



Gemini[®] VII 2390



SUPERIOR RESULTS WITH UNIQUE FEATURES

Gemini VII 2390 Series Surface Area Analyzers

Rapid and Precise Surface Area Analysis

Surface area and pore volume are important physical properties that influence the quality and utility of many materials and products. Therefore, it is critically important that these characteristics be accurately determined and controlled. Likewise, knowledge of surface area and pore volume, often is an important key in understanding the formation, structure, and potential application of many natural materials.

Micromeritics' Gemini VII 2390 Series of surface area analyzers rapidly and reliably produces accurate and repeatable surface area and pore volume results. Their low cost, speed, simplicity of use, reliability, and ruggedness have earned the Gemini a place in laboratories worldwide as an essential tool in research and quality control environments.

Unique Features

The clear advantage of the Gemini's capabilities lie in its unique and innovative design which makes for not only a reliable and accurate instrument but also offers an easy to use operating system with intuitive reporting.

Innovation:

Gemini utilizes a unique adaptive rate dosing algorithm and is a special case of the static volumetric technique. Speed and sensitivity are unsurpassed by other static volumetric instruments.

Accuracy:

Micromeritics invented the balance tube design, which negates free-

space errors introduced by thermal gradient variations or by initial mismeasurement of free space.

The Gemini permits low surface area measurements without requiring krypton and the use of a servo valve controls the rate of gas flow into the sample tube to accurately attain target pressures without pressure overshoot.

Faster Results:

The sample controls the rate at which the gas is delivered thus accelerating delivery of the analysis gas. This results in a surface area analyzer that is as fast as the physics of adsorption allows.



How-to videos provide on-screen instruction on instrument operation reducing training time for new users.

Easy-to-follow installation videos and system verification tests ensure optimum performance and reliability.

Flexibility:

Three choices of software control:

- Embedded software allows for operation without an external PC through the keypad
- Windows 7 or greater operating system
- Gemini VII Confirm™ 21 CFR Part 11 option for regulated pharmaceutical applications

Three Model Options

Gemini VII 2390a

The Gemini VII 2390a model is ideal for rapid and accurate surface area determinations by single-point and multipoint BET and Langmuir methods. In addition, it provides standard methods for total micropore volume using the t-plot method. Included in this model's capabilities is the ability to determine statistical thickness surface area (STSA) of carbon blacks. (Refer to ASTM D 6556, ISO/DIS 18852.2, or ISO/CD 4652-2/3.)

