magROCK

MAGNETIC SUSCEPTIBILITY METER

USER'S MANUAL

This manual has been written to help users of the magROCK Magnetic Susceptibility Meter. Whilst all reasonable efforts have been taken to ensure that facts are correct and advice given is sound, the user must accept full responsibility for the operation of their equipment and the interpretation of data.

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1. WARRANTY

Alpha Geoscience and Geo Equipment warrant the magROCK Magnetic Susceptibility Meter against defective components and workmanship for repair at the office of Alpha Geoscience in Sydney, or authorised repair facilities, free of charge for a period of twelve (12) months from date of purchase. Shipment costs are to be borne by the customer. Malfunction due to improper use is not covered in this warranty. Alpha Geoscience disclaims any liability for consequential damage resulting from defects in the performance of the magROCK. The magROCK is a general use handheld geophysical tool that is not warranted as being fit for a particular or specialized purpose and there is no warranty of merchantability for such purposes.
This warranty applies only if:

I. The instrument is used only under the operating conditions and in the manner recommended in the magROCK user manual;
II. The instrument has not been misused or abused in any manner or repairs attempted thereon;
III. Written notice of the failure within the warranty period is forwarded to Alpha Geoscience and the directions received for properly identifying items returned under warranty are followed; and
IV. The return notice authorises Alpha Geoscience to examine and disassemble returned products to the extent Alpha Geoscience deems necessary to ascertain the cause of failure.

The warranties expressed herein are exclusive. There are no other warranties, either expressed or implied, beyond those set forth herein, and Alpha Geoscience does not assume any other obligation or liability in connection with the sale or use of the said product. Any product or services repaired under this warranty shall be warranted for the unexpended portion of the original warranty period only
This warranty does not apply to limited life components such as USB cable, CD or the outer shipping case, etc.

2. QUICK OPERATING INSTRUCTIONS

ENTER	Execute button
▲ & ▼	Scroll buttons
ON / ESC	ON/OFF and revert to previous screen

To turn the instrument on Press **ON**
To turn the instrument off Press **ON** twice quickly or go to the Reading Menu (which is the first menu)**,** press ▼ until "⊗" is adjacent to the "OFF" menu item and then press **ENTER.**

When turned on, the start-up screen containing manufacturer details, will be displayed for about 3 seconds. Then the instrument will go directly into Reading (measuring) Mode and Menu.

It is important to calibrate the meter to compensate for any background effects before the instrument is used to take measurements. To calibrate the meter, move the flashing "⊗" using the ▼ arrow to select "**Calibrate".** Now hold the instrument clear of any magnetic material and any electronic devices and press **ENTER** to activate the Calibrate function. The unit will beep at one second intervals and a number will count in the display, indicating progress. When the number disappears, Calibrating has been set. The time taken will be about 10 seconds, but could be longer depending on how much error must be compensated.

Readings can now be taken. Place the sensor end of the meter with the Teflon Shield against the sample. The display will indicate whether the reading is in **SI** or **CGS** Units. Either can be selected from the Main Menu (see Sect. **5).** It should be noted that to conserve power, the magROCK will turn OFF after 3 minutes, however this can be cancelled by going to the **Main Menu** and executing the **Stay On** function. Once this function is selected, the magROCK will stay on until the batteries go flat, or the instrument is manually turned off.

3. GENERAL INFORMATION

The magROCK Magnetic Susceptibility Meter is designed to measure the magnetic susceptibility of rock outcrops, rock samples and drill core. The mineral that largely governs the magnetic behaviour of a rock, and which accounts for most of the susceptibility observed, is magnetite. The susceptibility of magnetite depends on several factors, such as the intensity of the magnetising field, the chemical

composition of the magnetite and its grain size. Susceptibility can however be used to determine the magnetic abundance, provided that the dependence between susceptibility and magnetic abundance is known.

Principle of operation
The function of the magROCK is based on electromagnetic induction. There are two coils placed orthogonally to each other in the detector head, which is mounted in the top of the unit's housing. In a non-magnetic environment, the voltage induced from the transmitter coil to the receiver coil is (calibrated to) zero. When a rock sample is brought near the coils, voltage which is proportional to the magnetic susceptibility of the sample is induced in the receiver coil. This signal is detected by a phase-locked amplifier and after rectification, it is used to drive the circuitry for the display of the magnetic susceptibility reading. The reading is directly calibrated for susceptibility.

