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Model 425 Gaussmeter

LakeShore

Model 425 Gaussmeter

- Field ranges from 350 mG to 350 kG
- DC measurement resolution to 4¾ digits (1 part of ±35,000)
- Basic DC accuracy of ±0.20%
- DC to 10 kHz AC frequency
- USB interface
- Large liquid crystal display
- Sort function (displays pass/fail message)
- Alarm with relay
- Standard probe included
- Standard and custom probes available

Introduction

Designed to meet the demanding needs of the permanent magnet industry, the Lake Shore Model 425 gaussmeter provides high end functionality and performance in an affordable desktop instrument. Magnet testing and sorting have never been easier. When used in combination with the built in relay and audible alarm features, the Model 425 takes the guesswork out of pass/fail criteria. Additional features including DC to 10 kHz AC frequency response, max hold and relative measurement make the Model 425 the ideal tool for your manufacturing, quality control and R&D flux density measurement applications. For added functionality and value, the Model 425 also includes a standard Lake Shore Hall probe. Put the Model 425 gaussmeter to use with confidence knowing it's supported by the industry leading experts in magnet measurement instrument, sensor and Hall probe technology.

Throughput

Throughput involves much more than just the update rate of an instrument. An intuitive menu navigation and keypad, along with overall ease of use are equally important. The Model 425 is designed with these qualities in mind. The operation is straightforward, with user display prompts to aid set-up. We understand that time is money! In addition to being user friendly, the automated magnet testing and sorting features of the Model 425 streamline sorting and testing operations. In addition, hot swapping of Hall probes allows you to switch probe types without powering the instrument off and back on. These features support increased productivity, allowing you to spend less time setting up your instrument and more time working on the task at hand.

DC measurement mode

Static or slowly changing fields are measured in DC mode. In this mode, the Model 425 uses probe field compensation to correct for probe nonlinearities, resulting in a DC accuracy to ±0.20%. Measurement resolution is enhanced with internal filtering, allowing resolution to 4¾ digits with reading rates to 30 readings per second over the USB interface.

AC measurement mode

In addition to the DC measurement mode, the Model 425 offers an AC measurement mode for measuring periodic AC fields. The instrument provides an overall frequency range of 10 Hz to 10 kHz and is equipped with both narrow and wide band frequency modes. While in narrow band mode, frequencies above 400 Hz are filtered out for improved measurement performance.

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Measurement Features

The Model 425 offers a variety of features to enhance the usability and convenience of the gaussmeter.

Autorange: In addition to manual range selection, the instrument automatically chooses an appropriate range for the measured field. Autorange works in DC and AC measurement modes.

Probe zero: Allows you to zero all ranges while in DC mode with the simple push of a key.

Display units: Field magnitude can be displayed in units of G, T, Oe, and A/m with resistance in Ω.

Max hold: The instrument stores and displays the captured maximum DC or AC field reading.

Relative reading: The relative mode calculates the difference between a live reading and the relative setpoint to highlight deviation from a known field point. This feature can be used in DC or AC measurement modes.

Instrument calibration: Lake Shore recommends an annual recalibration schedule for all precision gaussmeters. Recalibrations are always available from Lake Shore, but the Model 425 allows you to field calibrate the instrument if necessary. Recalibration requires a computer interface and precision low resistance standards of known value.

Instrument Probe Features

The Model 425 offers the best measurement performance when used along with Lake Shore Hall probes. Firmware-based features work in tandem with the probe's calibration and programming to ensure accurate, repeatable measurements and ease of setup. Many of the features require probe characteristics that are stored in the probe connector's non-volatile memory.

Probe field compensation: The Hall effect devices used in gaussmeter probes produce a near linear response in the presence of a magnetic field. The small nonlinearities present in each individual device can be measured and subtracted from the field reading. Model 425 probes are calibrated in a way to provide the most accurate DC readings.

Probe information: The gaussmeter reads the probe information on power up or any time the probe is changed to allow hot swapping of probes. Critical probe information can be viewed on the front panel and read over the computer interface to ensure proper system configuration.

