



Laboratory density and
sound velocity meter

Perfection. In every detail.

Fueled by its uncontested market leadership in the field of digital density meters, Anton Paar's forward-looking philosophy has now set a serious milestone in the history of U-tube technology. Applying the patented Pulsed Excitation Method results in the first-ever digital density meter with a repeatability up to the 7th digit. In DSA 5000 M, the most precise density measurement in the world now teams up with the latest sound velocity measurement technology, both reflecting perfection in every detail.

DSA 5000 M measures density and sound velocity in one setup, at the same time, and under the same conditions. This makes it the best choice for special applications such as sulfuric acid. It is the only way to measure H₂SO₄ in the full concentration range with one and the same setup. It is also the only way to measure sound velocity and density with one single instrument: Researchers profit from the time-saving possibility to measure two parameters in one go. R&D teams in countless industries already rely on the efficiency, accuracy, and stability of DSA 5000 M.

Its performance, especially when paired with an automated sample changer, also makes it the fastest way to determine the concentration of binary and even ternary mixtures. Whenever it comes to efficiency and high throughput in quality control, DSA 5000 M asserts itself as an inevitable supplement to a classic titrator.

R&D

Two parameters in one instrument

The most accurate results for high-end research

Density and sound velocity are important parameters for the characterization of new formulations. The highly sensitive measurements of density and sound velocity by DSA 5000 M allow investigations into phase transitions, i.e. denaturation (for example of lipids, polysaccharides, proteins, insulin, etc.). With its wide temperature range, and the possibility to change temperatures quickly, it's the most convenient way to carry out thermodynamic studies on e.g. fuels, solvents, or ionic liquids.

H₂SO₄

Full concentration range in just one setup

From 0 % to 114 % in 2 minutes

With DSA 5000 M, it's not necessary to change the measurement setup for different concentrations of sulfuric acid and oleum. Only 3.5 mL of sample are required for one measurement, reducing the handling of the dangerous chemicals to a minimum. Consumables for dilution are not required. Users also appreciate the non-destructive analysis and elimination of any potential human errors.

Various chemicals

The shortest measuring times available

Unparalleled efficiency in quality control

Measuring times of a maximum of 4 minutes and a throughput of up to 30 samples per hour make DSA 5000 M the instrument of choice for efficient quality control of various chemicals. At just one push of a button, it displays three results (density, sound velocity, concentration). DSA 5000 M is commonly used for inks, paints, phosphoric acid, and ternary solutions such as formaldehyde and methanol. Typical application fields can be found in the semiconductor, petroleum, pharmaceutical, fertilizer, food, and cosmetics industries.



Excellent features. Excellent results.

New measuring method and cell design

DSA 5000 M measures density with the new patented Pulsed Excitation Method that leads to:

- the most accurate density results ever
- the highest repeatability and reproducibility you can get
- the most effective viscosity correction ever
- additional measurement of the sample's viscosity
- more sensitive detection of gas bubbles or particles in the sample by FillingCheck™
- no temperature-dependent measurement errors or drifts due to ThermoBalance™
- steady condition monitoring to make sure results are not affected by external influences

The updated sound velocity cell is CNC-machined in one piece, resulting in the highest ever pressure resistance (up to 8 bar). It also enables measurements in an unbeatable temperature range of 0 °C to 100 °C.

Viscosity correction: Stable results for samples of any viscosity

Across the entire viscosity range of samples, the automatic viscosity correction eliminates viscosity-related errors in density measurements twice as effectively as ever before, leading to the highest repeatability available, allowing you to detect deviations in the production and react immediately to minimize downtimes. The viscosity correction in DSA 5000 M is calibrated ex-factory so it is not necessary to invest in calibration and expensive standards.

Bubble-free filling for accurate results with FillingCheck™ and U-View™

To make sure results are not distorted by filling errors, DSA 5000 M comes with two features to check that samples are filled correctly. FillingCheck™ detects filling errors fully automatically and in real-time, and gives a warning in case the filled sample contains bubbles or particles. The U-View™ camera displays high-resolution live images of the filled U-tube. The images are also stored and printed together with the measuring results.



Accurate results at up to 100 °C with ThermoBalance™

DSA 5000 M uses a reference oscillator in the density measuring cell to reach the highest precision up to the 7th digit at temperatures between 0 °C and 100 °C. Temperature-related fluctuations of the glass tube are eliminated, even after years of operation. This makes DSA 5000 M particularly useful for thermodynamic studies with frequently changing measuring temperatures and routine quality control with changing sample temperatures.

