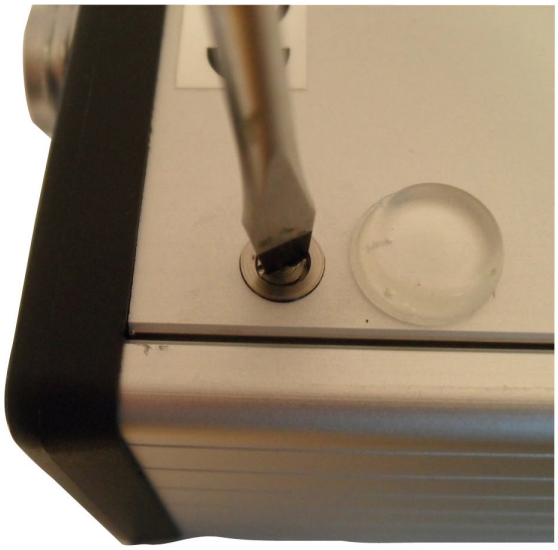
To install the battery cells, or to remove discharged or defective cells, use the following procedure:



Key:
A – Enclosure lid retaining screw B – Enclosure lid retaining screw
C – Earth lead fixing (do not remove)

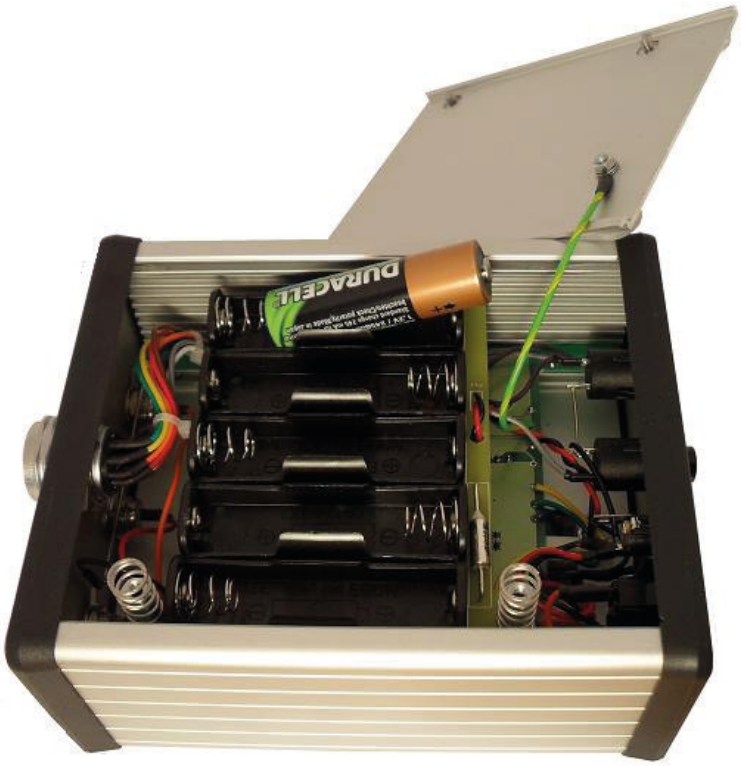
Place the Magmeter-2 on a suitable surface with the underside facing up and the two enclosure lid retaining screws nearest to you.

Using a flat-bladed screwdriver of the appropriate size, fully loosen screw A to allow the edge of the lid to clear the enclosure end cap.



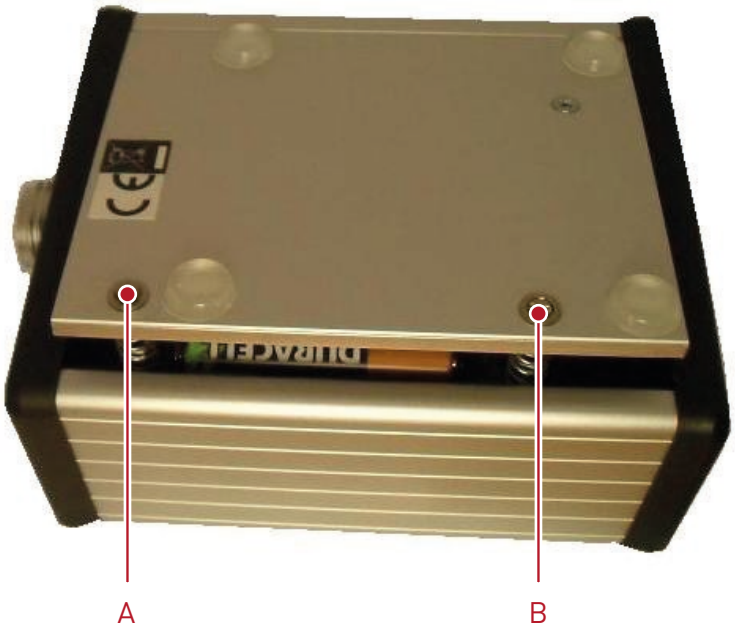
Fully loosen screw B and the lid of the enclosure will lift due to the internal springs.

