HIRST Magnetic Instruments Ltd.

# Pulsed Field Magnetometer PFM14.B

- For the measurement of industrial permanent magnetic materials and Magnets
- High Temperature Capability
- Very High Repeatability
- Sample Temperature Measurement
- Rapid Measurement
- Fast Quality Control
- Controlled Sweep Rate
- Controlled Temperature

Hirst Magnetic Instruments PFM14.B Pulsed Field Magnetometer is one of the range of Pulsed Field Magnetometers suitable for non destructive testing and characterisation of industrial permanent magnets.

Designed for industrial use, the PFM14.B offers fast, non contact, full loop measurements of all industrial magnets, with unparalleled speed and repeatability.

The PFM14.B can measure manually loaded virgin or premagnetised permanent magnets, measure their full loop characteristic and can deliver a demagnetised magnet in a fraction of the time taken by any other technique. The results are immediately available at the PC including PASS/FAIL information. The PFM14.B extracts all key magnetic parameters automatically.

The PFM14.B is controlled via a comprehensive and extensive windows based application software with extensive database facilities storing full data on every single measurement. Data can also be exported in a variety of formats.

Images for Illustration Purposes Only

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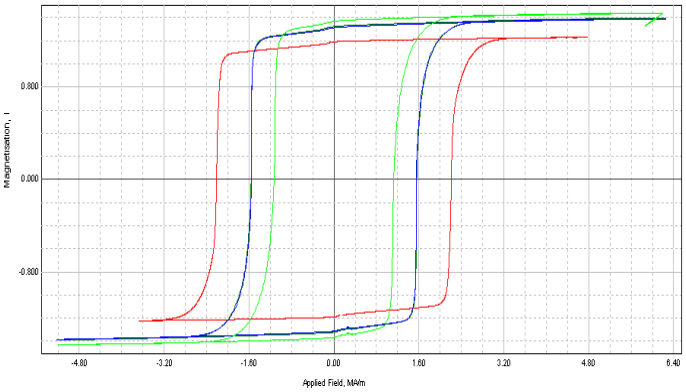
Registered in England No 1564814

Hirst Magnetic Instruments PFM14.B is a pulsed field magnetometer capable of the non destructive testing and characterisation of industrial permanent magnet materials to measure their full loop characteristic in a rapid, non contact, open circuit process. The process needs no premagnetisation of magnets (unlike permeameters/hysterisographs) and can deliver a demagnetised magnet at the end of the rapid measurement process.




Suitable for all materials including bonded and sintered:- Ferrite, NdFeB, Sm2Co17 and SmCo5 including high Hcj magnets. The system offers repeatability of measurements at speeds that is simply unattainable with other methods of measurement.

## Operation

The magnet to be tested is loaded into the sample holder and inserted into the PFM measurement chamber. The PFM14.B then automatically proceeds to measure the full loop characteristics and displays the results immediately with all critical parameters automatically extracted.

The measurement process involves generating large "pulsed" magnetic fields. It is these pulsed magnetic fields that drive the magnet around its major hysteresis loop, suitably placed pickup coils detect the applied field and the magnets response to the applied field. J and H signals are fed via the integrators to the PC where they are processed to form JH and BH loops representing the characteristics of the material.

### Temperature control and monitoring

The PFM14.B has integral sample temperature monitoring and features two methods for dealing with sample temperature; constant temperature and corrected temperature. In constant temperature mode the sample's temperature is monitored and measurements are only taken place at the desired sample temperature. In corrected temperature mode, high speed measurements can be made using a temperature correction coefficient that can be determined in constant temperature mode. Corrected temperature mode is ideal for measuring large batches of magnets for QA analysis as fast as possible. Both methods of magnet temperature control result in excellent repeatabilities. The system has been specifically designed to operate at high temperatures to provide measurements up to 200°C.

