MAG INSTRUMENTS

VFTB VARIABLE FIELD TRANSLATION BALANCE

www.mag-instruments.com

Versatile stationary device for **thermomagnetic measurements**

A VFTB a is versatile and affordable tool for characterising magnetic materials at variable temperatures.

Originally developed by Petersen Instruments, VFTBs are widely used in the research fields of paleo- and rock magnetism.

Key features

User-friendly operation

Easy sample mounting and automatic measurement sequences at defined temperatures, facilitate a user-friendly measurement process.

Build-in heating unit

An integrated high-temperature oven allows magnetic measurements at up to 800°C without any adjustments to the instrument.

Susceptibility and magnetisation measurements

The new generation of VFTBs enable simultaneous measurements of the reversible (magnetic susceptibility) and irreversible (remanent) magnetisation.

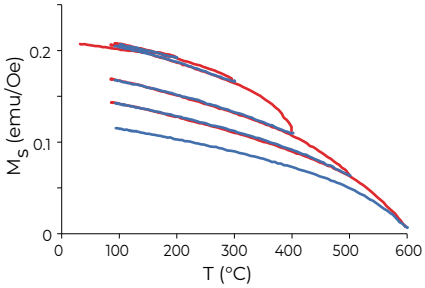
Dynamic range of 10^{-8} - 0.1 Am^2

The large dynamic range allows for various research applications, from the measurement of weakly magnetic natural materials such as sandstone, limestone, and soil to strongly magnetic synthetic materials.

In-field measurements up to 1 T

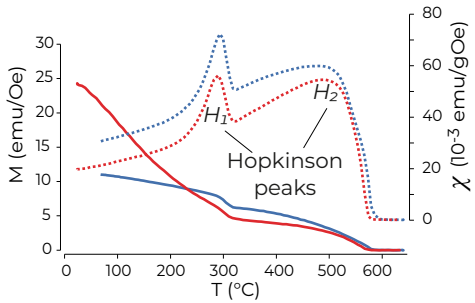
The application of strong magnetic fields allows saturating and characterising of a wide range of natural and synthetic magnetic materials and facilitates accurate curie point measurements.

Measurement examples



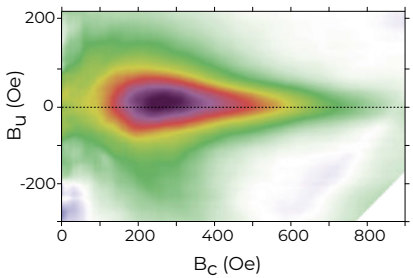
Curie point determination

Thermomagnetic curves of the saturation magnetisation (M_s) allow determining Curie temperatures of up to 800°C. Sequential heating and cooling cycles give insight into sample alteration at progressively increasing heating temperatures.



Simultaneous measurement of susceptibility and magnetisation

Simultaneous thermomagnetic measurements of susceptibility and magnetisation expand the range of research applications, as they allow for a more comprehensive characterisation of magnetic mineralogy and grain size, particularly in natural materials with complex mixed mineralogy.



FORC diagram

First-order reversal curve (FORC) measurements allow for a detailed characterisation of the material's domain state and magnetostatic interactions. Measurement files are compatible with the FORCinel processing software.

Designed for user-friendly **high-temperature experiments**

Magnetic field source

Electromagnet to generate static fields of up to 1 T.

Forcer coils

Coil setup to generate gradient fields that force the sample to oscillate depending on its magnetisation.

VFTB-EM

Susceptibility coils

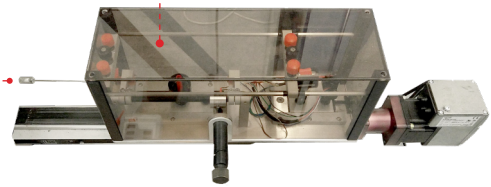
Additional coils to generate an alternating magnetic field for AC susceptibility measurements.

Oven

Sample chamber with an integrated furnace.

Sensing unit

The casing contains the sample holder and the translation balance.



