

## **Model 7410 Vibrating Sample Magnetometer**

### **Introduction**

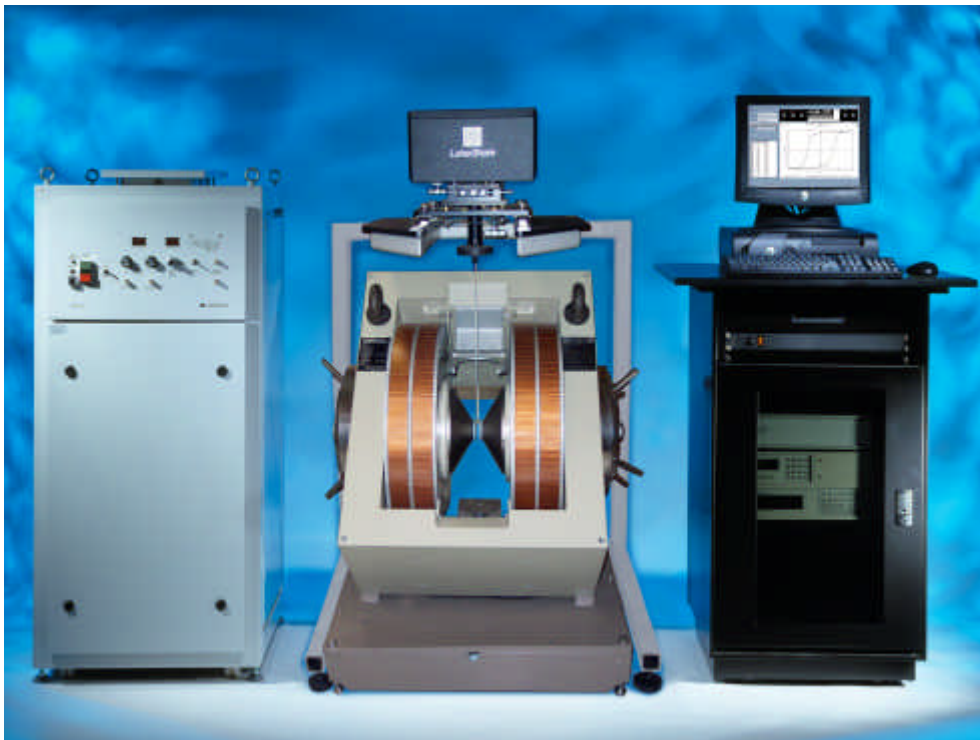
Lake Shore's Vibrating Sample Magnetometers perform magnetic measurements for materials research and development, quality control, and production testing.

The Model 7410 is capable of characterizing a variety of particulate and continuous magnetic media materials including; audio, video, and digital data tapes, flexible media, magneto-optical materials, sputtered and plated thin film materials including multilayer GMR, CMR, exchange-bias and spin valve materials.

### **Measurements**

The following parameters are either measured directly or can easily be derived through the software

- Hysteresis Loops
  - Saturation magnetization ( $M_{SAT}$ ), Retentivity or remanent magnetization ( $M_{REM}$ )
  - Coercivity ( $H_C$ ),  $S^*$ , Slope at  $H_C$ , value of  $dM/dH$  or differential susceptibility at  $H_C$
  - Switching field distribution (SFD)
  - Flatness, Squareness ratio (SQR)
- Minor hysteresis loops
- Initial magnetization curve
- DC remanence
- AC remanence
- Vector measurements ( $m_x$  and  $m_y$ )
- Magnetization data as a function of time





## Materials

All types of magnetic materials:

- Diamagnetic, Paramagnetic, Ferromagnetic, Ferrimagnetic, Antiferromagnetic materials and Anisotropic materials
- Particulate and continuous magnetic recording materials and GMR, CMR, exchange biased and spin-valve materials
- Magnetic-optical materials
- Bulk materials, powders, thin films, single crystals, and liquids are readily accommodated

## Features

- Noise Floor/Sensitivity to 0.1  $\mu$ emu @ 16.2 mm (0.64 inch) air gap, corresponding to <3.5 mm (0.14 inch) sensing coil gap, and 10 s/pt averaging
- Variable magnet air gap permits magnet/coil adjustments to suit samples and provide field strengths to 31 kOe
- Water-cooled magnet coils provide excellent field stability when high power is required to achieve the maximum field capability
- Bipolar power supply provides smooth continuous transition through zero field
- Fast data acquisition – average sample run (hysteresis loop) over full field range typically requires only minutes
- Windows™ NT/2000 menu driven color graphic software for system operation, data acquisition, and analysis. System software includes operation and control of the magnet power supply, VSM control unit, and gaussmeter. Real-time feedback of processed magnetic moment measurement data can be displayed in either graphical or tabular format.