### Industrial measurements

The PFM14.B is optimised for industrial, high speed, measurements of magnets. The operator requires no operation of the PC system to perform QA analysis of industrial batches of magnets. The operator simply loads the magnet and inserts this into the machine, the measurements automatically start and are recorded to the database, a PASS or FAIL status displayed on the screen.
All measurement parameters are fully selectable via the PC system and a security level setting in the software can be used to prevent unauthorized changes to settings.

### Software

All Hirst PFM systems are supplied with comprehensive software. The software uses the familiar Windows environment to give a simple and effective user interface. All the PFM's functions are accessible through the user interface as well as extensive data processing and storage features.

### Familiar windows environment

Comprehensive Windows software is provided. 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 QA and similar applications. The database can be stored on a central server so that multiple PFM machines can be monitored from a central location

### 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 settings 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

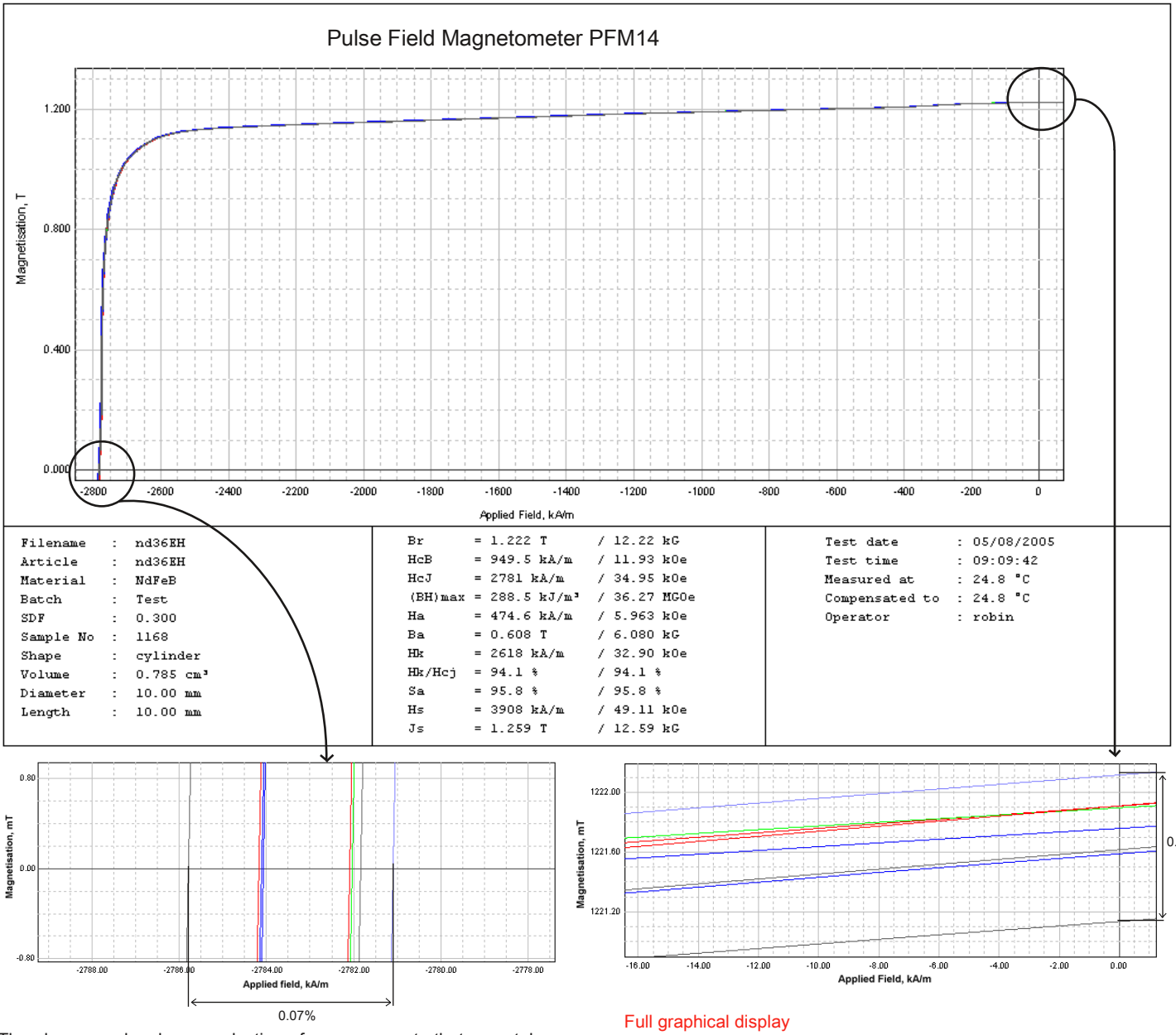
Br, $H_cJ$, $H_cB$, BHMax, Ha, Ba, Hk, Hk/Hcj, Sa, Hs and Js are all automatically extracted from every measurement and displayed separately along side JH and BH loops.

