

**Thermo Fisher Scientific Surfer applies the principle of static volumetric gas adsorption (physical and chemical adsorption) under controlled conditions (temperature and pressure) to determine micro structural properties of solids and powders.**

## Thermo Scientific Surfer Gas Adsorption Porosimeter



### Surfer Degassing Unit

- Reduced bench space due to independent chassis degasser.
- Connectable to Surfer primary vacuum or to external vacuum system.
- Sample degasser with three stations up to 450°C with independent vacuum access and temperature control.
- Two valve system to evacuate safely very fine powders in the degasser.



Surfer will determine, depending on the configuration and the type of experiment, the following physical properties:

- Specific surface area ( $m^2/g$ ).
- Pore size distribution in the meso, micro, ultra-micro and extended mesopore ranges.
- Total pore volume ( $cc/g$ ).

Surfer is the ultimate solution for surface area determination.

The new Surfer features a number of unmatched advantages and features.

- Improved design of stainless steel manifold to reach unmatched vacuum degree over the sample thus permitting investigation on new ultra-micro porous materials.

- Temperature controlled cabinet by a P.I.D. device assures unmatched stability independently from environment variations.
- New gas injection system to introduce precisely extremely small as well as very large amount of adsorptive. The injection system does not add any dead volume to the system during the gas equilibration.
- New long lasting liquid coolant level control for best stabilization of the pressure in the system.
- Wide range of available configurations.
- Complete instrument control by a computer connected through LAN/COM ports.

## Product Specifications Thermo Scientific Surfer Analyzer

### Analytical capability

	Physisorption and Chemisorption capability
	One analysis port
	Three independent sample preparation ports

### Measurement ranges

Specific surface area:	0.01 m <sup>2</sup> /g and above (N <sub>2</sub> /77K); 0.0005 m <sup>2</sup> /g and above (Kr/77K), (depending on sample nature and instrument configuration)
Specific pore volume:	From 0.0001 cc/g
Pore size range:	0.32-500 nm in pore diameter (depending on calculation model and instrument configuration)

### Gas inlets

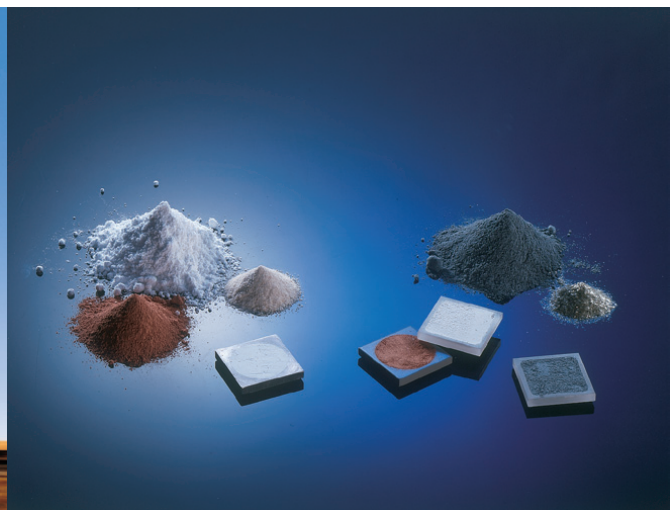
Adsorbate:	Four inlet ports automatically selectable
Inlet pressure:	Maximum inlet pressure 150 kPa
Accepted adsorbates:	N <sub>2</sub> , Ar, CO <sub>2</sub> , He, Kr, H <sub>2</sub> , O <sub>2</sub> , CO, CH <sub>4</sub> , light hydrocarbons, any non-condensing gas in the operating conditions

### Sample holders

Small size (about 10 cc), inlet diameter 8 mm (available with vacuum stopcock), medium size (about 15 cc), inlet diameter 8 mm (available with vacuum stopcock)

### Vacuum system: depending on Surfer configuration

Primary vacuum:	<ol style="list-style-type: none"> <li>1. Rotative double stage oil pump: final vacuum 4.5x10<sup>-3</sup> torr with active alumina filter</li> <li>2. Diaphragm dry pump: final vacuum 2.6 torr</li> <li>3. Optional: scroll dry pump (final vacuum 0.05 torr)</li> </ol>
Secondary vacuum:	<ol style="list-style-type: none"> <li>1. Turbo molecular drag pump: better than 1x10<sup>-5</sup> torr measured over the sample</li> <li>2. Turbo molecular pump: final vacuum 7.5x10<sup>-8</sup> torr measured over the pump</li> </ol>
Vacuum measurement:	<ol style="list-style-type: none"> <li>1. Micropirani: range from atmosphere to 1x10<sup>-5</sup> torr</li> <li>2. VMT 100: range from 0.75 torr to 7.5x10<sup>-4</sup> torr</li> </ol>
Filters:	Active alumina filter between vacuum pump and manifold (recommended in case of rotative oil pumps)