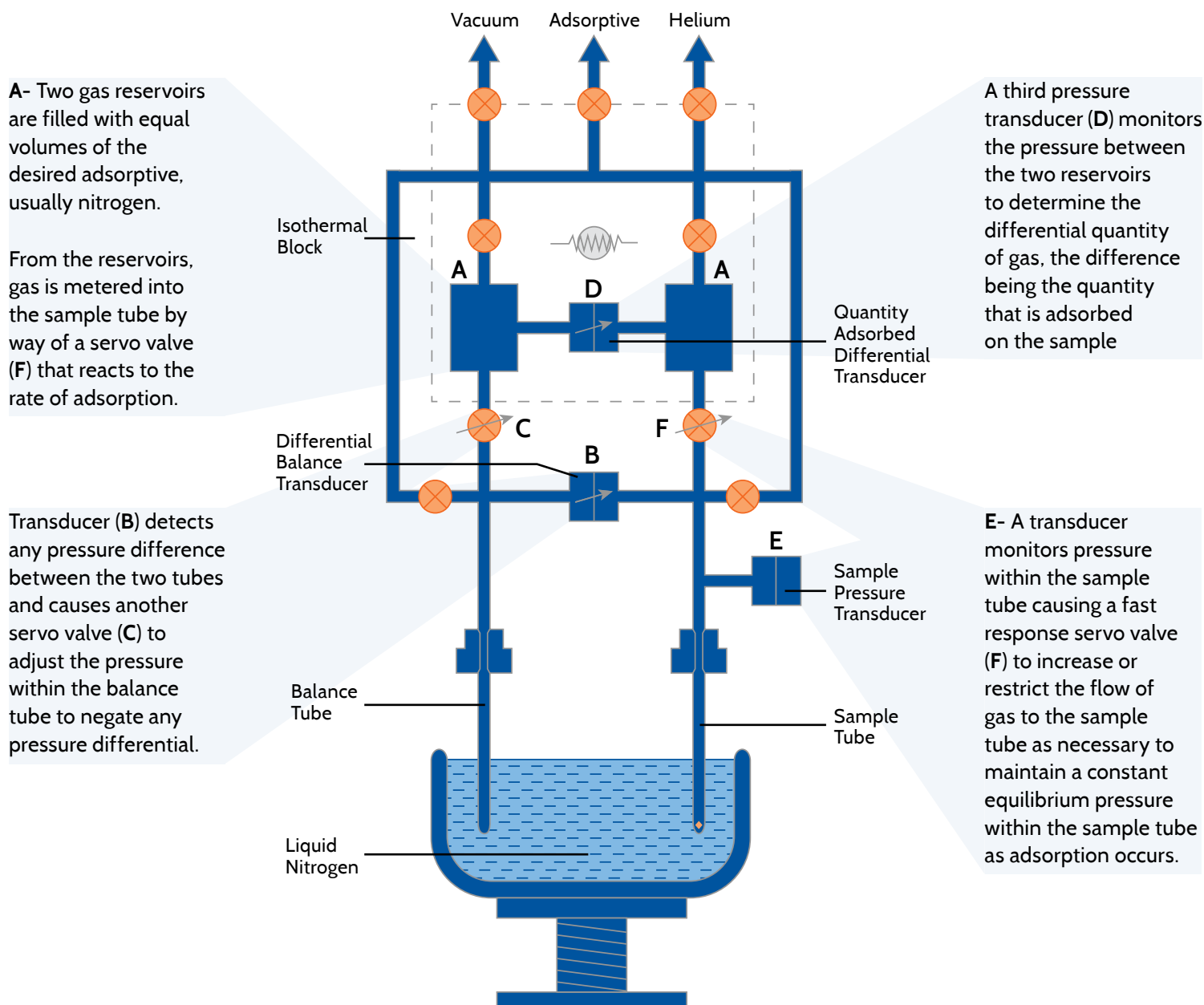
Gemini VII 2390p

The Gemini VII 2390p model provides additional precision with the addition of a saturation pressure (P_0) tube that allows the system to monitor the saturation pressure of the adsorptive on a continuous basis during an analysis using a dedicated pressure transducer. This design feature permits a rapid measurement of the adsorption isotherm to near-saturation, as well as determination of pore size distribution.

Gemini VII 2390t

The Gemini VII 2390t model has all of the facilities of the 2390p with the addition of a larger dewar and longer sample tubes for extended analysis times. This provides the additional capability to measure the complete adsorption-desorption isotherm and perform pore size distribution measurements by BJH or DH using up to 1000 data points.

Unique Design: The Gemini Technique



Superior Data Presentation Capability

Operating Software

Gemini analyzers can be operated from a keypad by way of embedded software or from a computer using the more-powerful and versatile Gemini Windows optional software.

The embedded software includes:

- System verification tests
- Single- and Multipoint BET (Brunauer, Emmett, and Teller) surface area
- Langmuir surface area
- Total pore volume
- Total micropore volume and area by the t-Plot method using Halsey, Harkins-Jura, or Carbon Black STSA thickness curves
- Horvath-Kawazoe for micropore distribution
- BJH pore size distribution using adsorption isotherm (Gemini 2390p and 2390t only)
- BJH adsorption and desorption isotherm, 1000 data points (Gemini 2390t only)

Optional Gemini Windows Software

The easy-to-use Gemini Windows 7 interface enhances the capabilities to plan, launch, and control the analysis. You can collect, organize, archive and reduce raw data, and store standardized sample information and analysis conditions for easy access during later applications. Finished reports may be generated to screen, paper, or to files in various formats. Features include cut-and-paste graphics and tables, scalable-and-editable graphs, and customizable report formats. Using computer control, you can operate up to four Gemini analyzers simultaneously from a single computer.

Gemini Windows® Features

Gemini Windows software provides additional features not included with the embedded software.

