Hirst MAGNETIC INSTRUMENTS LTD

ARP03 Automatic Recording Permeameter/VSM

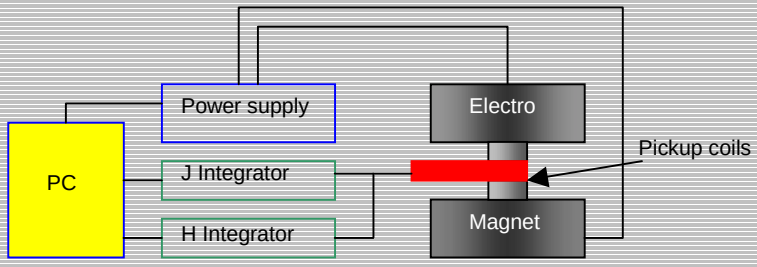
The ARP03 is an Automatic Recording Permeameter/VSM for the characterisation of soft and hard magnetic materials

FEATURES

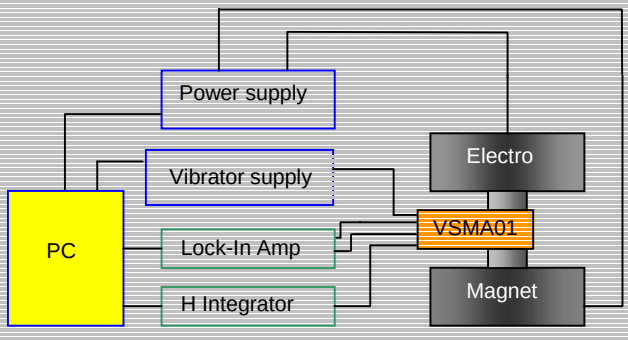
- Permeameter and VSM measurements
- Measurement of soft and hard materials
- Measurement database
- Automatic measurement sequencer
- Data export functions
- Full graphical PC control

Hirst Magnetic Instruments' ARP03 PC controlled automatic permeameter offers sophisticated measuring functions with an easy to use, but powerful graphical user interface. A unique feature allows the system to be transformed into a fully featured Vibrating sample magnetometer (VSM) with an optional component.

Unique features, innovation and industry standard products are the trademarks of Hirst Magnetic Instruments Limited, a company with over 40 years experience in the magnetics industry.



ARP02 in permeameter mode



ARP02 in VSM mode (with VSMA01)

MAGNETIC SYSTEMS FOR SCIENCE AND INDUSTRY

Introduction

Permeameters and Vibrating Sample Magnetometers (VSMs) are the two industry standards in magnetic characterisation techniques. Permeameters can also be know as hysteresismeter and permeagraphs.

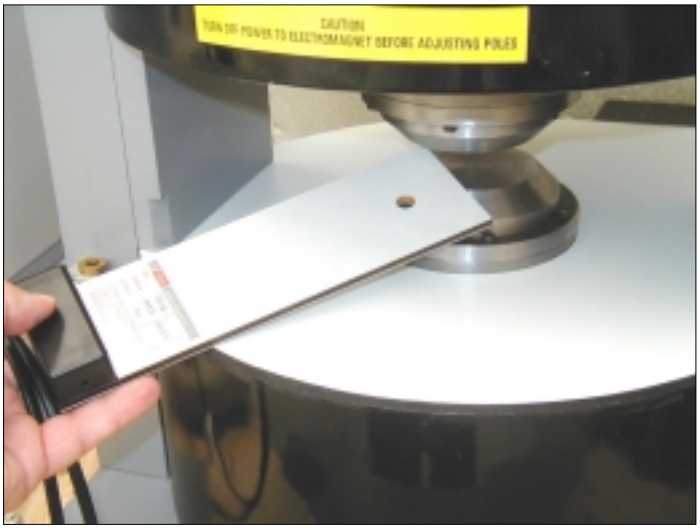
Both measurement systems work by driving the magnet around its hysteresis loop using an applied field from the electromagnet. The measurement system then detects the applied field (H) and the samples response to the applied field (J).

Soft and hard materials can be measured, including rare earth*. The limit for rare earth materials is the value of coercivity of the sample. For samples that have a suitable coercivity and saturation value, it is possible to obtain full loops, not just single quadrants.

The ARP03 automatic recording permeameter is made up of four main parts: the control PC, the electronics rack, the electromagnet and the pick up assembly. When complemented with the optional VSMA01 vibrating sample magnetometer adapter, the system becomes an extremely versatile magnetic measurement station with operation available in two modes. Closed circuit measurements can be carried out in permeameter mode and high sensitivity open circuit measurements are achieved in VSM mode.