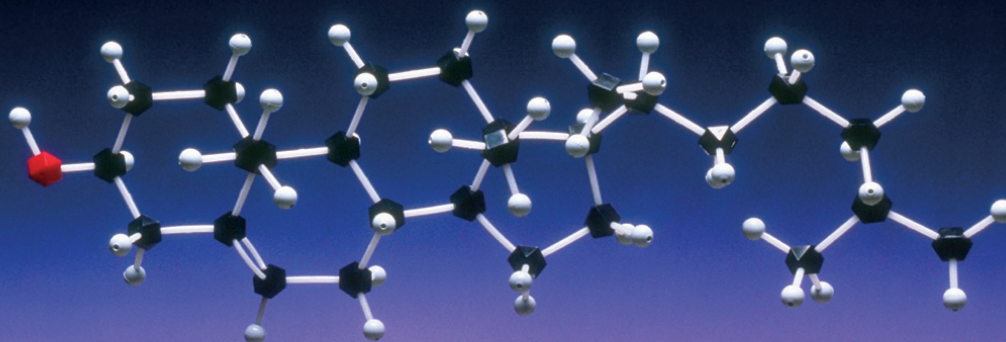
## Product Specifications Thermo Scientific Surfer Analyzer

### Temperature controlled zone

Cabinet:	Temperature controlled cabinet (enclosing manifold, tubing, pressure transducers) Typical temperature set point: 35.0°C Temperature stability: +/- 0.1°C Temperature sensor: PT100 Temperature reading resolution: 0.1°C Heating control: P.I.D. (proportional, integrative, derivative)
Manifold:	Temperature sensor: PT100 Temperature reading resolution: 0.01°C

### Pressure measurement

Injection transducer:	Absolute capacitive 1000 torr F.S., accuracy better than 0.25% of reading, maximum displayed resolution 0.0001 torr (optional 0.15% accuracy on reading)
Equilibrium transducers: (up to three depending on Surfer configuration)	<ol style="list-style-type: none"><li>1. Absolute capacitive 1000 torr FS, accuracy better than 0.25% of reading, maximum displayed resolution 0.0001 torr (optional 0.15% accuracy on reading)</li><li>2. Absolute capacitive 100 torr FS, accuracy 0.25% of reading, maximum displayed resolution 0.00001 torr</li><li>3. Absolute capacitive 10 torr FS, accuracy 0.25% of reading, maximum displayed resolution 0.000001 torr</li><li>4. Absolute capacitive 1 torr FS, accuracy 0.25% of reading, maximum displayed resolution 0.0000001 torr</li></ol>
Pressure range accuracy:	Built-in linearization and calibration procedures assure a pressure detection accuracy (combined errors) better than 0.1% on reading using standard transducers
Built-in A/D converter:	24 bit A/D converter, 8 digits resolution 12 bit A/D converter, 4 digits resolution
Saturation pressure:	Calibrated by atmospheric pressure sensor, resolution 0.1 torr, can be used with liquid nitrogen and liquid argon



## Product Specifications Thermo Scientific Surfer Analyzer

### Coolant system

Accepted coolants:	Liquid nitrogen and liquid argon with automatic level control. Automatic Dewar raising and lowering
Level control:	Measured by a level sensor. Level control +/- 50 micron from set point
Analysis Dewar capacity:	3 liters capacity spherical low evaporation rate Dewar
Lasting time:	Minimum 72 hours for liquid nitrogen (complete filling). Maximum lasting time depends on sample nature and Dewar ageing

