Anton Paar

Advanced High-Pressure **Gas Sorption Analyzer**

iSorb HP Series

iSorb HP:
Versatile.
Essential.
Safe.

The iSorb HP series offers four models to meet your needs
One- and two-sample configurations are available with a maximum pressure of 100 bar or 200 bar, respectively. All models include a built-in rotary oil vacuum pump (turbo vacuum pump is optional) and sample degassing capabilities. The single-station instrument uses four pressure transducers for precise measurements across the entire pressure range. The two-station instrument employs six transducers, enabling simultaneous measurements on two samples while maintaining high-pressure capabilities.

High-pressure gas sorption: A powerful tool for material characterization
The iSorb HP analyzers are essential for studying sorbent materials in a variety of applications, including carbon dioxide and methane sequestration, hydrogen storage, and gas separation.
These instruments provide accurate and reliable volumetric measurements, allowing you to record complete adsorption and desorption isotherms over a wide range of pressures and temperatures.

Sample handling and safety
For in-situ sample preparation, the instrument offers automated degassing capabilities. You can customize degassing parameters such as ramp rate, hold temperature, vacuum time, final temperature, and backfill conditions.
The iSorb HP series features stainless steel construction for safe operation. The PC software provides real-time pressure monitoring and alerts, ensuring safe sample manipulation.

→ Manifold Temperature: Precisely controlled between 30 °C and 50 °C (±0.02 °C) for accurate CO_2 isotherm measurements up to the maximum instrument pressure.

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Benefits:
Efficiency.
Precision.
Accuracy.

Exceptional range and capability: Analysis pressures from 0.1 mbar up to 200 bar.

Efficient use of gas supply: With optional booster.

Accurate pressure measurement: High-precision pressure transducers measure to within 0.05 % of full scale.

Increased sensitivity: Achieved by isolating the cell from the dosing volume.

Wide range of analysis temperatures: From below 20 K up to 773 K.

- ✓ **Flexibility:** A wide range of sample sizes and shapes, from powders to small monoliths, can be accommodated by choosing from four different cell sizes.
- ✓ **Efficient degassing:** Optional turbo-molecular pump creates pressures as low as 109 mbar for removing desorbed gas from microporous samples, even those with tortuous pore networks.
- ✓ **Precise adsorptive dosing:** Multi-point calibration of the dosing manifold volume and precise control of the its temperature create accurate volumetric dosing of the analysis gas, even at high pressures.
- ✓ **Leak-tight manifold and sample cells:** Metal-to-metal seals and pneumatic valves minimize cases of leaking and make accurate high-pressure measurements possible.
- ✓ **Maximum safety:** Numerous interlocks and safety features in software and the instrument ensure the safety of the operator, even when working at 200 bar.

Multi-gas ports
Optional additional gas inputs allow rapid switching of analysis gas between measurements without disconnecting and reconnecting each time.

Thermostat bath
Circulator option provides precise control of temperature at the sample cell – maintained by the iSorb HP directly communicating with the bath circulator.