## System Specifications

### General

<b>Moment Measurement range</b>	0.1 x 10 <sup>-6</sup> emu to 1000 emu
<b>Time constants (TC)</b>	0.1, 0.3, 1.0, 3.0, or 10.0 seconds
<b>Output stability</b>	Better than $\pm 0.05\%$ of full scale per day for fixed coil geometry at constant field and temperature
<b>Absolute accuracy</b>	Better than 1% of reading $\pm 0.2\%$ of full scale (when test sample and calibrant are geometrically identical)
<b>Reproducibility</b>	Better than $\pm 1\%$ , or $\pm 0.15\%$ of full scale, whichever is greater, fixed rotation angle
<b>Field accuracy in gauss</b>	1% of reading or $\pm 0.05\%$ of full scale

### Performance Specifications

	Standard configuration		High field uniformity option	
<b>Magnet pole face diameter</b>	50 mm (1.96 in)		150 mm (5.9 in)	
<b>Coil set</b>	740EMSC - 1 in mini pickup coils		730ESC - 2 in large pickup coils	
<b>Magnet air gap range</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Minimum</b>	<b>Maximum</b>
	16.2 mm (0.64 in)	38.1 mm (1.5 in)	29 mm (1.14 in)	51 mm (2.0 in)
<b>Sample access</b>	<3.5 mm (0.14 in)	<25.4 mm (1.0 in)	<3.5 mm (0.14 in)	<25.4 mm (1.0 in)
<b>Magnetic field</b>	31 kOe	23 kOe	22.5 kOe	19.2 kOe

### Noise Floor/Sensitivity @ 16.2 mm operating air gap with Standard Configuration

0.1  $\mu$ emu @ 0.1 s TC, 10 s/pt averaging  
 0.4  $\mu$ emu @ 0.1 s TC, 1.0 s/pt averaging  
 0.75  $\mu$ emu @ 0.1 s TC, 0.1 s/pt averaging

### Noise Floor/Sensitivity @ 29 mm operating air gap with High field uniformity option

0.5  $\mu$ emu @ 0.1 s TC, 10 s/pt averaging

## Equipment

### Model 736 VSM Electronics with integrated gaussmeter

<b>Resolution</b>	±1 part out of 300,000
<b>Precision</b>	Up to 0.0007% of full scale for 350 G and above ranges

### Model 740EMSC mini pick-up coils

### Model 731 Mechanical VSM head drive assembly and mounting structure Instrumentation console

### Model EM10-HV Variable Gap Electromagnet

<b>Pole diameter</b>	254 mm (10 inch)
<b>Pole face diameter</b>	50 mm (1.96 inch)
<b>Cooling water requirements</b>	Tap water or closed cooling system (optional chiller available)
<b>Flow rate</b>	11.4 liters/minute (3 gallons/minute) @ 45-75 psi

### Model 668 Bipolar Power Supply

<b>Maximum output</b>	±135 amps / ±65 volts / 8.8 kW
<b>3 phase AC line input; current draw</b>	208 VAC, 50-60Hz; 39 A 400 VAC, 50-60 Hz; 19 A
<b>Power consumption</b>	15 kVA
<b>Cooling water requirements:</b>	Tap water or closed cooling system between +15 °C to +24 °C
<b>Flow rate:</b>	8 liters/minute (2.2 gallons/minute) @ 45-75 psi

### Model 740940 Sample tail kit

- (1) 740937: One-piece quartz, 3.5mm air gap, thin-film side
  - (1) 740938: One-piece quartz, 3.5 mm air gap, thin-film bottom
  - (1) 740939: Sample tail only, quartz to Kel-F
    - (3) 730931: Bulk/Powder upper and bottom sample cup, Kel-F
    - (3) 730933: Thin-film side sample holder, Kel-F
    - (3) 730934: Thin-film bottom sample holder, Kel-F
- (Liquid holders are purchased separately)

### Computer

≥2.6 GHz Intel processor, ≥40 GB hard drive, ≥256 MB of RAM, 32 MB USB Memory Stick, CD-ROM, LCD monitor, Windows™ NT/2000, and National Instruments GPIB / IEEE-488 interface.

### VSM Software

Windows™ NT/2000 menu driven, enhanced color-graphic software for system operation, data acquisition and analysis. System software includes operation and control of the magnet power supply, VSM control unit, and gaussmeter. Real-time feedback of processed magnetic moment measurement data can be displayed in either graphical or tabular format.

**Printer** HP InkJet printer

**Shipping weight** Five (5) crates totaling 3266 kg (7185 lb)