* As with all permeameters, with hard materials it is necessary to first fully saturate the sample then drive the material through the demagnetisation quadrant. Please contact us for details of magnetisers.

Permeameter

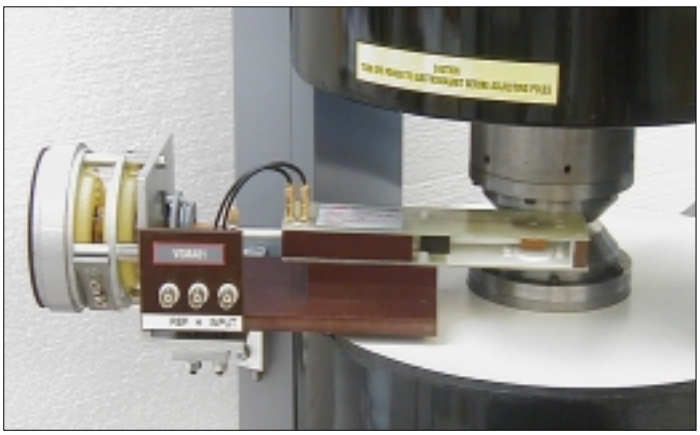


Permeameter measurement coil

The Permeameter pick up assembly will accept a sample up to 10mm diameter (Other diameters available on request.)

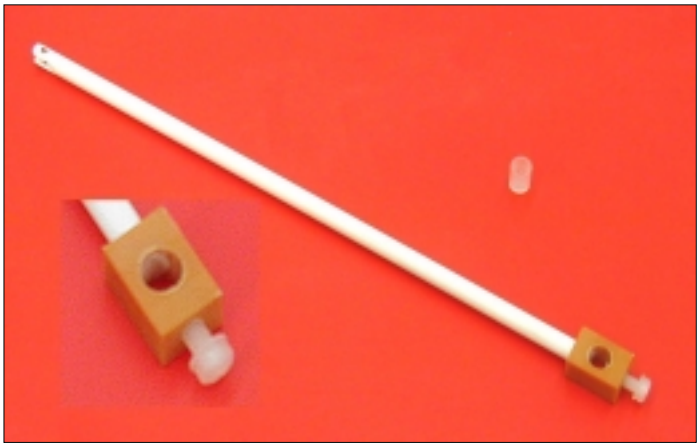
Full loops for soft materials and second quadrant measurements for rare earth materials (subject to the sample's coercivity) are available using the permeameter mode. The sample height is accommodated by increasing or decreasing the pole gap using the rotary winding handle so that the pole faces are touching the magnet.

VSMA01 adapter



VSMA01 adapter

The VSMA01 may be substituted for the permeameter pick up assembly to convert the unit to an automatic recording vibrating sample magnetometer. In this mode, major and minor loop measurements are available for soft and hard materials (subject to available maximum field). The VSMA01 requires a standard pole gap of 25mm.



VSM sample holder

Samples are loaded into the VSM sample carrier in one of two ways. Bonded particulate or solid materials are loaded directly into the carrier and are secured with a nylon lock bolt. Samples of up to 7mm diameter and 5mm thickness can be accommodated. Powders (or colloidal suspensions) are loaded into a sealed adapter which, in turn, is loaded into the sample holder in the same way as a solid.

The VSMA01 adapter is fitted on a swinging arm to allow easy access to the sample holder. The sample holder is also attached via a horizontal bearing that can be rotated, allowing the sample rod to be easily removed

Main system

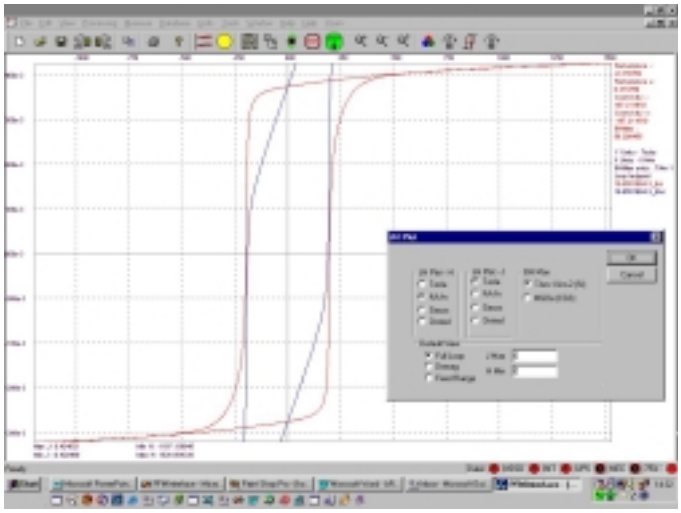
ARP03 front panel

ARP03 rear panel

Clear indicators on the front panel provide status monitoring for hardware systems. Also located on the front panel is the VSMA01 I/O section to facilitate quick and easy change over from permeameter to vibrating sample magnetometer.