### Data export facilities

Comprehensive data export facilities allows data to be easily migrated to other software applications. Supporting clipboard operations data can by exported be simply clicking the mouse on the required trace and it is copied to the clipboard in a numerical format or data can be saved in csv/txt files.

### Full backup, including backup to CD

Measurements can be backed up to CD. 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 directly from CD without restoring the data to the hard disk.







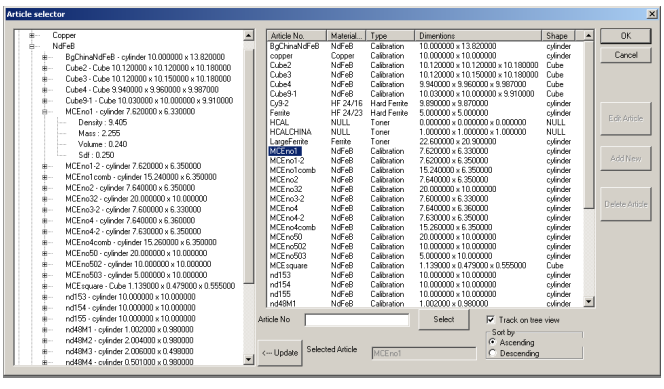



Full graphical display

The above graphs show a selection of measurements that were taken over a 37 minute period. During the test the magnet sample was fully removed and inserted from the system for each test and this still resulted in a repeatability of better than +/- 0.08 % for J and H. The results are also tabulated in the table below. This is a selection of measurements over the 37 minute period, the system its self is capable of a cycle time of 12 seconds with the same level of repeatability.

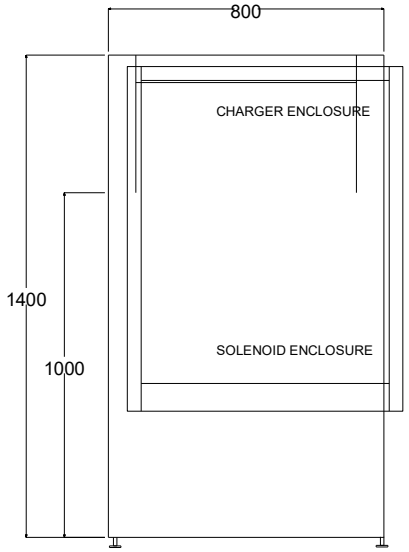
| Br T | HcJ kA/m | BHMax kJ/m3 | Time |
|---|---|---|---|
| 1,221 | -2785 | 287.6 | 09:42:21 |
| 1,221 | -2785 | 287.7 | 09:37:40 |
| 1,220 | -2783 | 287.7 | 09:34:37 |
| 1,221 | -2787 | 287.9 | 09:29:46 |
| 1,221 | -2785 | 287.8 | 09:25:58 |
| 1,221 | -2786 | 287.9 | 09:22:07 |
| 1,221 | -2783 | 287.9 | 09:18:27 |
| 1,221 | -2785 | 288.0 | 09:14:31 |
| 1,221 | -2783 | 288.0 | 09:09:42 |
| 1,222 | -2783 | 287.9 | 09:05:35 |
| **Repeatability** | 0.08% | 0.07% | 0.07% |