Extension cable: The complex nature of Hall effect measurements makes it necessary to match extension cables to the probe when longer cables are needed. Keeping probes and their extensions from getting mixed up can become a problem when more than one probe is used. The Model 425 alleviates most of the hassle by allowing you to match probes to extension cables in the field. Stored information can be viewed on the front panel and read over the computer interface to ensure proper mating.

Hall effect generators (magnetic field sensors): The Model 425 will operate with a discrete Lake Shore Hall effect generator when a suitable probe is not available. You can program the nominal sensitivity and serial number into an optional HMCBL blank connector to provide all gaussmeter functions except field compensation. If no sensitivity information is available, the Model 425 reverts to resistance measurement.

The probe connection

The Model 425 is only half the magnetic measurement equation. For the complete solution, Lake Shore offers a full complement of standard and custom Hall effect probes in a variety of sizes and sensitivities. One of ten standard Hall probes is included with the Model 425. See page 5 for details on the Hall probes you can choose to receive with the Model 425.

Display and Interface Features

The Model 425 has a 2-line by 20-character liquid crystal display. During normal operation, the display is used to report field readings and give results of other features such as max or relative. When setting the instrument parameters, the display gives you meaningful prompts and feedback to simplify operation.

Following are four examples of the various display configurations:

Normal reading — the default mode with the display of the live DC field reading.

Max DC hold on — the maximum value is shown in the lower display while the upper display contains the live DC field reading.

Alarm on — the alarm gives an audible and visual indication of when the field value is selectively outside or inside a user specified range. The relay can be associated with the alarm.

Sort on — the live reading is shown in the upper display while the lower display contains the pass/fail (repetitive sorting or testing) message. The relay facilitates pass/fail operation.

Keypad

The instrument keypad has 14 keys with individual keys assigned to frequently used features. Menus are reserved for less frequently used setup operations. The keypad can be locked out to prevent unintended changes of instrument setup.

Alarm, relay and sort

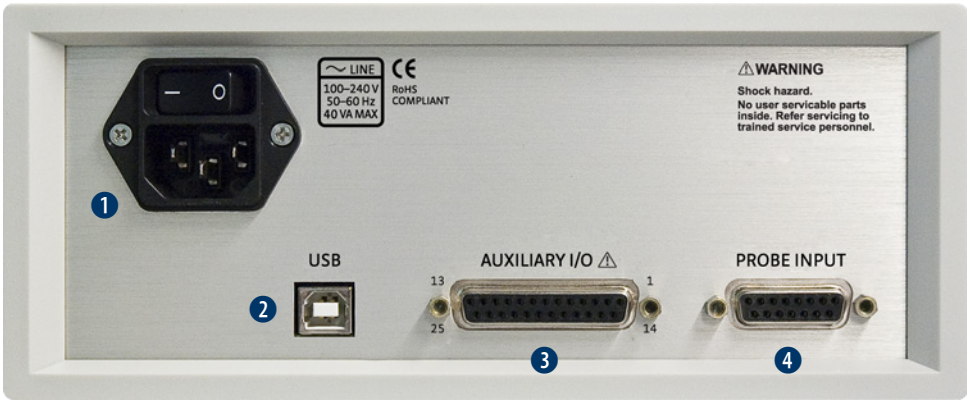
High and low alarm functions and one relay are included with the instrument, and can be used to automate repetitive magnet testing and sorting operations. Alarm actuators include display annunciator, audible beeper, and a relay. The alarm can be configured to display a pass or fail message and the relay can be configured to activate a mechanism to separate parts that meet pre-set fail criteria. The relay can also be controlled manually for other system needs.

Monitor output

The monitor output provides an analog representation of the reading that is corrected for probe offset and nominal sensitivity. This feature makes it possible to view the analog signal, which has not been digitally processed. The monitor output can be connected to an oscilloscope or data acquisition system.

Computer interface

The Model 425 is equipped with a universal serial bus (USB) interface. It emulates an RS-232C serial port at a fixed baud rate of 57,600, but with the physical connections of a USB. In addition to gathering data, nearly every function of the instrument can be controlled through the USB interface. The reading rate over the interface is nominally 30 readings per second. A LabVIEW™ driver is available from the downloads section of the Lake Shore website at www.lakeshore.com.



