MAG
INSTRUMENTS

USM

ULTRA-SENSITIVE SPINNER MAGNETOMETER

www.mag-instruments.com

A new generation of **spinning magnetometers**

The USM stands for a new generation of spinning magnetometers with advanced sensor technology at an affordable price.

USM peovides ecxeptionally sensitive full-vector measurements for weak and strong samples without superconducting complexity

Fits
everywhere

With its small space requirements of only 42 cm × 37 cm × 90 cm, quadruple-layer permalloy shielding and no additional devices other than a PC connected to it, the USM is made to fit in every lab.

Measures
everything

Custom exchangeable specimen holders, a slow spinning rate and large measurement range make the USM a versatile, state-of-the art magnetometer with a wide range of applications.

Key features

Extremely sensitive, non-cryogenic magnetometer
Without need for superconducting parts, the USM operates extremely reliable and is not dependent on additional devices or coolants

Intuitive measurement procedure
An intuitive software, custom specimen holders and an automatic rotator ensure an efficient workflow.

Large dynamic range (7×10^{-13} – 0.1 Am^2)
The USM uniquely covers a measurement range of 7×10^{-13} - 0.1 Am^2 promoting a wide range of applications from analysing weak environmental or biological samples to investigating strongly magnetised synthetic materials.

Customized specimen holders
Custom specimen holders support cubic, prismatic, and cylindrical specimens. The supported range extends from 3 mm cube side length to a maximum cross-section defined by the Ø35 mm holder opening.

Multi-sensor setup
Adjustable sensor position and multiple sensors allow an increased measurement range and precision for various sample sizes.

Measurement of fragile samples
The slow spinning rate of 2 Hz allows the measurement of fragile materials such as unconsolidated sediments.

Magnetic homogeneity check
Every measurement includes an estimate of the specimen's magnetic homogeneity. An inhomogeneous magnetisation can reduce the measurement accuracy and indicate, for example, partial remagnetisation or a non-uniform distribution of magnetic carriers.

A non-cryogenic design for
highest precision magnetic measurements

Sample handler
Automatic actuation of the sample handler after each measurement

Quadruple-shielded measurement space
Ensuring minimum influence by external magnetic fields, even without a shielded room

Movable sensor
Adjustable sensor position to ensure maximum flexibility

USB interface
Connect to a PC for comprehensive software control

Specimen holder
Custom holders support different specimen shapes from 3 mm cube side length to oriented mini cores

Rotator function
Automatic change of the sample orientation for fully automated measurements

Multi-sense
Increased measurement range through multiple sensors

Operation

Control software

The USM can be operated with the integrated laboratory software (ILS). ILS user-friendly interface allows one to acquire, store, manipulate and export the measurement data.

Fast & easy workflow

Optional rotator feature to minimise the user actions during a measurement sequence for a seamless and efficient workflow.

Standalone operation

Without the need for additional devices or cooling, the USM is fully operational just by connecting it to a PC.

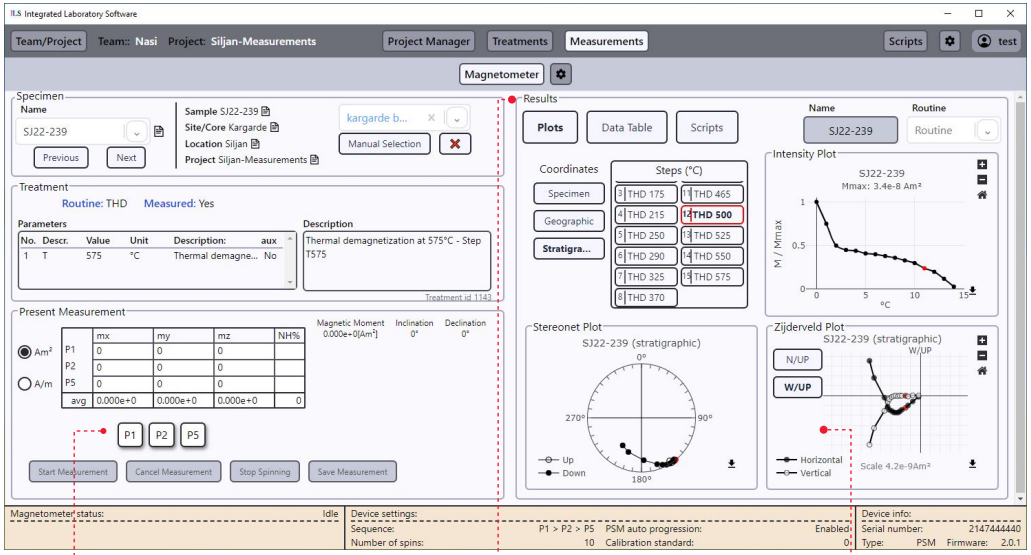
Precision & flexibility

To ensure that specimens are precisely oriented and centred, we provide custom sample holders for arbitrary shapes with a footprint smaller than 34 mm diameter.

Custom control

On request, we can also provide a communication library for smooth integration and operation of the USM with your own laboratory software.

Integrated Laboretory Software
for easy data acquisition



Measurement

Displays progress of the current measurement and a summary of the raw data

Results

Tabular and graphical presentation of each specimen's results stored in the database

Data Visualisation

Clear visualization of each specimen's results using stereonet, Zijderveld, and intensity plots

Software

Data Management

- Integrate Laboretory Software (ILS) is the dedicated control and data-management software for operating the USM.
- It provides a structured Project → Site → Sample → Specimen hierarchy of metadata, with full support for creating, editing, and managing all entities directly within the software.