Features such as:

- Installation and how-to videos
- Reduction of user-entered data
- Automatically generated pressure tables with user-selected endpoints
- Storage of all historical sample data for retrieval
- User-defined pressure table
- Summary report
- Sample log
- Isotherm plot overlays
- Autoscaling x- and y-axes
- Cut-and-paste graphics and tables
- Data export to ASCII and spreadsheet formats
- User-defined thickness curve (manually entered or from data file)
- Fixed pore size tables
- Linear and log plots (isotherm, pore volume, pore area)
- Cumulative and differential data
- Broekhoff-de Boer thickness curve

21 CFR Part 11 Option

Also available is Confirm™ software, which addresses the many requirements specified by 21 CFR Part 11 validation, security, audit trails, reporting, and more.

Micromeritics Gas Adsorption Reports

Windows software with all Micromeritics' gas adsorption instruments contains the following reports:

Isotherm Reports:

- tabular
- graphical
- pressure composition isotherm

Isotherm modeling and surface area:

- BET
- Langmuir
- Temkin
- Freundlich

Standard isotherm models:

- t-plot: micropore volume, micropore area, external surface area
- alpha-s method
- f-ratio method

Classic models for mesopore volume, area, and distribution:

- BJH*
- Dollimore-Heal*

Classic models for micropore distribution:

- Dubinin-Radushkevich and Astakhov
- Horvath-Kawazoe
- Saito-Foley
- Cheng-Yang
- MP method

Density Functional Theory for pore size modeling:

- Slit-shaped pores using N₂, Ar, or CO₂
- Cylindrical pores for alkaline-exchanged zeolites using N₂ or Ar
- Cylindrical pores for hydrogen- or ammonium-exchanged zeolites using N₂ or Ar
- Windows-shaped model for pillared clay

Density Functional Theory for surface energy:

- Surface area and energy distributions using nitrogen at 77 K
- Surface area and energy distributions using argon at 87 K

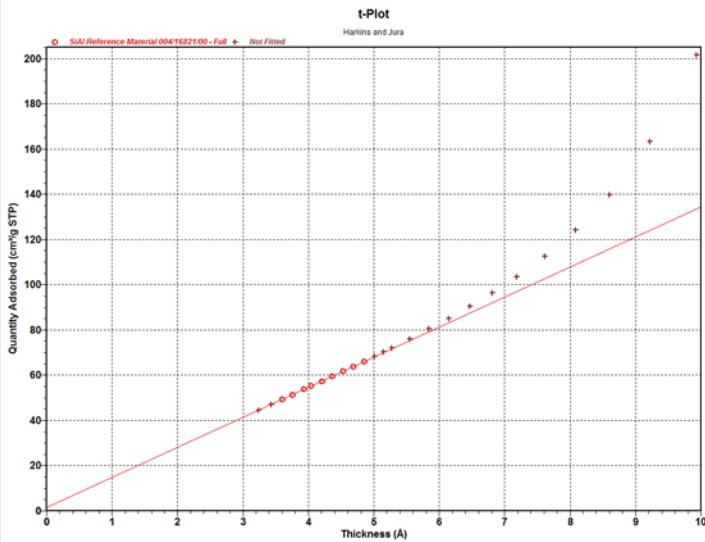
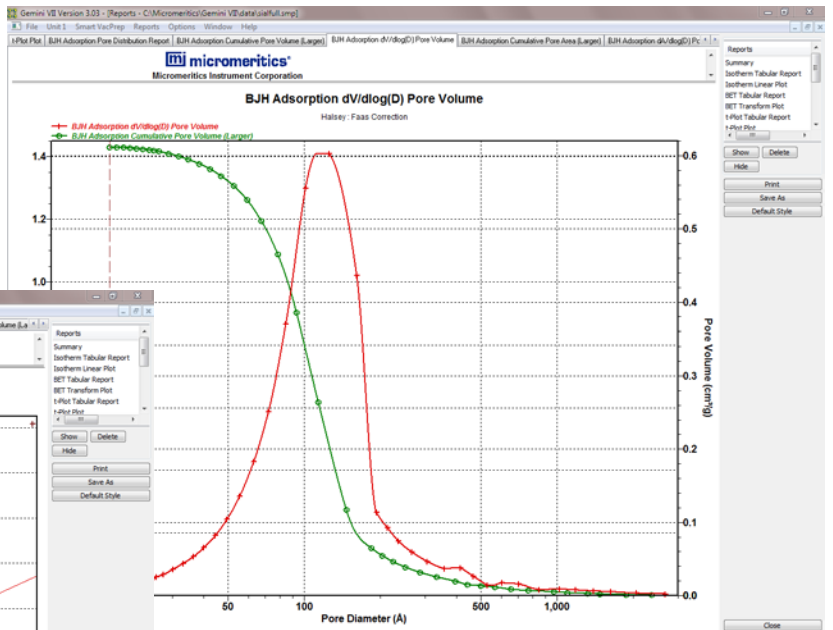
*BJH and Dollimore-Heal require the Gemini VII 2390t to take full advantage of pore size reports based upon the desorption isotherm

