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1. About this Manual

This manual describes the installation, operation and maintenance of the Magmeter-2 Power Supply and Display Units. It should be read in conjunction with the product brochure [DS2520] and outline drawing DR3694 which can be found on the Magmeter-2 product page on the Bartington Instruments website at: www.bartington.com.

Photographs of key components are included, labelled with numbers.

1.1. Symbols Glossary

This manual provides the information necessary to help customers install and operate the Magmeter-2 Power Supply and Display Units from Bartington Instruments.

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

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

**Caution**: The Magmeter-2 is fitted with AA size NiMH (Nickel Metal Hydride) rechargeable batteries. Only AA size rechargeable batteries that are specified as compatible in product brochure DS2520 can be used in this product.
3. Compatible Magnetometers

**Caution:** Use of incompatible magnetometers may cause damage to the Magmeter-2 and/or the magnetometer. The Magmeter-2 is designed to operate with various Bartington Instruments magnetometers. For the current list refer to product brochure DS2520 or the product compatibility table at www.bartington.com/product-compatibility.html.

**Note:** Bartington Instruments cannot advise on the integration of this equipment with any third party products.

4. Introduction to the Magmeter-2

4.1. Summary

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 provides simple access to filtered versions of the sensor’s XYZ outputs. Magmeter-2 has a 4½ digit display. See product brochure DS2520 for the precise resolutions of the unit.

4.2. Functional Description

4.2.1. Power

The Magmeter-2 will supply power as stated in product brochure DS2520 for a range of sensors. The power is supplied from the internal, rechargeable batteries or from the plug-in power adaptor, which is also used to charge the Magmeter-2 batteries.

**Note:** When connected to the mains, the Magmeter-2 will operate without any battery cells being installed. To install or replace defective cells, refer to Installing and Replacing the Internal Batteries.

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

4.2.2. 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. See Magnetometer Output Type Selection.
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 the long Power Ground cable.

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.

### 4.2.3. 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.

### 5. Magmeter-2 Inputs, Outputs and Controls

**Note:** The precise external layout of the Magmeter-2 and Magmeter-2 may differ subtly but the principles remain the same. Outline drawings for both units are available from the product page.
5.1. Back Panel Connections and Controls

1. X Signal Conditioned Output (BNC connector)
2. Y Signal Conditioned Output (BNC connector)
3. 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.

4. Space for unique serial number
5. 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).
5.2. Front Panel Controls

6. 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 [Magnetometer Output Type Selection](#)).

7. DC/AC Coupling (High Pass Filter (HPF) Control)
   DC (button out)
   AC (button pressed in)

8. Charge LED

9. On/Off LED

10. On/Off Switch

11. Socket for external charging adaptor
5.3. Top Panel Displays

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 [see Magnetometer Output Type Selection].

**Note:** Where applicable, scaling parameters are indicated by 1V on Magmeter-2, e.g. the first switch position on Magmeter-2 is 100µT/1V.

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.

6. Installing Magmeter-2

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 (item 8, Front Panel Controls) 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:** 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:** Battery capacity will decrease over time, depending on age and use.

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.

See also Environmental Precautions.

6.3.2. Orientation

The Magmeter-2 can be orientated horizontally or vertically.

6.3.3. Temperature

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

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

6.3.4. 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 10 above) is OFF (position “0”).

2. Connect the magnetometer to the Magmeter-2 magnetometer socket. 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.
6.5. Initial Settings

6.5.1. Magnetometer Output Type Selection

Before switching on the equipment, set the magnetometer output type selector switch to the correct position for your magnetometer. Refer to the appropriate magnetometer datasheets.

7. Using Magmeter-2

7.1. Environmental Precautions

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

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

7.2. 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. See [Connecting the Equipment](#).

With the Power switch (item 10 above) ON (position “1”), the power LED (item 9) 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.
8. 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.