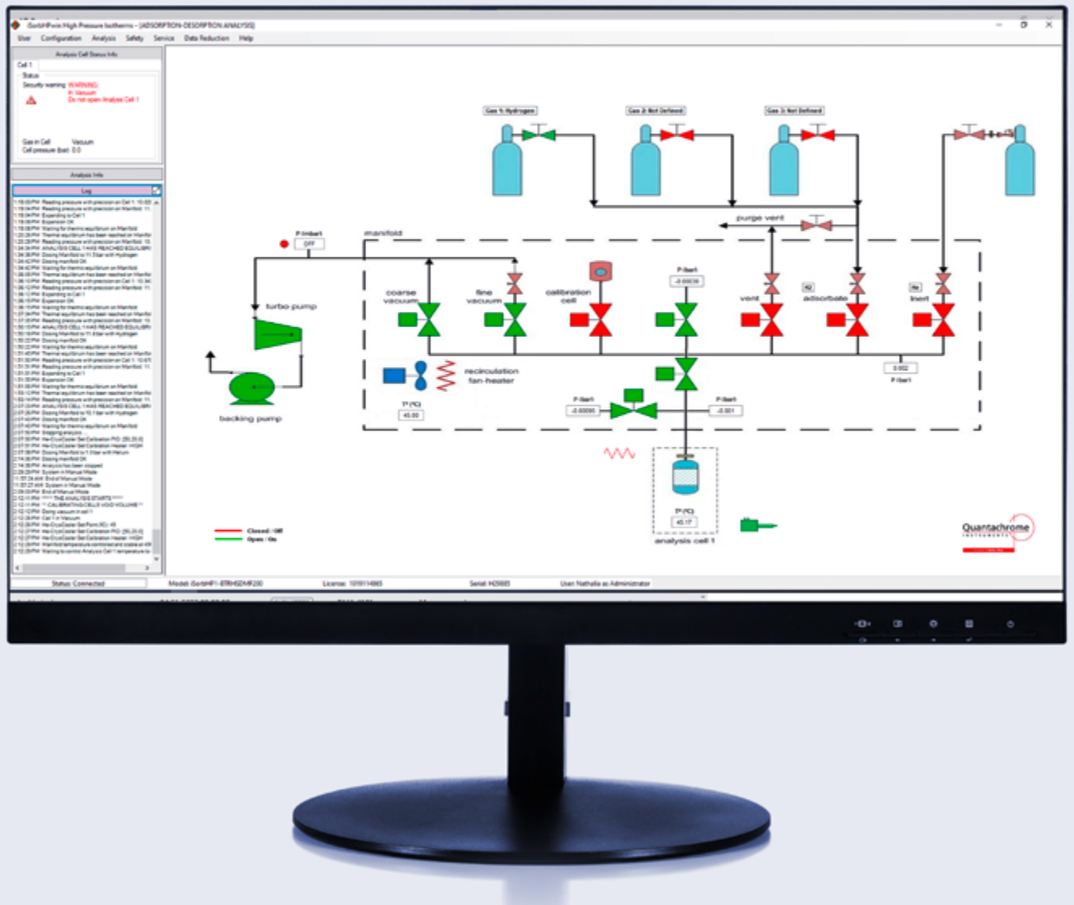
Sample preparation
Removing previously adsorbed gases and vapors from the sample is done in the analysis cell, and can be done directly on the iSorb HP or on external equipment.

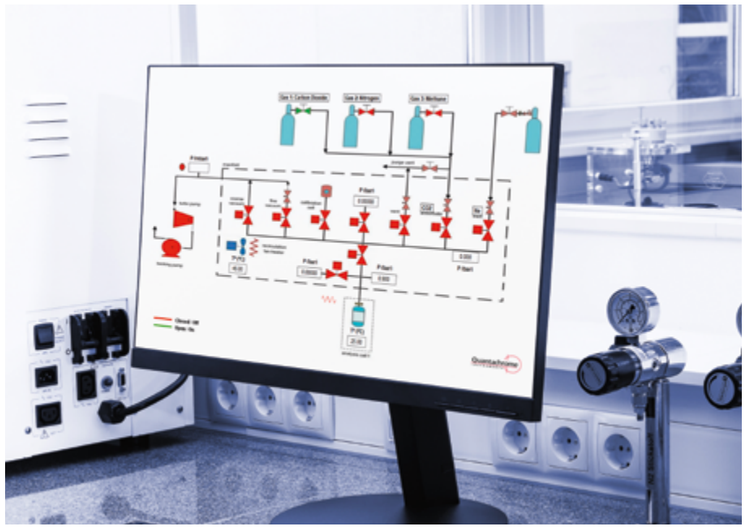
Cryogenics
Liquid nitrogen temperature measurements can be fully automated using a large capacity Dewar, electronic level sensing, and fill control valve.

Let the Software Guide You

Use the powerful software to customize your application-specific measurement conditions. Define temperature, pressure range, number of data points, and equilibrium settings according to adsorption and desorption kinetics. Watch the data acquisition in real time.

- → Data analysis using the built-in methods library assures accurate calculations of the true adsorbed amounts from the experimental ‘surface excess’ values. Choose from up to seven equations of state that correct non-ideal gas behavior according to gas type and the relationship between density and temperature plus pressure.
- → Overlay and compare different isotherms to calculate the heat of adsorption/desorption from multiple isotherms measured at different temperatures using the isosteric thermodynamics feature.
- → Report hydrogen isotherms as pressure-composition-temperature (PCT) plots and calculate kinetics of hydride formation and decomposition.





