

Operating Instruction

DiaSusz

Magnetic Susceptibility System
for synthetic diamonds



This product is not qualified for use in explosive atmospheres or life support systems.

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1. DiaSusz - magnetic susceptibility system for synthetic diamond

The system consists of a susceptibility meter MS2, a small volume sensor MS2G and a PC software. It allows the precise control of the magnetic separators in a diamond plant. A small amount of every fraction is sufficient to measure directly the result of magnetic separation. The measuring process is quick enough to serve as an in-line process control. To control the output of a separator stage it takes 8 carats of diamond and approx. 15 seconds of handling and measuring. The diamond is not affected by the measurement.

The device is portable and battery powered, so it can be used at various places inside the plant.

For laboratory use a PC can be connected via serial interface to make handling of data much easier.

2. Introduction

The MS2 Magnetic Susceptibility System comprises a portable measuring instrument, the MS2 meter, and a variety of sensors. The meter displays the magnetic susceptibility value of materials when these are brought within the influence of the sensor. Each sensor is designed for a specific application and sample type. The sensor is connected to the MS2 meter via a simple coaxial cable. An RS232 serial interface allows the instrument to operate in conjunction with custom PC software running on any PC. The MS2 meter is powered by internal rechargeable batteries or by external power supply.

The circuitry within the MS2 powers the sensors and processes the measurement information produced by them. The measurements are obtained digitally using a time dependent method. This results in precise and repeatable measurements. The sensors are independently calibrated and are therefore fully interchangeable between MS2 instruments.

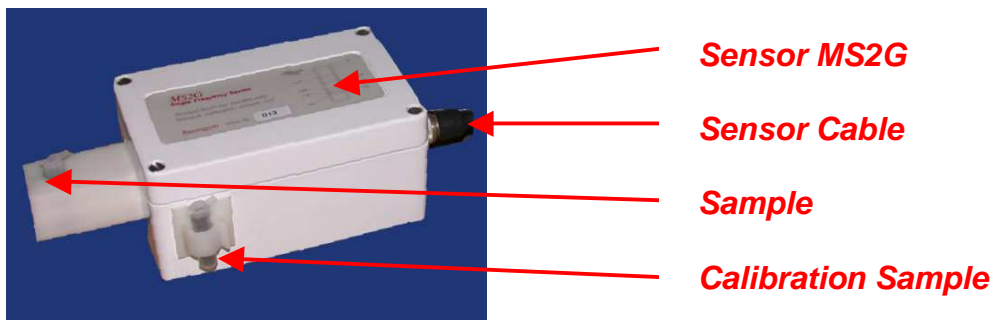
For case of viewing on the laboratory bench the MS2 can be placed on a special tilt stand.

3. General description of the meter model MS2

The MS2 circuitry is housed in an enclosure weighing 1.3kg with approximate dimensions of 160mm*255mm*50mm. Operating switches, a TNC sensor cable connector and a 4-digit liquid crystal display are situated on the front panel. The RS232 serial interface connector and a battery charger input socket are located on the rear panel of the instrument.

Internal NiCd batteries provide 12 hours continuous use and can be recharged from either the mains or a vehicle dashboard.

4. General description of the sensor



The sensor operates on the principle of a.c. induction. Power is supplied to the oscillator circuit within the sensor. This generates a low intensity (80 amperes per metre approx.) alternating magnetic field. Any material brought within the influence of this field will bring about a change in oscillator frequency. The frequency information is returned in pulse form to the MS2 meter, where it is converted into a value of magnetic susceptibility.

Detailed description of the meter

5. Front panel controls

There are five front panel controls



1 **Range multiplier switch**

This switch allows selection of either x1 or x0.1 sensitivity range. In the second case the result is shown to the first place of decimal and a 10-fold increase in measurement time provides additional noise filtering. The switch also activates the battery indicator.

2 **ZERO push button**

This button permits air readings to be taken. By performing a measurement to "air" this control re-sets the instrument and brings subsequent measurements within the range of the display.

3 **MEASURE push button**

This button permits sample readings to be taken.

4 **Toggle switch**

this performs the same function as the push button but permits continuous measurements

5 **On/Off Switch**

This switch controls the internal battery supply and also permits the selection of either SI or CGS units.

6. SI and CGS units

The instrument may be pre-set to display the susceptibility value directly in one or other of the dimensional systems thus producing a basic mass or volume specific unit of:

	Mass (x)	Volume (K)
SI	$10^{-8} \text{ (m}^3\text{/kg)}$	10^{-5}
CGS	$10^{-6} \text{ (m}^3\text{/g)}$	10^{-6}

Numerical conversion from SI to CGS units is accomplished by dividing the SI value by 4π -i.e. $X_{\text{CGS}} = X_{\text{SI}} / 4\pi$ The meter model MS2 performs this function internally but by using the constant 0.4π to keep the numbers in a similar range of magnitude.