Lift the lid and place aside to gain access to the battery cell compartment.



Insert each cell into the compartment in turn.

When all 5 cells are in place, locate the back edge of the lid in the enclosure.



Tighten screws A and B in any order.

6.2. *Initial Charging of the Battery Cells*

To charge the Magmeter-2 batteries, connect the mains charger and switch on the mains supply (if appropriate). The charging LED [3] will begin to flash indicating that "fast charging" is taking place. Once the fast charge cycle has completed, the LED will stop flashing and be lit (ON) continuously, to indicate that "trickle charging" is continuing.

Note: When battery cells are inserted for the first time, they should be continuously charged for 16 hours to ensure full capacity.

Note: The Magmeter-2 can be used whilst charging the battery cells or used directly from mains power without any battery cells being installed. However, the outputs may carry some charger noise.

Note: If the Magmeter-2 is powered by the mains charger with no battery cells installed, the charging LED may flash. This is normal and can be ignored.

Note: The charging LED will switch off when the batteries are fully charged.

Note: To prepare for long periods away from a charging source, battery cells may be pre-charged and used to replace discharged cells in the field.

Note: If the battery voltage falls below 5V a warning buzzer will sound when the Magmeter-2 is switched on.

Note: Battery capacity will decrease over time, depending on age and use.

Caution: The operating temperature range is altered during battery charging.

6.3. Location of the Equipment

6.3.1. Potentially Hazardous Locations

WARNING: The charger supplied with this equipment is powered by mains electricity. Do not use in wet or damp locations, where water may enter the unit and create a safety hazard.

6.3.2. Temperature

To minimise temperature induced drift effects, position the Magmeter-2:

- in a constant ambient temperature
- out of direct sunlight.

6.3.3. Proximity to Other Equipment

The Magmeter-2 contains no high frequency electronics likely to cause emissions which could create interference with other equipment. The unit is unlikely to be affected by interference from other equipment in the normal operating environment.

Note: The Magmeter-2 is built with ferromagnetic materials and should therefore be kept at least 1 metre away from any magnetometers.

Caution: The Magmeter-2 should not be located in an environment with high radio frequency noise as this would interfere with BNC connection to a DVM or Acquisition unit.

6.4. Connecting the Equipment

Caution: Do not connect or break the connection between the magnetometer and the Magmeter-2 with the Magmeter-2 switched on, as this could cause damage to the magnetometer.

Connect the equipment in the following sequence:

1. Ensure the ON/OFF switch (item 5 above) is OFF (position "0").
2. Connect the magnetometer to the Magmeter-2 magnetometer socket [11]. Ensure the connector pins are correctly aligned with those in the socket. The locking ring should be hand-tightened only.
3. Connect BNC outputs to your external equipment, as required.

Note: When connected to the mains, the Magmeter-2 will operate without any battery cells being installed.

6.5. Using the Magmeter-2

6.5.1. Switching On and Off

Caution: Connect the magnetometer before switching on the Magmeter, as connecting a "live" cable to the magnetometer may cause damage. Similarly, switch off the Magmeter-2 before disconnecting the magnetometer.

With the Power switch (item 5 above) ON (position "1"), the power LED (item 4) will be continuously lit (ON).

Note: For best results, after switching on the power, leave the Magmeter-2 for 20 minutes for the internal temperature to stabilise, before performing any measurements.

6.5.2. Taking Readings

The three diplays on the top panel will display magnetic field readings in μT. To ensure that these are correct, you should ensure that the correct scaling factor has been applied using the selection screw on the top panel. You should refer to the magnetometer datasheet for it's scaling factor.

The displays output the RMS value of the analogue output voltages if the unit is set to AC coupling, and will display the DC voltage if the unit is set to DC coupling.

For illumination of the displays, the press button below the screen need to be pressed. Please note that this is not a switch, and illumination of the display only takes place when the button is pressed in.

6.5.3. Filtering

A permanent low-pass filter and selectable high-pass filter are provided for each channel: X, Y and Z. Refer to product brochure DS2520 for the cut-off frequency of the filters.

The low-pass filters remove the high frequency noise components of the signal from the sensor. The high frequency signal is associated with the excitation signal (breakthrough) of the fluxgate sensor.

The high-pass filters are intended to filter out the DC or static field component so that the alternating components above the cut-off frequency of the filter can be isolated.

> **Note:** The low pass filter inside the Magmeter-2 will have a lesser effect on attenuating the breakthrough of the low power sensors such as Mag648/649 with lower excitation breakthrough (see datasheet for values).

6.5.4. Signal Buffering

The input buffer is a differential instrumentation amplifier to minimise loading on input signals.

> **Note:** Output must be selected as Balanced or Unbalanced, using the Magnetometer Output Type Selector Switch, depending on the type of sensor connected.

