



Characterize rings and strips at high resolution in DC and AC

The AMH-series Permeameters are automatic measuring systems to characterize rings and strips in DC and AC conditions. Laboratorio Elettrofisico manufactures a complete line of combination permeameters for soft magnetic materials for DC up to 1 MHz.

DC measurement provides analysis for the intrinsic and static properties. The AC measurement offers analysis for the behavior of the materials under dynamic conditions. Dynamic properties are affected by many factors depending on the particular application conditions.

Laboratorio Elettrofisico AC permeameter provides the designer with realistic characteristics of power losses, saturation field and induction performance relating to thickness of the material and the electrical resistivity.

KEY BENEFITS

- Remanence B_r , coercivity H_c , saturation values H_{sat} , B_{sat} , J_{sat} , cycle area, relative permeability, losses, losses separation, etc.
- All DC/AC AMH-series meet the International Standards IEC 60404-4, IEC 60404-2, IEC 60404-6 and ASTM A773
- Automatic measurement of complete DC or AC hysteresis loop, normal magnetization curve, permeability curve
- The measuring cycle is fully automatic and is controlled by Laboratorio Elettrofisico exclusive software (Neon v.10), resulting in complete characterization of the material under test.

STANDARD CONFIGURATION

The main cabinet containing:

- Fluxmeter
- Arbitrary Function Generator
- Power amplifier
- Fast Acquisition Unit
- Reference sample for day-to-day control
- Dedicated software Neon v.10
- PC and printer
- Connection tool for ring sample

TECHNICAL SPECS FOR ALL MODELS

The Laboratorio Elettrofisico AMH Series offers a wide range of permeameter models for AC/DC measurement for soft magnetic ring or strips. Listed below in the chart are the various models that describe the performance range.

GENERAL	AMH-1K-S	AMH-200-K-S	AMH-50K-S	AMH-1M-S
Frequency range	DC ÷ 1.2 kHz	DC ÷ 200 kHz	DC ÷ 50 kHz	DC ÷ 1 MHz
Max power	2200 VA peak	2200 VA peak	6600 VA peak	300 VA peak
Measurable materials	Soft Magnetic Materials			
Measurable quantities	B _{sat} , J _{sat} , H _{sat} , Br, H _c , cycle area, μ_{rel} , specific losses P, losses separation			
Measurable shapes	Ring, strip (with optional Epstein frame)			
Sample size Ring	No physical limitation (size affects the max H field)			
Sample size Strip (Epstein)	30 mm x 300 mm (multiple of 4)			
Typical accuracy Ring	B _{sat} , Br: ±1%; H _{sat} , H _c : ±1%, μ_r : ±2%; Losses: ±3%			
Typical accuracy Strip	B _{sat} , Br: ±1%; H _{sat} , H _c : ±1%, μ_r : ±2%; Losses: ±3%			
Test time	60-180 seconds (typical)			
Operating T range	15÷40 °C			

ACQUISITION UNIT

ADC Resolution	16 bits	12 bits	12 bits	12 bits
Sampling rate	1.00 MS/s	2 GS/s	2 GS/s	2 GS/s
Max voltage range	± 11 V	± 20 V	± 20 V	±20 V

FUNCTION GENERATOR

Frequency	1 μ Hz to 20 MHz (1 μ Hz resolution) max measuring frequency is limited by acquisition unit			
Voltage amplitude	20 mV _{pp} to 20 V _{pp} (4 digit resolution)			
Amplitude resolution	14 bits			
THD	0.04%			

FLUXMETER

Model	Digital Flux			
Ranges	(1, 2, 5, 10, 20, 50, 100) x 2000 μ Wb			
Resolution	from 1 μ Wb (range 1) to 100 μ Wb (range 100)			
Accuracy	±0.5%			
Drift	Less than 1 digit/minute			

PC AND SOFTWARE

Operating system	Windows			
Software	Neon v.10 (English or Italian)			
Connection	LAN			

MAIN CABINET

Power Supply	220 Vac 50/60 Hz, 16 A absorption, 380 Vac 3 phase + ground, 50/60 Hz, 32 A absorption (AMH-50K-S only)			
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MANUALS AND DOCUMENTATION

Instruction manual (English or Italian)
Calibration certificate, CE mark



MODEL DIMENSIONS



AMH-1K-S

L 543 x W 710 x H 556 mm
L 21" x W 28" x H 21.8"