7. Internal batteries

WARNING: *When using the mains power supply ensure that you are using a mains adapter that is correct for local ac mains voltage (110 V or 240 V).*

To recharge the batteries connect either the 12 V mains power supply adapter or the vehicle dashboard cable to the 2.1 mm connector on the rear panel of the Instrument where a yellow LED will indicate that charging is taking place. Re rate of charge will depend on whether the Instrument is switched ON (trickle charge) or OFF (full charge).

Re charger Input is polarity protected and any d.c. source between 6 and 18 volts can be used. To maintain the full capacity of the batteries it is necessary to completely discharge and recharge them from time to time.

8. Battery charging-laboratory use

When the Instrument is switched on and connected to the mains supply via the battery charger the batteries receive a trickle charge and therefore continuous use from the power supply is permitted.

9. Battery charging-field use

For field use the batteries will need to be charged overnight for use the following day. A full recharge will take 16 hours with the Instrument switched off and connected to an external mains supply or vehicle dashboard. To prevent overcharging it is recommended that charging is not continued for more than 16 hours.

10. Battery check

Re condition of die batteries can be checked by selecting „BATT,, on die range multiplier switch. Re battery Indicator lamp will appear:

green :	charge acceptable
yellow :	re-charge soon
red :	re-charge immediately

Use of die Instrument when die battery voltage is low will cause excessive measurement drift.

11. Connecting a sensor

Connect die sensor to be used to die front panel socket of die *MS2* meter with the 50 ohm TNC to INC cable and switch on by selecting either SI or CGS units.

12. Taking measurements

- (I) Take an "air" reading by pressing the ZERO push button with the sample to be measured away from the influence of the sensor. The display will appear blank and a colon will appear to show the instrument is "busy". The completion of a ZERO cycle will be announced by a bleep and the display will show all zeros.
- (ii) Place the sample within the influence of the sensor and press the MEASURE button. The "BUSY" colon will appear and the display will show the previous reading until updated at the completion of the current measurement period. This is announced with a bleep and at this time serial data will be transmitted.
- (iii) If either pushbutton is enabled at the completion of a cycle a repeat measurement will be taken.
- (iv) To measure weakly magnetic material, select the more sensitive x 0,1 range and compensate for any thermally induced drift by making a series of three measurements. The mean of an air measurement before and after the sample is subtracted from the sample measurement.

13. TECHNICAL SPECIFICATIONS FOR METER MODEL MS2:

Enclosure material	:	ABS
Weight	:	1.3 kg
Overall dimensions	:	255 x 158 x 50 mm
Operating temperature range	:	-10°C to 40°C
Storage temperature range	:	-20°C to 70 °C
Display	:	4 digit LCD including sign
Linearity	:	1% 1 to 9999 (overrange to 29999)
Batteries	:	16.8v x 600 mAh sealed NiCd removable cassette
Current drain	:	quiescent 6 mA, measuring 20 mA
Battery operation	:	12 hours minimum
Battery charge	:	16 hour; full charge
Sensor connection	:	50 ohm TNC connector
Sensor cable type	:	RG58CU 50 ohms 100 pF/M (200m maximum length)
Instrument care	:	clean with mild detergent and water

14. SMALL VOLUME SENSOR MS2G

Technical specification:

Sample cavity diameter	:	8.5 mm
Sample cavity height	:	28 mm (approx. 8ct. Diamond powder 40/50 mesh)
Sensitive region	:	5 mm length at centre of cavity
Calibration accuracy	:	2%* (a calibration check sample supplied)
Resolution	:	1×10^{-7} CGS
Measurement period	:	
on x1 range	:	0.9 seconds (SI). 0.7 seconds(CGS)
Operating frequency	:	1.3 kHz
Drift at room temperature	:	$< 2 \times 10^{-7}$ CGS in 5 minutes
Enclosure	:	Aluminium and ceramic
Weight	:	670g
Dimensions	:	180 x 80 x 67 (mm)
Sample vial	:	Kartell part number 730

❖ *May be used with sample volume down to 0.2 cm³ - scaling correction data supplied-*

15. PC SOFTWARE

PC Software is supplied, which can control the measuring device, keep track of the measured data and display results sorted by various criteria. The software can be installed on any PC which has a WINDOWS operating system and a serial port available.

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