Workstation

The rack houses the power supply, control electronics and a Windows PC with control software.

Sample holder

Quartz-glass rod with horizontal sample cavity (Ø 5 or 10 mm) for easy sample mounting.

Frame and suspension

Stable setup to reduce oscillations of the system and ensure a low noise level.

Operation

Temperature control

An integrated oven allows to heat samples up to 800°C. Available liquid nitrogen accessories for electromagnet VFTBs allow low-temperature measurements down to ca. -180°C (93K).

Control software

The VFTB is controlled by a comprehensive windows-based software, that allows for the definition of automatic measurement sequences and more.

Measurement atmosphere

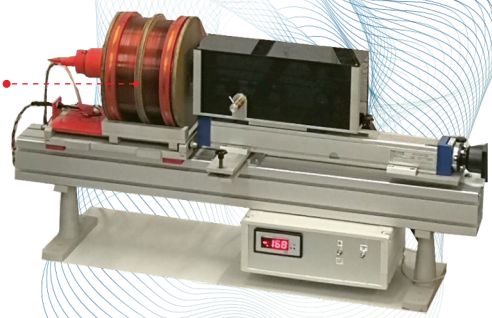
All measurements can be performed in an inert gas atmosphere such as argon, helium, or nitrogen to minimise sample oxidation.

Sample mounting

Solid or powder samples of up to 0.7 cm^3 are directly placed into the cavity of a sample holder and fixated with a small amount of quartz wool.

Magnetic field source

Solenoid to generate static fields of up to 300 mT.

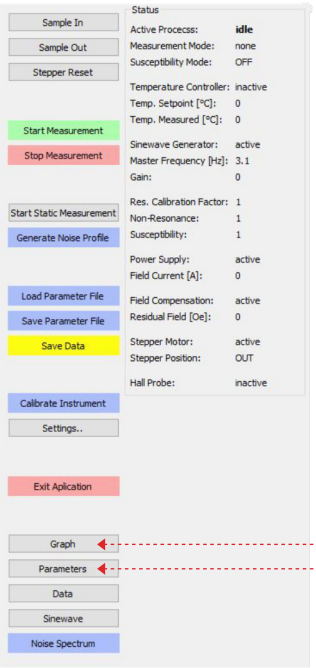


VFTB-SL

Intuitive control software for **easy data acquisition**

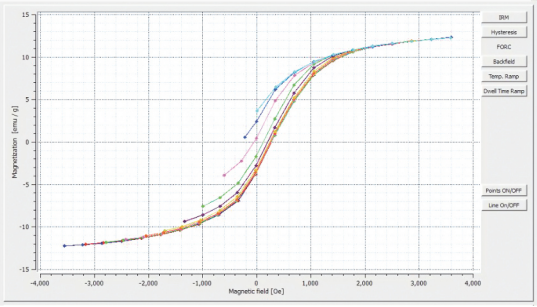
Main control

Calibrate instrument, position the sample, load measurement parameters, etc.



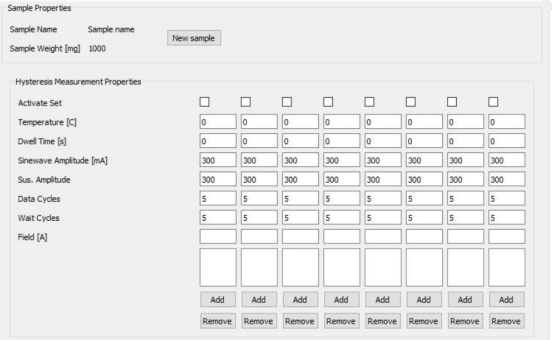
Results panel

Monitor the data acquisition in real-time and review all results of the measurement sequence.



Parameter panel

Define measurement settings and sequences of multiple measurements.



Status bar

Monitor the current state of all system components.

Software features

Main functionality

- Program and execute automatic measurement protocols.
- Review and save measurement results.
- Calibrate instrument and optimise sample position and sensitivity.