Two air intakes are located on the front panel for power supply cooling. Interconnections are easily made at the rear of the electronics rack as connections, where necessary, are colour coded. Four connections to the control computer,two connections to the electromagnet coils (one per coil), and the mains input connection are made here. The rear panel also includes main power on/off switch, all system fuses and two air exhausts.

Software



ARP03 Windows control and measurement software

Features

- **Familiar windows environment**
  Comprehensive Windows software is provided, capable of running the system in either permeameter or VSM mode at the press of a button. The software follows similar design to many other applications that run on Microsoft Windows™ creating a familiar environment and reducing the time to learn the software.

- **Measurement database for 100% traceability**
  A measurement database stores every measurement made on the system ensuring 100% traceability and making it impossible to lose a measurement. A more traditional system of entering filenames is also available but it is not a requirement to use it. Especially useful for industrial QC and similar applications.

- **Sample database for easy cataloguing**
  Details of sample bulk properties, dimensions and required measurement parameters can be stored. When the sample details are recalled, the measurement options are automatically set-up based on the parameters stored with the sample. The sample details are also used in the processing of data to produce JH and BH loops that are calibrated to unit volume.

- **Automatically extracts critical measurement parameters**
  Full digital processing
  The software's data processing features in built digital filters to remove any noise from the

signal, with a user definable corner frequency.

- Data export facilities

  Comprehensive data export facilities allow data to be easily migrated to other software. The current measurement can be exported through the clipboard as a copy operation or saved as a tab delimited file (txt).

- System calibration carried out from inside user interface

  System calibration constants are adjusted through the user interface. No manual editing of files required.

- Full backup, including backup to CD

  Measurements can be backed up to CD (subject to CD writer, optional). This is a fully integrated process to the software. A simple selection of the batch of measurements to be backed up is all that is required. The software takes care of the CD writing process. Data can easily be recalled from CD with very simple steps.

- Full graphical display

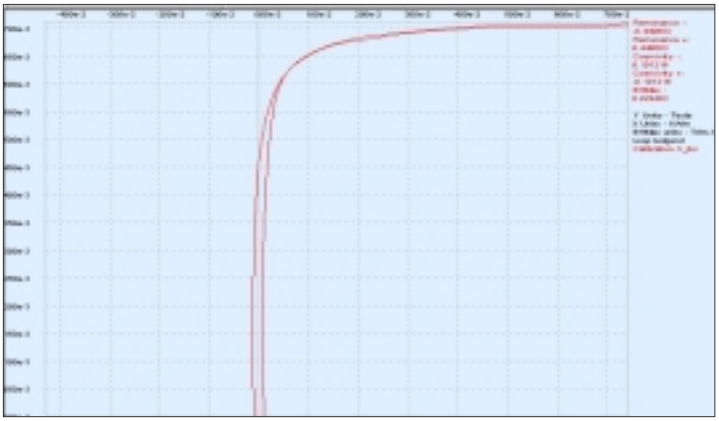
  The software can simultaneously display multiple loops either in one or separate window for easy comparison of measurements.

- Measurements available as hard copy with optional printer

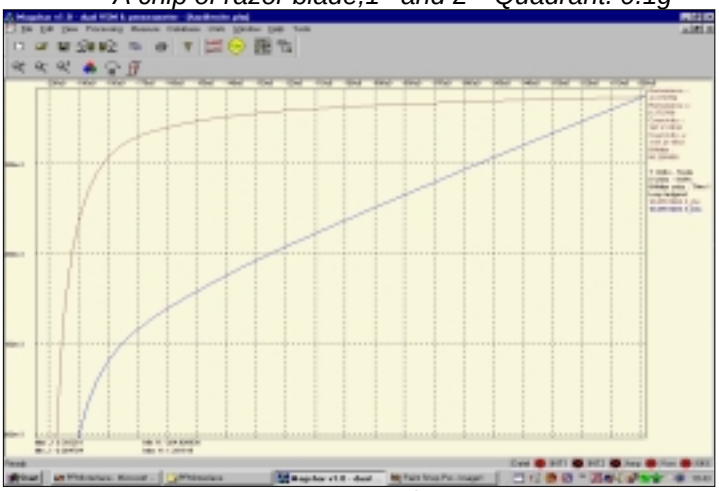
  Loops can easily be printed with a choice of data (JH,BH or both), with user definable extents.