1. *Line input assembly*
2. *USB interface*
3. *Auxiliary I/O*
4. *Probe input*

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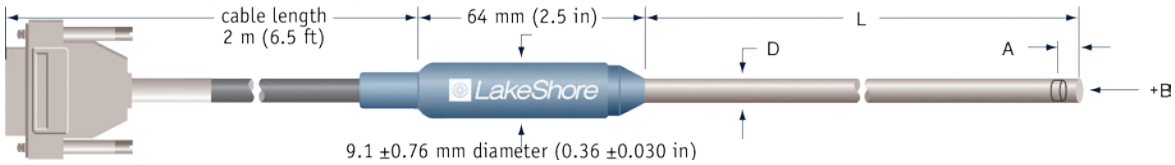
Hall Probe Selection

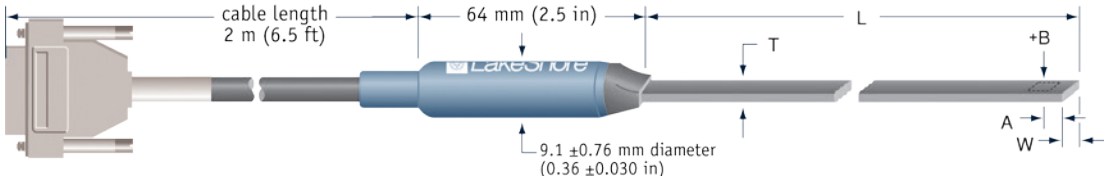
Listed below are the probes that you can choose from to include with your Model 425. Our experts can guide you through the probe selection process. Other standard probes are available at an additional cost. Lake Shore prides itself on making every attempt to satisfy customer requests for special probes. If you need a custom probe, contact Lake Shore for availability.

Axial probes



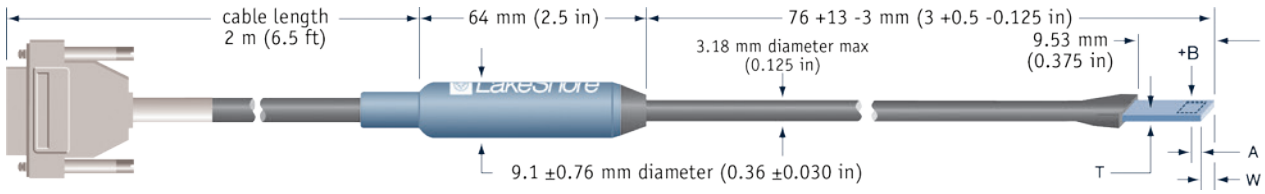
	L (in)	D (in)	A (in)	Active area (in)	Stem material	Frequency range	Usable full scale ranges	Corrected accuracy (% rdg)	Operating temp range (°C)	Temp coefficient (max) zero	Temp coefficient (max) calibration
HMNA-1904-VR	4 ±0.125	0.187 dia ±0.005	0.005 ±0.003	0.030 dia (approx)	Fiberglass epoxy	DC to 10 kHz	**HSE** 35 G, 350 G, 3.5 kG, 35 kG	±0.20% to 30 kG and ±0.25% 30 to 35 kG	0 °C to +75 °C	±0.09 G/°C	–0.04%/°C
HMMA-2502-VR	2 ±0.063	0.25 dia ±0.006	0.015 ±0.005		Aluminum	DC to 10 kHz					
HMNA-1904-VF	4 ±0.125	0.187 dia ±0.005	0.005 ±0.003		Fiberglass epoxy	DC to 800 Hz	**HST-4** 350 G, 3.5 kG, 35 kG	±0.10% to 30 kG and ±0.15% 30 to 35 kG		±0.13 G/°C	–0.005%/°C
HMMA-2502-VF	2 ±0.063	0.25 dia ±0.006	0.015 ±0.005		Aluminum	DC to 400 Hz					