4. DESCRIPTION OF INSTRUMENT

The magROCK is designed as a one piece instrument with a graphics display for the presentation of the magnetic susceptibility values in both digital and analog format and also an audible tone of varying frequency related to the value. This allows the operator to find the peak reading using the analog display or the highest frequency sound and then record a digital value.

The magROCK has an extensive solid-state memory with the ability to save 30 sets (**S** on screen) of 128 readings (**R** on screen). Therefore, 3840 readings in total can be saved.

The magROCK has an USB cable for the down loading of the data to a PC computer, either from memory or in real-time. The cable will lock into position on the magROCK and the retaining collar must be retracted backward to remove the cable. Please do not pull the cable and only release it using the collar.

5. MENU ITEMS AND DETAILED OPERATION

After turning on the magROCK and waiting 3 seconds for the manufacturer's information to pass, the Reading Mode and Menu will be displayed. The analogue graph will be at the top of the screen followed by the digital readout, the power (10^{-5} / 10^{-6}), the unit of measure currently in use and the set and reading time.

5.1. Reading Menu Functions:

S1 R1 **S** = Set and **R**=Reading. In the case on the left, the next reading will be stored in Set 1 and the Reading number is 1. Readings can be stored in any one of the 30 sets and each set can contain 128 readings. Note that the display indicates the storage location of the next reading which will be taken (when the magROCK is in "**Scan**" mode). When the magROCK is in the **"Step"** mode, the set and reading numbers of the current displayed value is shown.

Store When the **"⊗"** is next to **Store** and the **ENTER** button is pressed, the magROCK will store the current reading.

Calibrate By selecting this menu item and holding the magROCK in the air away from all magnetic material and interference, the magROCK will calibrate to zero. This should be done at the beginning of a series of readings, or if you notice that the magROCK has shifted from zero position despite there being no sample present.

Menu This function provides access to the **Main Menu** and from there to sub menus.

Off Switches the magROCK off.

5.2. Main Menu

After turning the magROCK on, you will automatically be at the **Reading Menu.** Scroll down to **Menu** and press **ENTER.** To execute a **Main Menu** item, press **ENTER** when the flashing "⊗" indicator is next to the desired command below.

Step / Scan Switches between the continuous **Scan** and the **Step** modes of operation. In **Scan** mode the screen actively displays the reading. In **Step** mode the reading saved is continually displayed together with its stored location.

SI / CGS Swaps between the display units of SI or CGS units, for the operator's convenience and preference. The units are related as follows: 1.0 [SI] = 4π [CGS] or
1.0 [SI] = 12.566 [CGS]

Memory Selects the Memory Menu. See section 5.3 on Page 8 for details.

InvertDis This function inverts the display so that whilst taking readings on the ground, the display is convenient to read.

Beep On Switches the audio tone on or off (only operates when meter is in "**Scan**" Mode)**.**

Stay On Cancels the three minute auto-off power save feature. Once activated, the meter can then only be turned off manually. Turning the magROCK off manually resets the auto-off function to operate.

5.3. Memory Menu

Recall Shifts the curser **"⊗"** to, and selects the **"Recall Menu"** (Section 5.4).

NewSet Switches to a screen where the scroll arrow ▲ can be used to select the desired set.

Delete Shifts the curser **"⊗"** to, and selects the **"Delete Menu".**

5.4. Recall Menu

Read Selects the **"Read Menu"** where the current reading will be displayed. Use the arrows to select the desired reading (of the 128 readings stored in the set).

SelectSet Of the 30 sets available, select the set where you want to store your data using the up arrows ▲ key.

5.5. New Set

5.6. Delete Menu

Del Read Deletes the most recently stored reading in the current set, i.e. deletes the reading in the set with the highest reading number (1 to 128).

ClearSet Select the set you wish to delete using the arrow keys and delete the entire set.

ClearAll Clears all sets and readings. This will take a few minutes if connected to a PC but is virtually instantaneous if the magROCK is not connected to a PC.

6. BAR GRAPH

The bar graph is an analogue representation of the digital read out. Please note that the power (to base ten) changes depending on the magnitude of the reading.

7. BATTERY REPLACEMENT

The magROCK will display the message "**Low Battery**" in place of the **Set (S)** and **Reading (R)** line when the batteries are exhausted. To replace the batteries, on the back of the meter, remove the

battery cover by unscrewing the two screws and replace the batteries with three (3) alkaline **"AA"** type batteries ONLY.