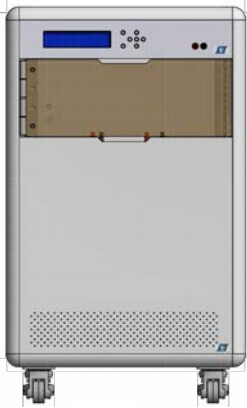
Weight 110 kg - 242 lb



AMH-200K-S

L 543 x W 710 x H 543 mm
L 21" x W 28" x H 21"

Weight 80 kg - 176 lb



AMH-50K-S

L 543 x W 830 x H 889 mm
L 21" x W 32.6" x H 35"

Weight 160 kg - 352 lb



AMH-1M-S

L 543 x W 710 x H 514 mm
L 21" x W 28" x H 20"

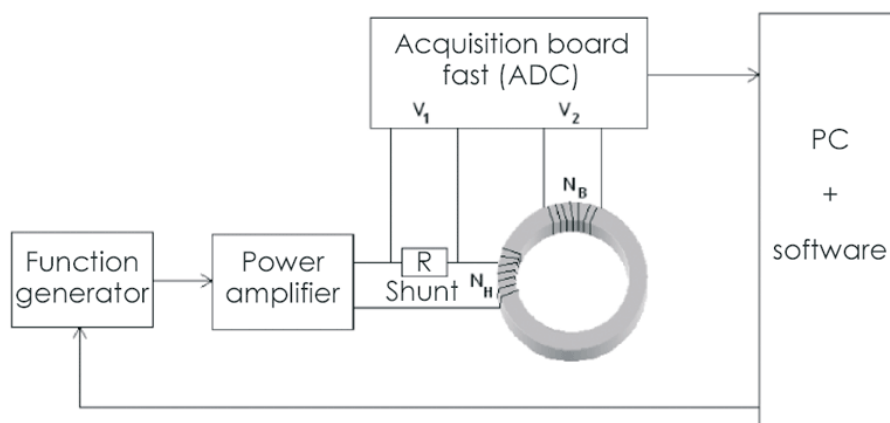
Weight 50 kg - 110 lb

HOW IT WORKS

The sample has to be prepared winding a primary set of turns N_H (Drive) around the sample for excitation and a secondary set of turns N_B (Sense) to detect the magnetic flux. The $H(t)$ field is determined measuring the current $i(t)$ in the primary winding: $H(t) = N_H \cdot i(t) / \ell$, where ℓ is the magnetic path. The current is measured by measuring the voltage across a low-inductance resistance R (shunt). For DC measurements, B is measured through the flux Φ by use of a fluxmeter, while for AC measurements, the $B(t)$ field is determined by integrating the voltage $V(t)$ from the secondary winding. An Arbitrary Function Generator generates a voltage at the desired frequency that is amplified by a power amplifier to reach a suitable level of excitation current. A general requirement is that B must change as a sinusoidal function with respect to time:

$$B(t) = B_0 \sin(2\pi f \cdot t)$$

Due to the non-linearity of magnetic materials, generally this condition is achieved only by a feedback control by the software, that drives the Arbitrary Function Generator to supply the suitable voltage $V(t)$ to reach the request condition. This feedback can be hidden to non-expert operators, or can be displayed during the measurement, if desired.



EF-LF Epstein Frame Test Set - Low frequencies

The EF-LF Epstein Frame Test Set is a 25 cm Epstein Frame designed for the magnetic characterization of electrical steel strip in accordance with IEC 60404-2, ASTM A343 and A348 test methods. When used in conjunction with one AMH-series, power losses and magnetizing characteristics at commercial frequencies can be measured by the means of a stack of rectangular test specimens.



EF-MF Epstein Frame Test Set - Medium frequencies

The EF-MF Epstein Frame is a 25 cm Epstein Frame designed for the magnetic characterization of electrical steel strip in the frequency range 400 Hz to 10 kHz, in accordance with IEC 60404-10 standard. Used in conjunction with one AMH-series, the magnetic characteristics and power losses can be measured by the means of a stack of rectangular test specimens.

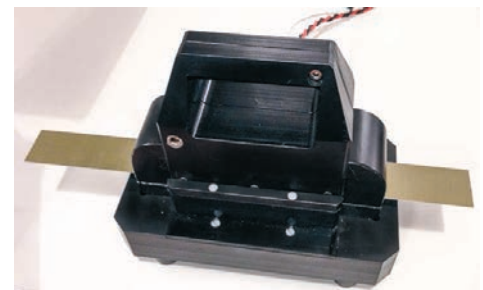


Specifications

	EF-LF	EF-MF
Frequency range	DC 400 Hz	400-10 000 Hz
Magnetic compensation	Yes	Yes
Maximum current	10 A peak	3 A peak
Maximum H field	7500 A/m (95 Oe)	640 A/m (8 Oe)
Effective length of magnetic path	0,94	0.94 m
Turns on primary winding N_H	700	200
Turns on secondary winding N_B	700	200
Recommended dimensions of the strips	30 x 280 mm (thickness from 0.05 to 0.5)	30 x 280 mm (thickness from 0.05 to 0.5)
Dimensions of measuring chamber	32 x 10	32 x 5 mm
Overall dimensions	360 x 326 x 166	360 x 326 x 139 mm
Weight	10 kg	7 kg