Transverse probes



	L (in)	T (in)	W (in)	A (in)	Active area (in)	Stem material	Frequency range	Usable full scale ranges	Corrected accuracy (% rdg)	Operating temp range	Temp coefficient (max) zero	Temp coefficient (max) calibration
HMMT-6J04-VR	4 ±0.125	0.061 max	0.180 ±0.005	0.150 ±0.050	0.040 dia (approx)	Aluminum	DC to 800 Hz	**HSE** 35 G, 350 G, 3.5 kG, 35 kG	±0.20% to 30 kG; ±0.25% 30 to 35 kG	0 °C to +75 °C	±0.09 G/°C	–0.04%/°C
HMNT-4E04-VR	4 ±0.125	0.045 max	0.150 ±0.005			Fiberglass epoxy	DC to 10 kHz					
HMMT-6J04-VF	4 ±0.125	0.061 max	0.180 ±0.005			Aluminum	DC to 400 Hz	**HST-4** 350 G, 3.5 kG, 35 kG	±0.10% to 30 kG; ±0.15% 30 to 35 kG		±0.13 G/°C	–0.005%/°C
HMNT-4E04-VF	4 ±0.125	0.045 max	0.150 ±0.005			Fiberglass epoxy	DC to 800 Hz					

Flexible transverse probes



	W (in)	T (in)	A (in)	Active area (in)	Stem material	Frequency range	Usable full scale ranges	Corrected accuracy (% rdg)	Operating temp range	Temp coefficient (max) zero	Temp coefficient (max) calibration
HMFT-3E03-VR	0.135 max	0.025 max	0.125 ±0.005	0.040 dia (approx)	Flexible plastic tubing	DC to 10 kHz	**HSE** 35 G, 350 G, 3.5 kG, 35 kG	±0.20% to 30 kG; ±0.25% 30 to 35 kG	0 °C to +75 °C	±0.09 G/°C	–0.04%/°C
HMFT-3E03-VF						DC to 800 Hz	**HST-4** 350 G, 3.5 kG, 35 kG	±0.10% to 30 kG; ±0.15% 30 to 35 kG		±0.13 G/°C	–0.005%/°C

Model 425 Specifications

(Does not include probe error, unless otherwise specified)

General measurement

Input type: Single Hall effect sensor
Maximum update rate: 30 rdg/s
Probe features: Linearity compensation, probe zero, and hot swap
Measurement features: Autorange, max hold, relative mode, and filter
Probe connector: 15-pin D-sub socket

DC measurement

Probe type Ranges	Filter on 4¾-digit resolution	Filter off 3¾-digit resolution
HST probe		
350 kG	000.01 kG	000.1 kG
35 kG	00.001 kG	00.01 kG
3.5 kG	0.0001 kG	0.001 kG
350 G	000.02 G	000.1 G
HSE probe		
35 kG	00.001 kG	00.01 kG
3.5 kG	0.0001 kG	0.001 kG
350 G	000.01 G	000.1 G
35 G	00.001 G	00.01 G
UHS probe		
35 G	00.001 G	00.01 G
3.5 G	0.0001 G	0.001 G
350 mG	000.02 mG	000.1 mG

Measurement resolution (RMS noise floor): Indicated by value in above table for shorted input
Display resolution: Indicated by number of digits in above table
DC accuracy: ±0.20% of reading ±0.05% of range
DC temperature coefficient: -0.01% of reading -0.003% of range/°C
DC filter: 16-point moving average

AC measurement

Probe type Ranges	3¾-digit resolution
HST probe	
350 kG	000.1 kG
35 kG	00.01 kG
3.5 kG	0.001 kG
350 G	000.1 G
HSE probe	
35 kG	00.01 kG
3.5 kG	0.001 kG
350 G	000.1 G
35 G	00.01 G
UHS probe	
35 G	00.01 G
3.5 G	0.001 G
350 mG	000.1 mG