Effective for Energy, Environment, and Emerging Technologies

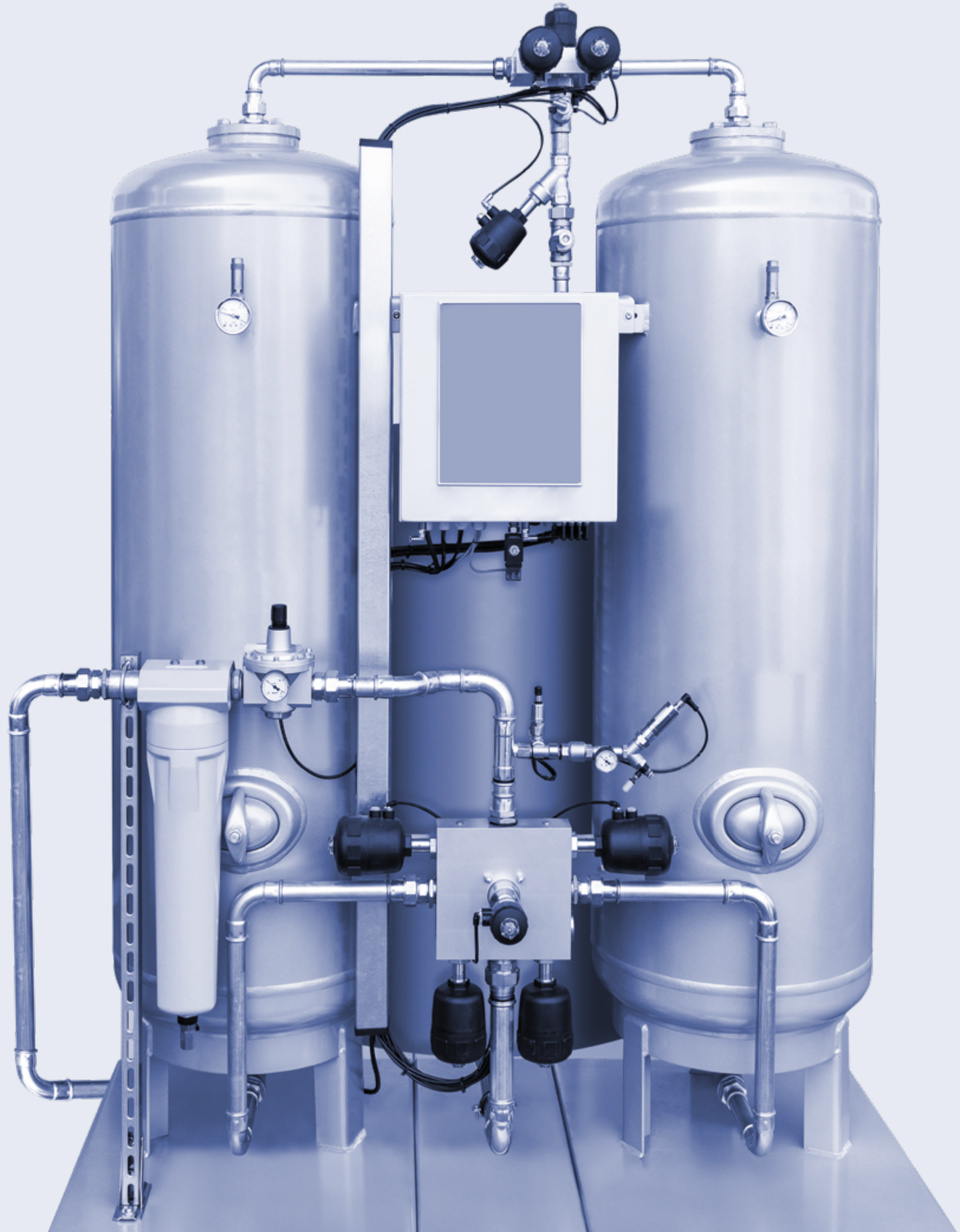
Hydrogen storage
Research new materials for transportation solutions, and benefit from more gas stored in a smaller volume! Easily measure adsorbed amounts at sub-ambient, even cryogenic temperatures.

CO_2 capture
Optimize conditions for maximum CO_2 removal and sequestration by porous materials such as activated carbons, zeolites, and metal organic frameworks.

Metal hydrides
Discover the formation and decomposition pressures and kinetics of the bulk solid reaction between hydrogen and certain metal alloys when researching hydrogen storage.

Gas separation
Compare and contrast adsorption capacities and thermodynamics for different gases. Generate fundamental data for process scale-up from bench to pilot plant.