ST-100 Single Strip Test Fixture

The ST-100 Single Strip Test Fixture is used to characterize the magnetic properties of materials in accordance with ASTM A804 (standard test methods for alternating magnetic properties of materials at power frequencies using sheet type test specifications). The Single Strip Test is a relative test and should be correlated with Epstein Frame data if absolute measurements are required. If the Epstein Frame is used, the strips need to be cut to the required size for the Epstein Frame.



Specifications

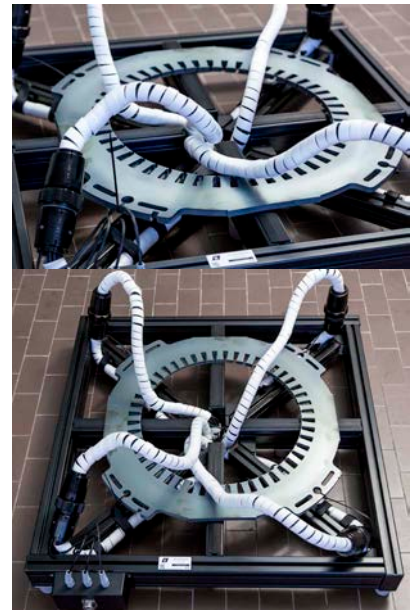
Frequency range	DC 400 Hz
Max sample size	0,8 x 45 mm
Minimum sample length	160 mm
Magnetic compensation	Yes
Overall dimensions	186 x 106 x 162 mm
Weight	5 kg

Module for improved sensitivity

In order to increase the resolution at low field (few A/m) is available a module for improved sensitivity.

RC-50-60-5-LF/HF Ring-coil

Ring coils (RC) are used to measure ring specimens without the necessity to wind turns on them. A ring coil consists basically of an open multipolar connector, in which its pins are connected to give NH excitation turns and NB measuring turns when closed. Ring coils are usually tailored on specific sizes, materials, frequencies, levels, since different measuring conditions require different NH and NB values. Most of the ring coils can be used in a wide range of measuring conditions. Ring coil contains both primary and secondary windings. The primary winding carries the current to produce the excitation field H. We have available two models of Ring coil for measurements at low frequency and high frequency.



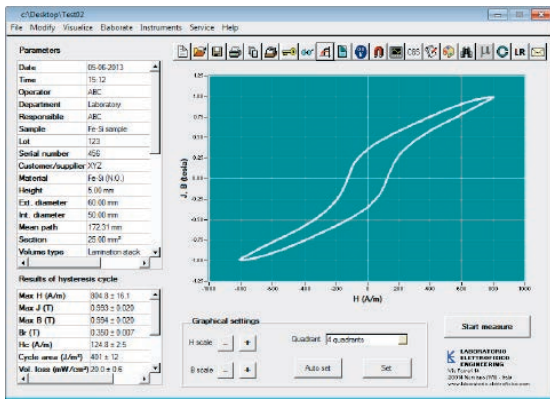
Technical Specs

Model	RC-50-60-5-LF	RC-50-60-5-HF
min frequency	DC	DC (recom. 1 kHz)
max frequency	1 kHz	20 kHz
min i.d. of sample	49 mm	49 mm
max o.d. of sample	80 mm	80 mm
max height of sample	10 mm	10 mm
Max current	13 A (peak)	13 A (peak)
N_H	28	20
N_B	9	6

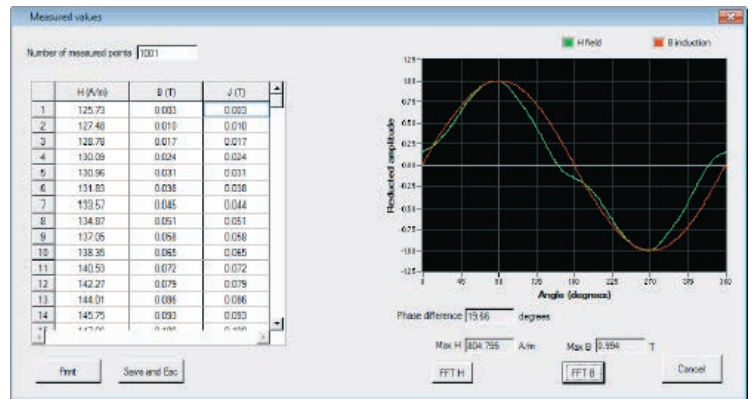


Our proprietary Neon v.10 software automatically manages measurements for the AMH-series, including comparison of different curves and statistical analysis. The software helps ensure the measuring process is accurate and absolute and helps prevent improper setting of the sample's parameters.