t-Plot Report

Micropore Volume: 0.002373 cm³/g
Micropore Area: 9.0366 m²/g
External Surface Area: 205.5550 m²/g
Slope: 13.289049 ± 0.036487 cm³/g Å STP
Y-Intercept: 1.534435 ± 0.153061 cm³/g STP
Correlation Coefficient: 0.999971
Surface Area Correction Factor: 1.000
Density Conversion Factor: 0.0015468
Total Surface Area (BET): 214.5918 m²/g
Thickness Range: 3.5000 Å to 5.0000 Å
Thickness Equation: Harkins and Jura

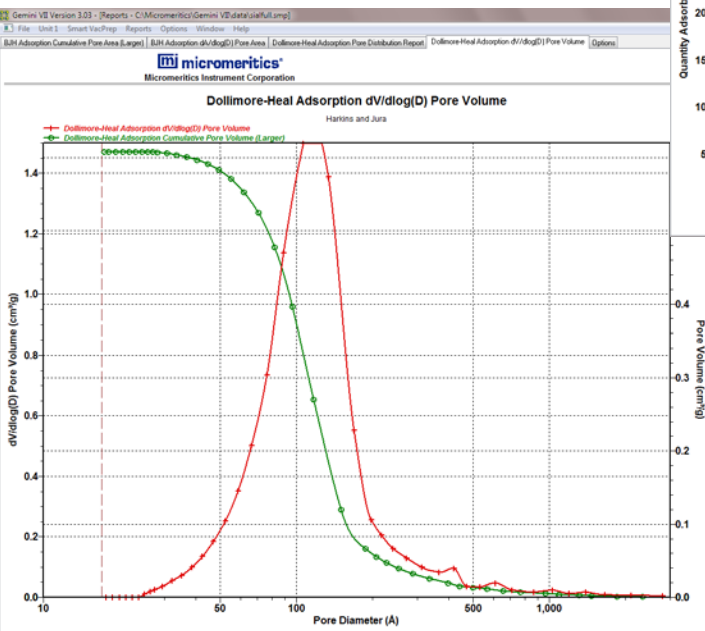
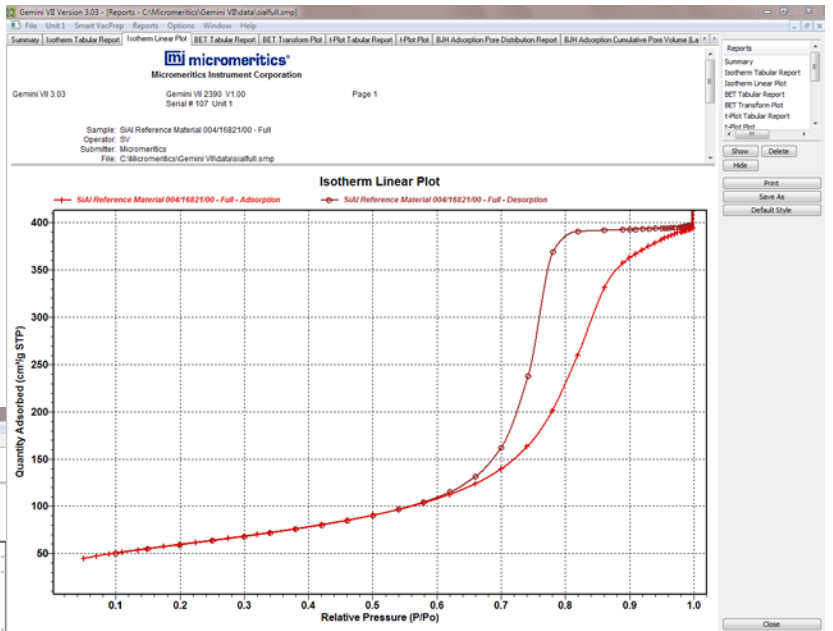
BET Report