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>No power output from the Magmeter-2 (when no mains connected via the plug-in charger adaptor)</td>
<td>Battery flat</td>
<td>Recharge</td>
</tr>
<tr>
<td></td>
<td>Battery expired</td>
<td>Replace batteries and charge</td>
</tr>
<tr>
<td></td>
<td>Battery not fitted</td>
<td>Fit batteries and charge</td>
</tr>
<tr>
<td></td>
<td>None of the above</td>
<td>Contact Bartington service team regarding repair</td>
</tr>
<tr>
<td>Magmeter-2 does not charge when mains connected via the plug-in charger adaptor</td>
<td>Battery not fitted</td>
<td>Fit batteries and charge</td>
</tr>
<tr>
<td></td>
<td>Failed 12V charger</td>
<td>Replace charger</td>
</tr>
<tr>
<td></td>
<td>None of the above</td>
<td>Contact Bartington service team regarding repair</td>
</tr>
<tr>
<td>Magmeter-2 makes buzzing sound</td>
<td>Battery voltage is below 5V</td>
<td>Recharge</td>
</tr>
<tr>
<td>Buzzer sounds when batteries have been removed</td>
<td>Faulty 12V Charger</td>
<td>Test charger output is 12V. Replace charger.</td>
</tr>
<tr>
<td></td>
<td>Defective Component</td>
<td>Return to Bartington Instruments for repair</td>
</tr>
<tr>
<td>Magmeter-2 does not hold its charge (reduced battery operation)</td>
<td>Batteries expired</td>
<td>Replace batteries and charge</td>
</tr>
<tr>
<td>Magmeter-2 stuck in AC or DC coupling mode</td>
<td>Defective component</td>
<td>Contact Bartington service team regarding repair</td>
</tr>
<tr>
<td>Issue Description</td>
<td>Cause</td>
<td>Action</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Magmeter-2 stuck in Balanced or Unbalanced mode</td>
<td>Defective component</td>
<td>Contact Bartington service team regarding repair</td>
</tr>
<tr>
<td>One or both LEDs do not light correctly</td>
<td>Defective component</td>
<td>Contact Bartington service team regarding repair</td>
</tr>
<tr>
<td>Backlight does not illuminate the screen</td>
<td>Button not pressed and held</td>
<td>Press and hold button to maintain backlight</td>
</tr>
<tr>
<td>Magmeter-2 defective</td>
<td></td>
<td>Contact Bartington service team regarding repair</td>
</tr>
<tr>
<td>With a sensor connected, all output signals are faulty</td>
<td>Coupled incorrectly</td>
<td>Check position of AC/DC coupling switch</td>
</tr>
<tr>
<td></td>
<td>Balance mode set incorrectly</td>
<td>Check position of balanced/unbalanced mode switch</td>
</tr>
<tr>
<td></td>
<td>Defective sensor cable</td>
<td>Check sensor cable using relevant datasheet. If found to be defective, contact Bartington service team regarding repair</td>
</tr>
<tr>
<td></td>
<td>Sensor defective</td>
<td>Contact Bartington service team regarding repair</td>
</tr>
<tr>
<td></td>
<td>Magmeter-2 defective</td>
<td>Contact Bartington service team regarding repair</td>
</tr>
<tr>
<td>With a sensor connected, one or two output signals are faulty</td>
<td>Defective sensor cable</td>
<td>Check sensor cable using relevant datasheet. If found to be defective, contact Bartington service team regarding repair</td>
</tr>
<tr>
<td></td>
<td>Sensor defective</td>
<td>Contact Bartington service team regarding repair</td>
</tr>
<tr>
<td></td>
<td>Magmeter-2 defective</td>
<td>Contact Bartington service team regarding repair</td>
</tr>
<tr>
<td>No output displayed (when not mains connected via the plug-in charger adaptor)</td>
<td>Batteries flat</td>
<td>Recharge the batteries</td>
</tr>
<tr>
<td></td>
<td>Batteries expired</td>
<td>Replace batteries and charge</td>
</tr>
<tr>
<td></td>
<td>Batteries not fitted</td>
<td>Fit batteries and charge</td>
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<tr>
<td></td>
<td>None of the above</td>
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</tr>
</tbody>
</table>
9. Care and Maintenance

The Magmeter-2 requires no routine maintenance. Apart from the battery there are no user serviceable parts.

9.1. 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.

9.2. Calibration

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

9.3. 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:

- Use a damp cloth to clean the outer surfaces.
- 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.
10. 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.

10.1. 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.