When Unbalanced is selected, one input of each differential amplifier is connected to Signal Ground, which is normally joined to Power Ground at the sensor, thereby eliminating the error caused by voltage dropped in case long cables are used.

When Balanced is selected, both inputs of the differential amplifier are connected to the sensor.

In Balanced mode, the differential signals and input amplifiers give the best possible accuracy. There is no interaction of signal ground currents and unequal sensor ground potentials caused by different voltage drops in the Power Ground cabling. Compared to Unbalanced mode, this configuration has the higher interference noise rejection, as noise will appear as a common mode signal at the input amplifiers.

After filtering, each analogue signal is fed to the appropriate BNC connector via a low impedance buffer. These buffers allow long cables to be used with high input impedance data acquisition systems. Refer to product brochure DS2520 for maximum loads.

> **Note:** Measuring these outputs can lead to a greater accuracy than that displayed on the LCDs.

6.6. Magmeter-2 Ratings

Refer to product brochure DS2520 or maximum environmental, electrical and mechanical ratings for the Magmeter-2.

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

7. Troubleshooting

The Magmeter-2 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.

Fault	Possible Cause	Solution
No power output from the Magmeter-2 (when no mains connected via the plug-in charger adaptor)	Battery flat	Recharge
	Battery expired	Replace batteries and charge
	Battery not fitted	Fit batteries and charge
	None of the above	Contact Bartington service team regarding repair
Magmeter-2 does not charge when mains connected via the plug-in charger adaptor	Battery not fitted	Fit batteries and charge
	Failed 12V charger	Replace charger
	None of the above	Contact Bartington service team regarding repair
Magmeter-2 makes buzzing sound	Battery voltage is below 5V	Recharge

Buzzer sounds when batteries have been removed	Faulty 12V Charger	Test charger output is 12V. Replace charger.
	Defective Component	Return to Bartington Instruments for repair
Magmeter-2 does not hold its charge (reduced battery operation)	Batteries expired	Replace batteries and charge
Magmeter-2 stuck in AC or DC coupling mode	Defective component	Contact Bartington service team regarding repair
Magmeter-2 stuck in Balanced or Unbalanced mode	Defective component	Contact Bartington service team regarding repair
One or both LEDs do not light correctly	Defective component	Contact Bartington service team regarding repair
Backlight does not illuminate the screen	Button not pressed and held	Press and hold button to maintain backlight
	Magmeter-2 defective	Contact Bartington service team regarding repair
With a sensor connected, all output signals are faulty	Coupled incorrectly	Check position of AC/DC coupling switch
	Balance mode set incorrectly	Check position of balanced/unbalanced mode switch
	Defective sensor cable	Check sensor cable using relevant datasheet. If found to be defective, contact Bartington service team regarding repair
	Sensor defective	Contact Bartington service team regarding repair
	Magmeter-2 defective	Contact Bartington service team regarding repair
With a sensor connected, one or two output signals are faulty	Defective sensor cable	Check sensor cable using relevant datasheet. If found to be defective, contact Bartington service team regarding repair
	Sensor defective	Contact Bartington service team regarding repair
	Magmeter-2 defective	Contact Bartington service team regarding repair

No output displayed (when not mains connected via the plug-in charger adaptor)	Batteries flat	Recharge the batteries
	Batteries expired	Replace batteries and charge
	Batteries not fitted	Fit batteries and charge
	None of the above	Contact Bartington service team regarding repair

8. *Care and Maintenance*

The Magmeter-2 requires no routine maintenance. There are no user serviceable parts.

Caution: Other than installing or replacing batteries as described in this manual, no attempt should be made by a user to repair the unit. Repairs by unauthorised people may be dangerous and could affect the safety of users, damage the equipment, and also invalidate the terms and conditions of the Warranty.

8.1. *Fuses*

As a safety feature the Magmeter-2 is fitted with a thermal fuse. If the Magmeter-2 overheats, which could occur as a result of the fitting of incorrect battery cells, the charging circuit will be permanently isolated. In this instance, the Magmeter-2 must be returned to Bartington Instruments for checks and repair.

WARNING: No attempt should be made by the user to repair the unit. Repairs by unauthorised personnel may be dangerous and could affect the safety of users, damage the equipment and also invalidate the terms and conditions of the Warranty.

8.2. *Calibration*

Routine recalibration is recommended at two years interval. Please contact Bartington Instruments service@bartington.com for enquiries.

8.3. Cleaning

Caution: Disconnect the electrical supply before performing any cleaning operation.

Periodic cleaning is not normally required.

If the system becomes soiled and cleaning is necessary:

1. Use a damp cloth to clean the outer surfaces.
2. Use an air duster to blow debris from the connectors.

Caution: Ensure water does not enter the system. The system must be completely dry before the electrical supply is reconnected.

Caution: Never use chemicals, such as solvents, when cleaning the Magmeter.

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

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 writing.

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