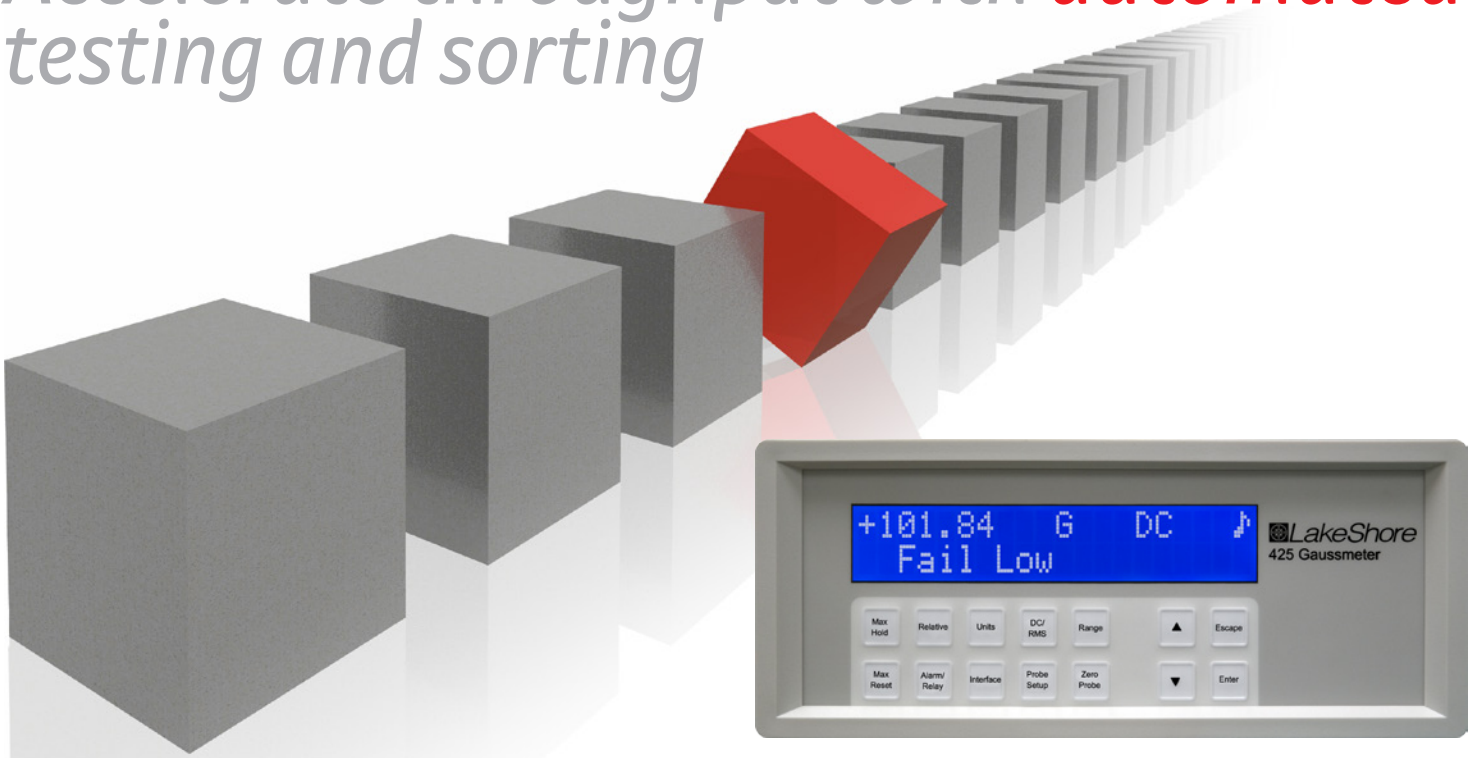
Measurement resolution (RMS noise floor): Indicated by value in above table, measured at mid-scale range
Display resolution: Indicated by number of digits in above table

	Narrow band mode	Wide band mode
AC accuracy	±2% of reading, ±0.05% of range (20 Hz to 100 Hz); ±2.5% of reading, ±0.05% of range (10 Hz to 400 Hz)	±2% of reading, ±0.05% of range (50 Hz to 10 kHz)
AC frequency response	10 Hz to 400 Hz	50 Hz to 10 kHz
Minimum input signal	>1% of range	>1% of range, except >2% of range on lowest range

AC specifications based on sine wave inputs or signals with crest factors <4.

