

QUANTACHROME

POREMASTER®

SERIES



Automated Mercury Porosimeters

Mercury Porosimetry

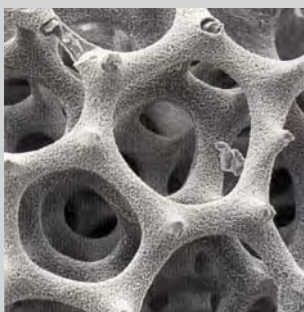
The operation of all mercury porosimeters is based upon the physical principle that a non-reactive, non-wetting liquid will not penetrate fine pores until sufficient pressure is applied to force its entry. The relationship between the applied pressure and the pore diameter into which mercury will intrude is given by the Washburn equation:

$$D = (-4\gamma \cos \theta)/P$$

where P is the applied pressure, D is the pore diameter, γ is the surface tension of the mercury (480 dyne cm^{-1}) and θ is the contact angle between mercury and the pore wall, usually taken as 140° . Monitoring mercury volume intruded as a function of pressure permits the generation of pore size/volume distributions from the Washburn equation.

Applications

Control of porosity in terms of pore volume, size and their distribution is important in hundreds of industries, products and processes. For more than 20 years, Quantachrome porosimeters have served quality control and research needs for characterization of materials such as catalysts, surgical implants, electrodes, ceramics and sintered metals, pharmaceuticals, membranes and many others. The widespread appeal of this technology owes much to the speed and high-resolution of the measurement and the broad pore size range that may be explored.



▲ Photomicrograph: Radiolaria

PoreMaster Overview

The PoreMaster Series of mercury porosimeters consists of four automated models: **PoreMaster 60** and **PoreMaster-60 GT** (*dual high-pressure*) which generates pressure to 60,000 psia for pore size analysis from 440 micron to 0.0036 micron pore diameter; and **PoreMaster 33** and **PoreMaster-33 GT** (*dual high-pressure*) which achieves a maximum pressure of 33,000 psia for study of pores in the range from 440 micron to 0.0064 micron pore diameter.

- Each model provides pore size, pore volume, bulk and apparent density, porosity, particle size and related properties.
- Each model includes two built-in low-pressure ports for filling of sample cells (penetrometers) and intrusion/extrusion measurements from vacuum to 50 psia.
- The **PoreMaster-60 GT** and **PoreMaster-33 GT** include two high-pressure ports in a patented single high-pressure cavity for **Greater Throughput**.
- High-pressure ports on all models operate in both continuous scanning or stepwise pressurization modes.
- Continuous scanning provides detail rich, high-resolution pore size data (up to 2,000 points) plus *Autospeed™* control for automatic adjustment of pressurization rate in response to individual sample characteristics. Stepwise pressurization

- provides lower resolution, but enables the system to stop and wait for user-selected time intervals to allow mercury to fully penetrate complex pore structures.

The **PoreMaster-33** and **PoreMaster-33 GT** are both fully upgradeable to 60,000 psia capability to meet your changing analytical needs.

- Obtain complete intrusion and extrusion data in as little as 10 minutes.

PoreMaster-60 and **-60 GT** include 1,500 and 60,000psia pressure transducers for higher accuracy across the analysis range.

Operation

The PoreMaster® Series was designed to yield excellent results for both experienced operators and those new to the technology.

- Easy-to-use penetrometers accommodate powders, pellets and bulk solids, minimizing the required sample cell inventory.
- Low-pressure stations can be programmed to simply evacuate and fill one or two penetrometers, or to perform complete low-pressure intrusion/extrusion analyses.
- At the click of a mouse, analytical sample parameters are automatically transferred from low- to high-pressure ports to eliminate transcription errors and increase productivity.

PoreMaster

PROGRAMMABLE • AUTOMATED



▲ PoreMaster GT

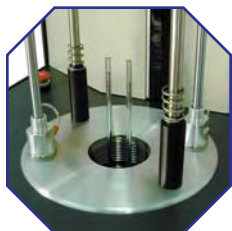
- Data is automatically acquired and displayed in real time. Data files are created and stored in user-selectable directories without user intervention.