8. CORRECTION FACTORS

In general, if samples are too small so that air is sensed by the detector, the reading will be somewhat less than the true value. How much depends on the actual air gap.

Correction factors for various drill core sizes are given below:

DRILLCORE CORRECTIONS FACTOR		
CORE	**DIAMETER**	**CORRECTIONS FACTOR**
AQ	27MM	1.83 ± 0.02
BQ	33MM	1.76 ± 0.02
NQ	48MM	1.52 ± 0.02
HQ	62MM	1.45 ± 0.02
PQ	85MM	1.23 ± 0.02

9. USB

The magROCK can communicate with a computer via the supplied USB cable. First install the magROCK software and driver. Only connect the magROCK once this is completed.

10. MAGROCK DATA DOWNLOAD SOFTWARE (SUPPLIED)

Installation of the magROCK program is a two-step process, similar to a multitude of other programs on the market that use an external device that attaches to a USB port.

1. Install the magROCK Windows program (BEFORE you plug the magROCK unit into any USB port). This places the magROCK USB driver in the "C:\Programs\magROCK\USB Driver" directory.

2. Plug the magROCK into a USB port. Windows should automatically detect the device, and start the "Found New Hardware" wizard. You must select the "Have Disk" option and using the "Browse" button, navigate to the "C:\Programs\magROCK\USB Driver" directory. Windows will then install the correct USB driver.

Start the magROCK program ONLY AFTER Step 2 has been successfully completed.

If you do Steps 1 and 2 out of order, there is no way for Windows to find the USB driver, because it does not yet exist on the user's computer.

As with any USB device, the user must have administrative privileges in order to be able to install hardware drivers. For users on single, stand-alone computers (such as laptops) users generally have administrative privileges so there is no problem. However, with computers on a local network in a business environment, the user may not have administrative privileges because the network administrator has set it up that way, and thus they will not be able to install any hardware drivers.

The magROCK Data Download Software program makes exporting data to a file very simple – either a text or Excel file. To install, simply insert the mini CD and it should auto run the installation. All magROCK keyboard functions can be operated via the PC remotely.

11. TROUBLE SHOOTING

The magROCK is a sophisticated measuring instrument and as such trouble shooting is rather complicated without special electronic equipment. Any unauthorised opening of the housing or modifications or adjustments to the magROCK electronics will void the Warranty (see page 2).

If any operation described in this manual does not work, check the following:

1. Check that the battery has sufficient power.
2. Check and clean the battery contacts to make sure they are making a good contact.

If this does not rectify the problem, it will be necessary for the unit to be returned to Alpha Geoscience for repair.

IMPORTANT NOTE: Always ship the instrument in the original pelican protective case and include the USB cable.

12. SPECIFICATIONS

12.1. Analog Digital Display

- 128 x 64 pixel LCD Graphics Display;
- Displays both the digital and analog magnetic susceptibility readings and other menu item functions;
- Digital readout updates approx. once per second, analogue graphics readout updates approx. 10 times per second;
- Displays results in either SI Units or CGS Units.

12.2. Technical Specifications

Sensitivity:	1 x 10^{-5} SI units
Resolution:	1 x 10^{-5} SI Units
Signal Frequency:	760 Hz
Sampling Rate:	10 Hz
Power Source:	Three Alkaline Type 1.5 Volt “AA” Batteries
Battery Life:	Better than ten (10) hours continuous use
Temperature Range:	Operating 0ºC to 50ºC storage -40ºC to 60ºC
Humidity:	10 – 90 % relative
Dimensions:	
	LENGTH 16 cm
	WIDTH 8 cm
	HEIGHT 4 cm
	WEIGHT 350g (incl. battery)

12.3. Accessories:

USB Cable
Operations Manual, and CD with PC software

12.4. Susceptibilities of rocks and minerals (rationalised SI units)

Rock Mineral	***Magnetic Susceptibility***
Common rock	
Salt	0 to 0.001
Slate	0 to 0.002
Limestone	0.00001 to 0.0001
Granulite	0.0001 to 0.05
Rhyolite	0.00025 to 0.01
Greenstone	0.0005 to 0.001
Basalt	0.001 to 0.1
Gabbro	0.001 to 0.1
Dolerite	0.01 to 0.15
Ores	
Pyrite	0.0001 to 0.005
Haematite	0.0001 to 0.001
Pyrrhotite	0.001 to 1.0
Chromite	0.0075 to 1.5
Magnetite	0.1 to 20.0

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