BET Surface Area: 214.5918 ± 0.3290 m²/g
Slope: 0.020097 ± 0.000031 g/cm³ STP
Y-Intercept: 0.000186 ± 0.000005 g/cm³ STP
C: 108.916571
Qm: 49.3022 cm³/g STP
Correlation Coefficient: 0.9999907
Molecular Cross-Sectional Area: 0.1620 nm²



The Gemini VII 2390p includes a dedicated transducer for continuously monitoring the saturation pressure of the cryogenic bath. This allows the Gemini VII 2390p to rapidly measure adsorption isotherms and determine the pore volume, area, and size distribution of mesoporous materials.

The Gemini VII 2390 Series analyzers provide rapid surface area analysis. The unique balanced design allows BET surface area to be measured using nitrogen for a broad range of materials. The Gemini offers precise measurements of low surface area materials using nitrogen. The determination of micropore volume, micropore surface area, and external surface area is available on all Gemini models using the standard t-plot calculations.



The Gemini VII 2390t features extended operation to facilitate the determination of the total isotherm. Both adsorption and desorption measurements may be obtained; this allows users the capability to determine the pore volume, area, and size distributions using BJH or Dollimore–Heal reports.

Accessories

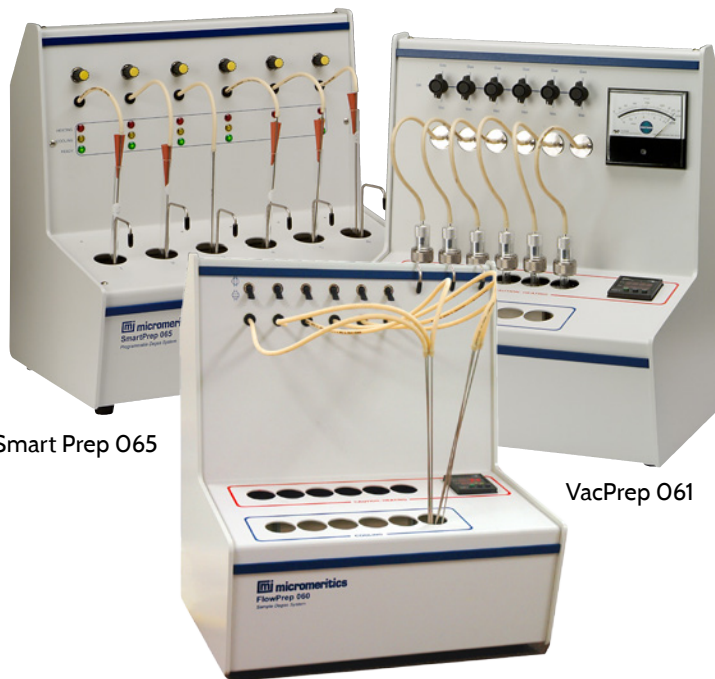
Sample Preparation Devices

Micromeritics offers numerous sample preparation devices for surface area and pore volume analysis. These devices combine flowing gas and/or vacuum with heat to remove atmospheric contaminants, such as water vapor and adsorbed gas, from the surface and pores of the sample. The quality of the data produced by surface area and pore volume analyses depends greatly on the cleanliness of the sample surface. All of Micromeritics sample preparation devices accept He, N₂, Ar, and other non-corrosive gases.

The SmartPrep™ O65 is a flowing-gas degassing unit which removes adsorbed contaminants from the surface and pores of your sample in preparation for analysis. It contains six sample ports, each one independently temperature-controlled for greater flexibility. It contains two serial ports, one for connecting to the computer and the other available for connection of an additional SmartPrep. The temperature, ramp rates, and soak times of each sample are individually controlled by the computer. Up to five ramps and soaks are allowed. All degas information is integrated into the sample data file for easy reference in the future.

The FlowPrep™ O60 applies both heat and a stream of inert gas to the sample. The heat causes contaminants to desorb from the surface and the stream of inert gas sweeps them out of the sample tube. The unit lets you choose the temperature, gas, and flow rate best suited for your sample material and application. Needle valves allow you to introduce the flowing gas slowly to prevent fluidization of samples.