AC temperature coefficient: ±0.01% of reading ±0.006% of range/°C

Accelerate throughput with automated testing and sorting



Front panel

Display: 2-line × 20-character LCD display module with 5.5 mm high characters and LED backlight
Display units: Gauss (G), tesla (T), oersted (Oe), and ampere per meter (A/m)
Display update rate: 3 rdg/s
Display resolution: To ±4¾ digits
Units multipliers: μ, m, k, M
Display annunciations: DC — DC measurement mode; RMS — AC RMS measurement mode; MAX — Max hold value; — Alarm on
Keypad: 14-key membrane
Front panel features: Display contrast control and keypad lock-out

Interfaces

USB
- **Function:** Emulates a standard RS-232 serial port
- **Baud rate:** 57,600
- **Connector:** B-type USB connector
- **Reading rate:** To 30 rdg/s
- **Software support:** LabVIEW™ driver (consult Lake Shore for availability)

Alarm
- **Settings:** High setpoint, low setpoint, inside or outside, algebraic or magnitude, audible on/off, and sort

Actuators: Display annunciator, sort message, beeper, and relay

Relays
- **Number:** 1
- **Contacts:** Normally open (NO), normally closed (NC), and common (C)
- **Contact rating:** 30 VDC at 2 A
- **Operation:** Follows alarm or operated manually
- **Connector:** Shared 25-pin D-sub socket

Monitor output
- **Configuration:** Real time analog voltage output proportional to measured field
- **Range:** ±3.5 V
- **Scale:** ±3.5 V = ± full scale on selected range
- **Frequency response:** DC to 10 kHz
- **Accuracy:** Offset and single point gain corrected to ±0.5% of reading ±0.1% of range, linearity is probe dependent
- **Minimum load resistance:** 1 kΩ (short circuit protected)
- **Connector:** Shared 25-pin D-sub socket

General

The Model 425 is the replacement for the Model 421 with a new software command set.
Ambient temperature: 15 °C to 35 °C at rated accuracy, 5 °C to 40 °C with reduced accuracy
Ambient field: Up to 100 G DC, measured at the instrument chassis
Power requirement: 100 VAC to 240 VAC, 50 Hz to 60 Hz, 40 VA
Size: 216 mm W × 89 mm H × 318 mm D (8.5 in × 3.5 in × 12.5 in), half rack
Weight: 2.1 kg (4.6 lb)
Approvals: CE mark, RoHS compliant

Probes and extensions

Probe compatibility: Full line of standard and custom probes (compatible with Model 425/455/475 probes)
Hall sensor compatibility: Front panel programmable sensitivity and serial number for user supplied Hall sensor using HMCBL cable
Extension cable compatibility: Probe extension cables with an EEPROM are available from 10 ft to 100 ft

Ordering Information

Part number	Description
425	Model 425 gaussmeter
425-HMXX-XXXX-XX	Model 425 gaussmeter with standard probe choice—specify selected probe number for HMXX-XXXX-XX (see list on page 5)

Please indicate your power/cord configuration:
100 VAC, U.S. power cord
120 VAC, U.S. power cord
220 VAC, European power cord
240 VAC, European power cord

Accessories included

G-106-253	I/O mating connector
G-106-264	I/O mating connector shell
4060	Zero gauss chamber
MAN-425	Model 425 user manual

Accessories available

4065	Large zero gauss chamber for gamma probe
HMCBL-6	User programmable cable with EEPROM (6 ft)
HMCBL-20	User programmable cable with EEPROM (20 ft)
HMPEC-10-U	Probe extension cable with EEPROM (10 ft), uncalibrated
HMPEC-25-U	Probe extension cable with EEPROM (25 ft), uncalibrated
HMPEC-50-U	Probe extension cable with EEPROM (50 ft), uncalibrated
HMPEC-100-U	Probe extension cable with EEPROM (100 ft), uncalibrated
RM-½	Rack mount kit for one ½-rack gaussmeter in 483 mm (19 in) rack
RM-2	Rack mount kit for two ½-rack gaussmeter in 483 mm (19 in) rack

Calibration service

CAL-N7-DATA	New instrument calibration for Model 425/455/475 with certificate and data
CAL-425-CERT	Instrument recalibration with certificate
CAL-425-DATA	Instrument recalibration with certificate and data

One probe included (additional probes ordered separately)
Custom probes available – consult Lake Shore

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Established in 1968, Lake Shore Cryotronics, Inc. is an international leader in developing innovative measurement and control solutions. Founded by Dr. John M. Swartz, a former professor of electrical engineering at the Ohio State University, and his brother David, Lake Shore produces equipment for the measurement of cryogenic temperatures, magnetic fields, and the characterization of the physical properties of materials in temperature and magnetic environments.