### Physical

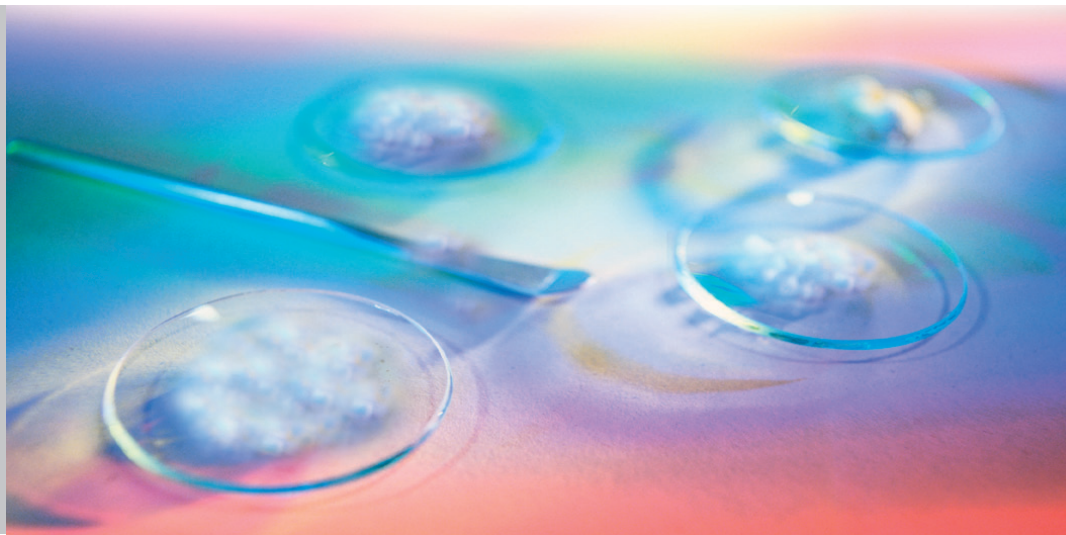
Power supply:	230 ~ V (+/- 10%) , 50-60 Hz, 1350 VA max
Dimensions:	70x50x107 (DxWxH)
Weight:	105 kg (packed 130 kg)
Environment:	15 - 30°C, 30 - 85% RH

## Thermo Scientific Surfer - Degasser

Degassing ports:	Three degassing ports with independent direct access to vacuum. Max vacuum degree depends on the vacuum system installed. Soft start vacuum generation prevents fine powder samples elutriation
Vacuum connection for degassing:	Degasser can be connected to the main vacuum source of Surfer or to an external and completely independent vacuum source.
Temperature:	From room temperature up to 450°C steps of 1°C
Accuracy:	+/- 1% of full scale temperature
Heating procedures:	Heating procedures: 1. ballistic ⇨ operates on two degassing stations 2. programmable rates from 1 to 10°C/min with multiple cycling ⇨ operates on a single station

### Physical

Power supply:	230 ~ V (+/- 10 %) , 50-60 Hz, 350 VA
Dimensions:	30x40x67 (DxWxH)
Weight:	23 kg (packed 43 kg)
Environment:	Temperature from 15 to 30°C, humidity from 30-85% RH



## Calculation Models for Surfer

### Standard Software

Main functions:	Instrument control, analytical parameters set up, isotherm display in real time, monitor data acquisition of pressures, temperatures and liquid level in function of time (all data can be saved in a separate text format file), basic calculations and reporting. Designed for Microsoft Windows XP/7
Specific surface area:	BET 2 parameters Dubinin-Radushkevich-Kaganer, Langmuir
Pore size distribution:	Barrett-Joyner-Halenda, Horvath-Kawazoe, Saito-Foley, NLDFT
Available graphs:	Isotherm Surface area Pore size distribution (histogram or derivative)
Available reports:	Different report types can be memorized in the software
Available data format:	Data can be exported as text or other electronic formats

### Advanced Data Processing Software

Main functions:	Encloses up-to-date calculation models for surface area and pore size determination. It also permits the creation of customized graphic formats to be enclosed directly in scientific publications. Designed for Microsoft Windows XP/7
Specific surface area:	BET 2 parameters BET full equation (3 parameters) with non linear regression function Langmuir model Dubinin-Radushkevich-Kaganer Excess Surface Work (ESW) model t-Plot alpha-Plot MP-Plot (Mikhail-Brunauer-Bodor)
Standard isotherms for t calculation:	Halsey, Fransil, Harkins-Jura, De Boer, Halenda, Lecloux, Hydroxylated silica, User defined standard
Mesopore size distribution:	Barrett-Joyner-Halenda, Dollimore-Heal, Cranston-Inkley Modelless method
Micropore size distribution:	Horvath-Kawazoe Saito-Foley Dubinin-Stoekli
Available potential functions:	Nitrogen – Graphite (@ 77K), Argon – Graphite (@ 77K, 87K), Carbon dioxide – Graphite (194K, 273K, 298K), Argon – Zeolite (@ 87K, 77K), Nitrogen – Zeolite (@ 77K), User defined
Chemisorption:	Subtraction procedure of isotherms for strong and weak chemisorption Back extrapolation to zero pressure for metal surface and dispersion calculation Langmuir model at variable exponent
Available graphs:	All calculations are applicable in graphic format. All graphs can be edited in almost all their components and exported in high resolution graphic file
Available reports:	Three main reports are available: summary, standard and extended. Each report type can be manually edited by the user

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