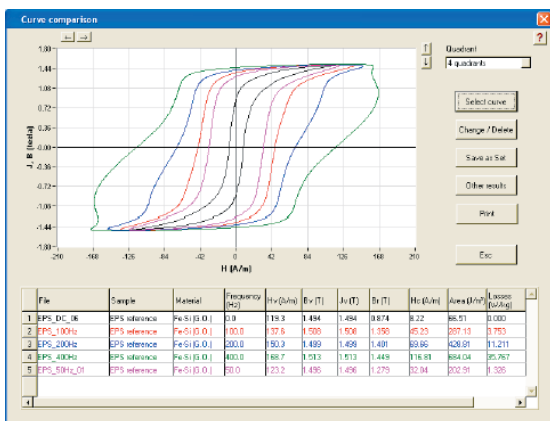
The Automatic Assistant notifies the operator and makes suggestion for the appropriate procedures or settings. The software also provides automatic creation for printing reports, database search feature and curve comparison.



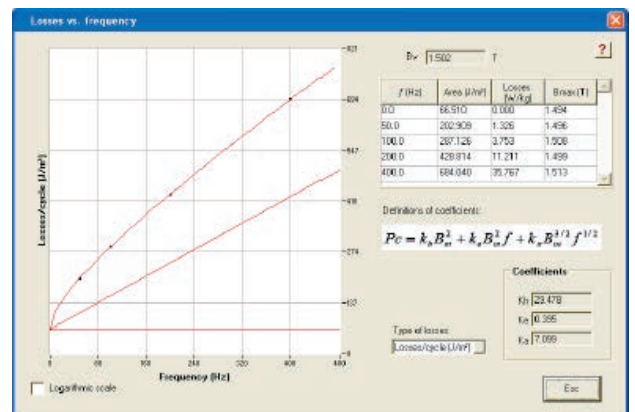
Main panel with example of measurement (at 50 Hz)



Measured points



Comparison of curves with same B_v at different frequencies, which allows the user to evaluate the losses separation and relative coefficients



Losses separation and relative coefficients



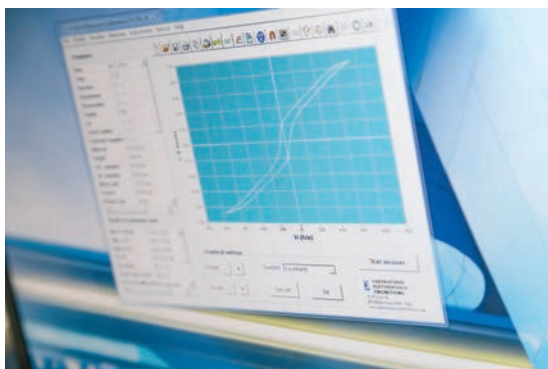
FEATURES

Type of measurement

- Hysteresis loop, normal magnetization curve and relative permeability, in DC and AC conditions
- Sinusoidal B and H condition
- Demagnetization of the sample

Results

- Hsat, Bsat, Jsat, Br, Hc, loop area, relative permeability, specific power losses, losses separation, Steinmetz coefficient and many advanced results
- Magnetic units in SI and CGS, measures in mm and inches, temperature in °C and °F



Data base and file searching

- Data base of measuring files with fast search options, ordering, selection, etc.
- Full compatibility with other spreadsheet programs, such as Microsoft Excel™

Set of measures

Ability to group together different measurements in the same graph. The software recognizes the group type and provides additional results such as losses separation and determination of Steinmetz coefficients

Setting of measuring parameters

- Manual or automatic settings of magnetizing and demagnetizing field, speed, resolutions and many other parameters
- Setting of acceptance limit for direct quality control

Data elaboration

- Curve comparison
- Curve's interpolation, automatic or using a mathematical function from a list
- Automatic control of the Fluxmeter
- Merging of different curves

Printing a report

- 3 pre-set reports with different sizes and contents
- Customized report option for changing the information and the language between English and Italian
- The report can be opened and saved with other word processor programs, like Microsoft Word™

Protection

Password protection for restricting access according to selected parameters