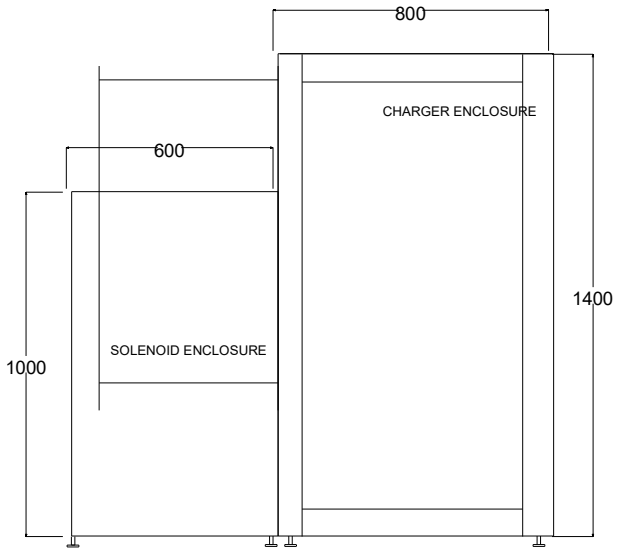
The software can simultaneously display multiple loops in either one or multiple windows for easy comparisons of measurements. Data is also available as a hard copy via a printer and can be displayed with a choice of S.I. and/or c.g.s. Units and a fully customisable report format.




Preprogramed material definitions allow quick recall of settings to avoid human error.

| | |
|---|---|
| Material Types | Sm2Co17, SmCo5,<br>NdFeB, Hard Ferrite |
| System Parameters<br>Maximum system energy<br>Maximum working voltage<br><br>Cycle time with temperature<br>Compensation and without demag<br><br>Cycle time with temperature<br>Compensation and demag<br><br>Maximum applied field | <br>9kJ<br>3kV<br><br>20 Seconds<br><br>23 Seconds<br><br><br>10.5T<br>8356kA/m<br>1050Oe |
| Maximum sample Diameter/width<br>Maximum sample height<br><br>Minimum sample Diameter/width<br>Minimum sample length | <br>10mm<br>26mm<br><br>5mm<br>5mm |
| Accuracy (traceable)<br>J Measurement<br>H Measurement | <br>+/- 1%<br>+/- 1% |
| Repeatability<br>Temperature controlled:-<br>J Measurement<br>H Measurement<br>Temperature compensated:-<br>J Measurement<br>H Measurement | <br><br>Better than 0.1%<br>Better than 0.1%<br><br>Better than 0.2%<br>Better than 0.2% |
| Measurement<br>J Channel<br>H Channel<br>Integration type<br><br><br><br>Resolution<br>Data rate<br>No data points<br>Eddy current effect removal | <br>Pickup coil, integrator<br>Pickup coil, integrator<br>Analogue differential with Auto drift correct and software Selectable ranges<br><br>14 bits<br>2.5Mhz<br>Up to 6000<br>f/2f* |
| Temperature Range<br>Ambient Temperature<br>Resolution<br>High Temperature<br>High Temperature control<br><br>Measurement methods | <br>Room Temp - 30°C<br>Better than 0.1°C<br>30°C - 200°C<br>+/- 0.3°C ≤ 100°C<br>+/- 0.5°C ≤ 100°C<br>Constant temperature<br>Corrected temperature |
| Bulk properties<br>Weight<br>Input Voltage<br>Max current<br>Frequency<br>Phases<br>Connectivity | <br>700Kg<br>110/240 Volts<br>25 Amps<br>50/60Hz<br>1<br>100Mbs, RJ45 socket for Ethernet, External USB socket for printer |




Hirst Magnetic Instruments Ltd. also manufactures wide ranges of magnetic instruments, magnetisers, demagnetisers, precision demagnetisers and special magnetic systems.

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

* The f/2f method is a patented process developed by Hirst Magnetic Instruments Ltd

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