▲ PoreMaster GT's Pneumatic Lift Assembly in elevated position

er® Series

OMATED • VERSATILE



▲ High-pressure cavity of the PoreMaster GT accommodates two samples.



▲ Penetrometers accommodate a wide range of sample sizes and geometries.



▲ Easily accessible low-pressure ports of the PoreMaster.

Safety

Safety is ensured with leading-edge technologies to eliminate any risk to the operator or environment.

- Dual safety interlocks on low-pressure ports prevent operation without cell retainer assembly.
- Software can be password-protected to limit access.
- Automated lift mechanism on **PoreMaster GT** series reduces risk of penetrometer breakage.
- Double-switch activated lift mechanism.
- Emergency stop easily accessible on front panel.
- Optional vent kit for interface to fume hood.
- Built-in cold trap prevents venting of mercury vapor.

Features & Benefits

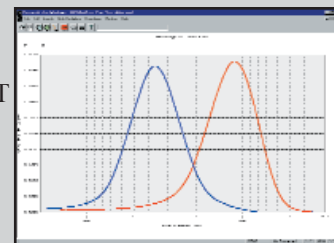
The PoreMaster Series is loaded with advanced features to ensure accuracy, operational convenience and rugged, reliable performance.

- Easy access to high-pressure cavity on all models for maintenance and cleanup.
- Computer-guided volume calibration ensures reliable data consistent with ISO 9000 and other quality standards.
- User-selectable data reduction parameters include mercury surface tension and contact angle for consistency with existing databases and research applications.
- Automated lift of **GT** cavity closure makes operation easy and reduces sealing thread wear.
- Status screen displays system conditions at a glance.
- Quiet high-pressure generator maintains a pleasant work environment.
- Automatic repeat intrusion/extrusion cycles for research on hysteresis phenomena.
- Simultaneous high- and low-pressure data acquisition for maximum productivity.
- Low- and high-pressure manual modes for troubleshooting and maintenance.
- Bench-mounted or floor-standing design to accommodate any lab.
- Automated oil-recirculation and filtration minimize consumption and disposal concerns while efficiently eliminating air from the hydraulic system.

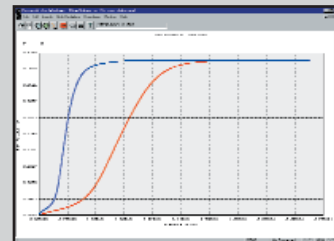
PoreMaster Software

The PoreMaster Series features state-of-the-art, computerized mercury porosimeters which operate in Windows® 95/98/2000/NT and XP environments.

The PoreMaster Data Reduction software provides the modern flexibility of programmable porosimetry; the convenience of stored analysis procedures; the efficiency of walk-away automation; instant feedback with display of the mercury intrusion/extrusion process on screen; and satisfaction of having a detailed printed report waiting for you when you return.



▲ Quantachrome offers a comprehensive data reduction and graphics program.



PoreMaster Data Reduction

PoreMaster Series instruments provide a comprehensive range of characterization models and methods in both graphical and tabular format, including:

- ✓ Cumulative pore volume versus pressure or pore diameter
- ✓ Cumulative surface area versus pressure or pore diameter
- ✓ Differential pore volume versus pressure or pore diameter
- ✓ Differential pore area versus pressure or pore diameter
- ✓ Pore number fraction versus pressure or pore diameter
- ✓ Particle size distribution (Mayer-Stowe and Smith-Stermer theories)
- ✓ Pore Tortuosity
- ✓ Permeability
- ✓ Throat/Pore Ratios
- ✓ Fractal Dimensions
- ✓ Statistics (mean, mode and median)
- ✓ Sample Compressibility
- ✓ Bulk and apparent density
- ✓ Percent porosity

Features & Benefits

- Low-pressure and high-pressure data files can be merged, printed and stored to automatically obtain a complete view of the pore size distribution from macropores down to the smallest mesopores.
- Convenient mercury density calculator computes mercury density over a wide range of temperatures for use in appropriate data reduction models.
- User-selectable data directories.
- Blank cell subtraction.
- Data reduction units may be presented in radius/diameter, Angstrom/nanometer/micron, and psia/Pascal.
- User-selectable colors for graph, intrusion/extrusion plots and markers, X and Y scaling, titles.