Efficient Measurement

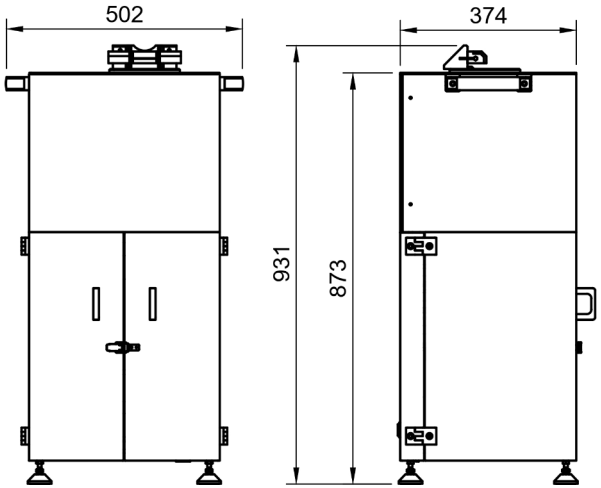
- ILS supports a comprehensive set of paleomagnetic measurement routines, including NRM, AFD, THD, IRM, ARM, AARM, and BF, as well as user-defined routines.
- Multi-step measurement sequences can be configured, saved, and executed for individual specimens or specimen groups.
- During the runs, software indicates the required specimen orientation for each step, supports up to six measurement positions, and automatically proceeds to the next specimen in the sequence.

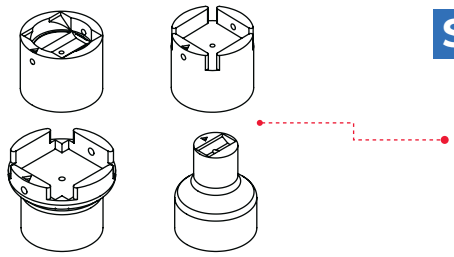
Real-Time Results

- Measurement results are displayed in real time in tabular, including Mx, My, Mz, |M|, D, I, Ig, Dg, Is, Ds, and non-homogeniety factor.
- Visualization of the results includes stereonet and Zijderveld plots in specimen, geographic, and tectonic coordinate systems, using N/Up and W/Up projections.
- Results can be exported in multiple formats, and the integrated Python interface enables custom querying, processing, visualization, and export directly from the project database.
- ILS provides a Python interface for direct access to the project database. Users can develop custom Python scripts to query and parse measurement data, perform advanced data processing, generate custom plots, and export in user-defined formats.

Technical **specifications**

Property	Value (Basic version)
Measurement range	8×10^{-12} – 1×10^{-6} Am^2
Sensitivity (1-inch core)	8×10^{-12} Am^2
Specimen size	⌀ 3-25 mm, 23 mm cube or prism. Others upon request.
Residual field	< 1 nT
Dimensions (W×D×H)	42 cm × 37 cm × 90 cm
Spinning frequency	2 Hz
Sample handling	manual





A set of customized specimen holders

Scope of delivery

- Ultra-sensitive Spinning Magnetometer
- Set of holders for cylindrical and cubic specimens
- One cylindrical and one cubic calibration sample
- Windows-based control software
- Remote installation and online training

Available extensions

Extension	Affected Property	Value
Multi-sense	Measurement range	8×10^{-12} – 0.1 Am^2
Movable Sensor	Sensitivity (mini core)	7×10^{-13} Am^2
Rotator	Sample handling	automatic

- Rotator option for automatic adjustment of sample position allows fully automated measurements. The sample only needs to be inserted manually once.
- Arrangement of an additional sensor enables increased measurement range up to 0.1 Am^2 for strong samples.
- Option for adjustable sensor position to maximize the instrument's sensitivity for different sample geometries. For mini cores, the sensitivity is increased by one order of magnitude compared to standard 1-inch cores

Areas of **Application**

Paleomagnetism

Measuring natural remanent magnetization of discrete specimens (e.g., 1-inch cores/cubes) before/after stepwise AF or thermal demagnetization to isolate the characteristic remanence for plate tectonic reconstructions, and investigation of the nature and history of the geomagnetic field.

Environmental Magnetism

Measuring natural remanence and laboratory-induced signals (e.g., ARM/IRM) of soil and sediments used as proxies for sediment composition, transport, and environmental change in paleoclimatic and paleoceanographic studies.

Rock Magnetism

High-sensitivity, 3-axis measurement of natural and laboratory-induced remanence (NRM, IRM, ARM) to quantify remanence acquisition and demagnetization behavior, magnetic grain size, and magnetic mineralogy, and to support rock-magnetic characterization of rocks and sediments ranging from weakly to strongly magnetized.

Magnetostratigraphy & Core Dating

Building polarity and paleointensity magnetostratigraphy from sediment, lava flows, and rock sequences to correlate sections and constrain ages.

Archaeomagnetism

Investigation of the magnetic properties of soil samples and archaeological artifacts to help refine the interpretation of magnetic survey anomalies, and to determine the paleointensity of baked archaeological artifacts for dating purposes.

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 design and manufacture robust scientific equipment for laboratory and field applications. Combining geophysical know-how with mechatronics and robotics engineering, our team prioritizes reliable data quality. Our product line includes state-of-the-art magnetometers and magnetic field generating instruments.

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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