The VacPrep™ O61 offers two methods for removing contaminants. In addition to flowing gas, it enables vacuum to be applied to prepare samples by heating and evacuation. This combination allows you to choose the preparation method that is best suited to your material or application. The VacPrep features six



Smart Prep O65

VacPrep O61

FlowPrep O60

degassing stations, and a choice of vacuum or gas flow preparation on each of the six stations. Needle valves are also provided allowing you to introduce slowly the flowing gas or vacuum to prevent fluidization of samples.

The Smart VacPrep™ O67 is an advanced six-port system that utilizes vacuum to prepare samples by heating and evacuation. Each of the ports may be operated independently. Samples may be added or removed from degas ports without disturbing the treatment of other samples undergoing preparation. Degassing automatically terminates when the samples have completed all programmed steps.



Smart VacPrep O67

Model O21 LN₂ Transfer System

The Model O21 LN₂ Transfer System allows you to transfer liquid nitrogen or liquid argon from a non-pressurized storage dewar into smaller containers used in laboratory experiments.

Additional accessories are available for special applications. Contact Micromeritics Sales Department for details. For more comprehensive information on the Gemini VII Series, visit our web site at www.micromeritics.com.



Model O21 LN₂ Transfer System

Specifications

Applicability

Surface Area	From 0.1 m ² , total; From 0.01 m ² /g, specific
Pore Volume	4 x 10 ⁻⁶ cm ³ /g

Pressure Measurement

Pressure Measurement Range	0 to 950 mm Hg
P/P₀ Resolution	<10 ⁻⁴
Relative Pressure Range	0 to 1.0 P/P ₀ (adsorption only)
Pressure Resolution	<0.1 mmHg
Accuracy and Linearity (transducer manufacturer's specification)	Better than ± 0.5% Full Scale

Environment

Temperature	10 to 35 °C (50 to 96 °F) operating; 0 to 50 °C (32 to 122 °F) non-operating
Humidity	20% to 80% relative, non-condensing

Gases

Adsorbate	Optimized for nitrogen in a liquid nitrogen sample bath; Gemini may be used with non-corrosive adsorbate gases having vapor pressures at both room and bath temperatures that are acceptably high relative to the resolution of the 1000-mmHg pressure transducer. Typically, oxygen, argon, carbon dioxide, butane, methane, and other light hydrocarbons will produce useful data above absolute pressures of a few mmHg. Helium inlet also provided
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Vacuum System

Vacuum source achieving 20 x 10⁻³ mmHg (or better) at the instrument inlet; having a device to reduce oil vapor backstreaming is recommended. The system must have an anti-suckback valve to prevent oil from being admitted into the Gemini should there be a power failure.

Sample Tube/Dewar

Standard Tube	Gemini VII 2390a and 2390p: 0.95 cm (3/8 in.) outside diameter by 15.5 cm (6.1 in) with 6.5 cm ³ of volume. Sample capacity is approximately 2.0 cm ³ Gemini VII 2390t: 0.95 cm (3/8 in) outside diameter by 20.5 cm (8.1 in.) with 8.9 cm ³ of volume. Sample capacity is approximately 2.0 cm ³
Dewar	~ 8 hours; Gemini VII 2390a and 2390p; ~ 24 hours; Gemini VII 2390t

Electrical

Voltage	85 to 265 VAC
Frequency	50/60 Hz
Power	150 VA, operating, max. plus vacuum pump

Computer Hardware and Software

Minimum Requirements	Windows® 7 Professional or higher operating system Memory: 512 megabytes of RAM Hard Disk Space: 20 gigabytes One CD ROM drive Monitor: 1024 x 768 display capability Ethernet port (capable of communicating with a 10 base-T card)
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Physical

Height	59 cm (23 in); Gemini VII 2390a and 2390p; 74 cm (29 in); Gemini VII 2390t
Width	40 cm (16 in)
Depth	51 cm (20 in)
Weight	32 kg (70 lbs); Gemini VII 2390a and 2390p; 35 kg (78 lbs); Gemini VII 2390t

**Due to continuous improvements, specifications are subject to change without notice.*



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To request a quote or additional product information, visit
micromeritics.com

Contact your local Micromeritics sales representative
or our Customer Service Department at
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