Summary

The ARP03 and VSMA01 offer a unique Permeameter/VSM combination creating a spectrum of material measurement sensitivities as well as open and closed magnetic measurements, making the ARP03/VSMA01 unrivalled in its price performance.



A chip of razor blade,1st and 2nd Quadrant. 0.1g sample.



Second quadrant of a HF24/16 (Hard Ferrite) J and B shown.

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Permeameter specifications

Accuracy (Traceable to NPL)

J Measurement	+/- 1%
H Measurement	+/- 1%
BH Product	+/- 2%

Repeatability

J Measurement	+/- 0.5%
H Measurement	+/- 0.5%
BH Product	+/- 1% Traceable

Measurement method

J channel	Pickup coil + Integrating flux meter
H channel	Pickup coil + integrating flux meter

Sample dimensions

Maximum diameter	10mm *
Minimum height	5mm
Maximum height	50mm

* Using 10mm pickup system. Other diameters are available on request.

VSMA01 Option

Accuracy (Traceable to NPL)

J Measurement	+/- 1%
H Measurement	+/- 1%
BH Product	+/- 2%

Repeatability

J Measurement	+/- 0.5%
H Measurement	+/- 0.5%
BH Product	+/- 1% Traceable

Sensitivity

J Pickup	2.5×10^{-6} EMU

Measurement method

H channel	Pickup coil + Integrating flux meter
J channel	Pickup coil + Lock-in Amplifier

Sample dimensions

Maximum diameter	7mm
Maximum height	5mm

Vibration

Frequency (Factory pre-set)	51.6Hz (adjustable)
Amplitude	Pre-set to optimum

Integrating Flux Meter Specifications

The Integrating fluxmeters are built into the main housing and are not user accessible components.

Ranges (Selectable from PC software)

1	3.333 mVS
2	33.33 mVS
3	333.3 mVs
4	3333 mVs

Fully automatic drift correction ensures no drift error in measurements.

Lock-In Amplifier Specifications

The Lock-in amplifier is built into the main housing and is not a user accessible component.

All functions are accessible through the PC software as part of the measurement set-up procedure.

Frequency range	10Hz-100kHz
Accuracy	1%
Gain stability	200ppm/^{o}C

Gain ranges

Input	7 ranges from x1 to x1000
Output	4 ranges from x1 to x1000
Total	28 ranges

Analogue filter

Time constants	24 Options from 82uS to 33s

ARP02 Specification

Power Supply

Input Voltage	230Vac Single Phase
Input Current (max)	10A
Output Voltage	0-90Vdc per output
Output Current	0-10A max per output

Measurement devices

2 Integrating flux meters

Lock-in Amplifier (VSMA01 option only)

16 bit, multi-channel data acquisition card

Electromagnet

Polepiece Diameter 75mm/100mm Interchangeable

Absorbed Power 1.8kW Maximum

75mm Pole Face
(Minimum Values)

5mm Gap	2.1 Tesla
10mm Gap	2.0 Tesla
20mm Gap	1.2 Tesla
50mm Gap	0.7 Tesla

Bulk properties

Working Temperature	+15C to +35C
Storage Temperature	0C to +45C
Max Working Humidity	90% RH
Weight	500Kg Approximately
Water Cooling	Water-cooled heatsinks fitted to magnet coils. External cooler optional
Heated Stage	Optional

PC

The PC supplied will be based on current PC specifications and availability. Please note that that the following is a minimum specification.

Minimum specifications

Monitor	17 "
Hard Disk Drive	10Gb
Operating System	Windows 98 SE
CD	CD-R
Processor	700Mhz
Mouse and Keyboard	Standard
Printer	Optional
Network Card	Optional
Sound Card	Optional
Graphics Card or on Board Graphics	Standard

Due to a process of continual improvement, Hirst Magnetic Instruments Ltd. Reserve the right to change any specifications without notice.

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