Data handling

- All measurement results are saved in text, graphic vector and raster format.
- Data export contains a parameter file that can easily be imported to repeat the identical measurement protocol on large sample sets.

Supported measurement types

- **Thermomagnetic measurements**
  Thermomagnetic curves of induced magnetisation, magnetic remanence, as well as AC susceptibility (3Hz) can be measured at defined heating/cooling rates and maximum temperatures of 800°C.
- **IRM acquisition**
  Isothermal remanent magnetisation acquisition curves can be measured at defined field steps and temperatures.
- **DC demagnetisation**
  The coercivity of remanence can be determined through DC demagnetisation (backfield) curves.
- **Magnetic hysteresis**
  Hysteresis loops with maximum fields of up to 1 T can be determined as a function of temperature.
- **FORC**
  First-order reversal curves can be measured for comprehensive material characterisation.

Technical **specifications**

Property	VFTB-EM	VFTB-SL
Dynamic range	1×10^{-8} – 0.1 Am^2	5×10^{-9} – 0.1 Am^2
Noise level	1×10^{-8} Am^2	5×10^{-9} Am^2
Temperature range	-180 - 800°C	Room t. - 800°C
Specimen size	Ø5 x 9 mm	Ø10 x 9 mm
Maximum field	1 T	0.3 T
Magnetic field source	Electromagnet	Solenoid

Scope of delivery

- VFTB (electromagnet or solenoid version)
- Re-circulation water chiller
- Workstation including a Windows PC
- VFTB control software
- On-site set up and training

Services
& supplies

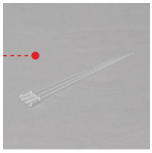
Services

We provide full maintenance and support for existing VFTB devices including:

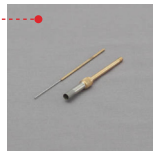
- systematic maintenance and device calibration,
- assistance in moving your device to other premises,
- customised software development.

Accessories

- **Sample holders**
  Quartz-made sample holders for all existing versions of VFTB.



- **Drill bits**
  Hollowed diamond drill bits for extracting samples from solid rock. Extracted cylindrical samples maximise the amount of material inside the sample holder for an optimal signal to noise ratio.



- **Quartz wool**
  High-temperature resistant quartz wool to fix sample inside the sample holder.

Application **examples**

Geosciences

The magnetic properties of materials like rocks, sediments, or soils can be investigated to better understand how rocks were formed, or how they acquired their magnetisation. Related proxy parameters can be determined to assess for instance, grain size or mineralogy of the investigated materials.

Archaeology & magnetometry

Characterising the magnetic properties of soil samples and other materials from archaeological sites helps to refine the interpretation of magnetic anomalies in magnetograms. Thermomagnetic properties of baked archaeological artefacts, for instance, can yield information about historic kiln temperatures.

Environmental sciences

The magnetic properties of soil and sediments can indicate environmental changes and serve as proxies for paleoclimatic and paleoceanographic studies.

Material sciences

The Material-specific magnetic properties such as coercivity, saturation magnetisation, and curie temperature can be determined. AC susceptibility, hysteresis, backfield and FORC measurements yield information on the grain size and grain interactions of ferromagnetic materials.

About
Mag-Instruments

Who we are

Based in Munich, Germany, Mag-Instruments was founded in 2014 by robotics engineer Dr. Przemyslaw Kryczka and a group of specialists in geophysics, mechatronics, and robotics to bring state-of-the-art technology into magnetic measurements.

In cooperation with Prof. Nikolai Petersen from the Ludwig Maximilian University of Munich, Mag-Instruments continues to manufacture and service all products originally developed by Petersen Instruments.

What we do

We develop and manufacture innovative, scientific equipment for laboratory and field applications. Our constantly-growing product line includes state-of-the-art magnetometers, magnetic field generating instruments such as Helmholtz coil setups, and demagnetising equipment.

Our in-house development process facilitates flexibility and cost reduction, allowing us to provide affordable, custom solutions for your research endeavour.

We can customise our products to best suit your individual application needs!

Contact us for new solutions, including automated measurement systems.

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