Adsorbents
Undertake original research in materials synthesis and development for gas-solid interactions over the widest range of temperatures and pressures.



iSorb HP options

Several optional accessories are available for the iSorb HP1 and iSorb HP2 analyzers. Such accessories increase flexibility and enable the instrument to be tailored to the needs and applications of your individual laboratory.

CryoCooler Option
The CryoCooler is a self-contained refrigeration system, which can maintain the sample cell temperature in the range of 20 K to 320 K maintained within ±0.1 K. These wide temperature ranges allow for surface area analysis at cryogenic temperatures, as well as super-critical analyses at higher temperatures. It is ideally suited for obtaining several isotherms at closely spaced temperatures when studying the heats of adsorption of a sample. The CryoCooler is completely cryogen-free, thus reducing cost of operation where liquefied gases are not readily available.

Recirculator Options
Precise control of the sample temperature is essential for accurate data, especially when working close to the critical point of the adsorptive gas. Recirculators are the most common method of regulating the sample temperature. They are completely software-controlled, ensuring unattended operation at temperatures from -20 °C up to +180 °C, maintained within ±0.01 °C.

Pressure Booster Option
When working at pressures up to 200 bar, the pressure in the gas tank will quickly drop below the maximum working pressure. In order to extend the life of gas tanks and provide sufficient pressure of analyses up to 200 bar, a booster option is available. It is strongly recommended for 200 bar systems and can also be used with 100 bar analyzers.

77 K Temperature Control Option
This accessory consists of a sample Dewar, a 60 L self-pressurized supply Dewar, LN_2 level sensor, and insulated supply lines. The software automatically maintains the LN_2 level in the sample Dewar by adding small amounts of LN_2 from the supply Dewar as needed.

Process Kinetics Option
When studying processes, such as hydride formation/decomposition, large amounts of gas can be required/ released. This option includes an expansion chamber and special cell with isolation valve.

Reliable.
Compliant.
Qualified.

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	HP1 ↓		**HP2** ↓	
Standard methods	ASTM D86 (Group 0, 1, 2, 3, 4), ASTM D850, ASTM D1078, EN ISO 3405 (Group 0, 1, 2, 3, 4), IP 123, IP 195, JIS K 2254, GOST 2177, ASTM D524, ASTM D4530		ASTM D86 (Group 0, 1, 2, 3, 4), EN ISO 3405 (Group 0, 1, 2, 3, 4), IP 123, JIS K 2254, GOST 2177	
Measurement principle	Manometric (vacuum-volumetric) gas sorption			
Number of analysis stations	1		2	
Maximum pressure data	100 bar	200 bar	100 bar	200 bar
Low-pressure transducers	2 (1 bar)		3 (1 bar)	
High-pressure transducers	2 (100 bar)	2 (200 bar)	3 (100 bar)	3 (200 bar)
Transducer accuracy	<±0.05 % full scale			
Minimum pressure data	0.0005 bar			
Vacuum pump	Internal oil pump			
Minimum pump	5 x 10^{-3} mbar			
Degas type	In situ, automated ramp rate and hold time with optional turbo pump for degassing			
Analysis temperature range	-253.15 °C to 500 °C			
Analysis temperature (with heating mantle)	100 °C to 500 °C			
Analysis temperature (with Recirculator)	-20 °C to 180 °C			
Analysis temperature (with CryoCooler)	-253.15 °C to 46.85 °C			
Manifold temperature control	30 °C to 50 °C, ±0.02 °C			
Gas inputs	4 (with Multi-Gas Port Option)			
Width	850 mm (33.5 in.)			
Height	1,000 mm (39.25 in.)			
Depth	505 mm (19.5 in.)			
Weight	150 kg (330 lbs.)			
Electrical	220 to 240 VAC, 50/60 Hz, single phase | 110 to 115 VAC, 50/60 Hz, single phase			
Environmental	Temperature between 10 °C to 35 °C | relative humidity from 0 % to 95 %			
Controller	PC with Windows 7 or newer, USB port			
Valve drive gas	Compressed air or nitrogen at 7 bar, dry, free of particles >0.2 µm			
Helium for void volume	99.999 % pure, regulated to about 10 bar			
Analysis gas	99.999 % pure, regulated to maximum analysis pressure or 55 bar if using optional Pressure Booster Option			

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