Condition monitoring: Precision in any environment

The conditions inside the measuring cells are constantly monitored and kept in-spec. This ensures that results are accurate and repeatable even under varying conditions such as humidity, changes in room temperature and air pressure, or filling styles of different users.

Additional modules and automation

DSA 5000 M can be equipped with measuring modules for viscosity, optical rotation, refractive index, pH and turbidity. To allow for high sample throughput, it can be extended with different sample changers from Anton Paar's Xsample series. They cover several automation degrees – from just filling to automated filling, measuring, and cleaning. Xsample sample changers conduct up to 71 measurements in a row and handle sample viscosities of up to 36,000 mPa.s.

Large touchscreen for a premium user experience

The PCAP touchscreen technology ensures smooth operation of DSA 5000 M. On the one hand, it is sensitive enough to recognize touches even when users are wearing gloves. On the other hand, the screen is robust enough to withstand shocks and sample spillage. Adaptable font sizes and the screen diagonal of 10.4" make results easily readable, even from a distance.

One instrument. Two unique measuring systems.

Density

The sample is introduced into a U-shaped tube made from borosilicate glass that is excited to oscillate at its characteristic frequency which is directly related to the density of the sample. After reaching a stable oscillation, the excitation is switched off and the oscillation fades out freely. This excitation and fade-out pattern is repeated continuously (patented Pulsed Excitation Method). By evaluating this pattern, highly precise density results are obtained, the effects of viscosity compensated, the sample's viscosity is even measured and air bubbles or particles are detected.



Temperature regulation

By means of Peltier technology, highly precise temperature regulation of both measuring cells makes sure that both results are obtained under the same physical conditions.

FillingCheck™

The quality of the measured results is ensured by the FillingCheck™ feature, which automatically detects filling problems such as bubbles or particles in both measuring cells.

Sound velocity

A piezoelectric actuator sends out ultrasonic pulses that travel through the sample. Because the sample is filled in a cell with known length, the travel distance is also known. A second piezoelectric element detects the sound pulse so the time the ultrasonic waves need to travel through the samples can be measured. The sound velocity (m/s) is then simply calculated by the relation of distance (m) to time (s).

Specifications

Measuring range

Density	0 g/cm ³ to 3 g/cm ³
Sound velocity	1000 m/s to 2000 m/s
Viscosity	10 to 3000 mPa.s
Temperature	0 °C to 100 °C (32 °F to 212 °F)
Pressure	0 bar to 8 bar (0 psi to 116 psi)

Repeatability s.d. *

Density	0.000001 g/cm ³
Sound velocity	0.1 m/s
Temperature	0.001 °C (0.002 °F)

Reproducibility s.d. *

Density	0.000005 g/cm ³
Sound velocity	0.5 m/s

Accuracy **

Density	0.000007 g/cm ³
Dynamic Viscosity***	5 %
Temperature	0.01 °C (0.02 °F)
Sulfuric acid & oleum	0 % to 100 % H ₂ SO ₄ : 0.02 % H ₂ SO ₄ 0 % to 28 % free SO ₃ : 0.04 % free SO ₃ 28 % to 65 % free SO ₃ : 0.1 % free SO ₃

Resolution

Density	0.000001 g/cm ³
Sound velocity	0.01 m/s
Viscosity	0.1 %
Temperature	0.001 °C

Patents

granted	AT 516420 (B1) AT 517082 (B1)
pending	AT 517486 (A1)

Features

USPs	U-View™, FillingCheck™, ThermoBalance™, Full range viscosity correction
Special functions	QM compliance, temperature scan, built-in pressure sensor, condition monitoring, adjustment at high viscosity
Automation	Automatic sample changers
Modularity	Measurement of viscosity, pH, refractive index, turbidity, optical rotation

Technical data

Predefined tables and customer functions	ethanol tables extract/sugar tables acid/base tables
Data memory	1000 measuring results (ring buffer option)
Power supply	AC 100 V to 240 V; 50 to 60 Hz; 190 VA
Required sample per measurement	approx. 3.5 mL
Measuring time per sample	1 minute to 4 minutes
Display	10.4 in, TFT PCAP touchscreen 640 px x 480 px
Input options	Touchscreen, optional keyboard, mouse, and bar code reader
Materials in contact with the sample	PTFE, borosilicate glass, stainless steel DIN 1.4539/UNS N08904, HTL 5 CR
Dimensions	495 mm x 330 mm x 230 mm (19.5 in x 13 in x 9.1 in)
Weight	22.5 kg (49.6 lbs)
Interfaces	4 x USB (2.0 full speed), 1 x Ethernet (100 Mbit), 1 x CAN Bus, 1 x RS-232, 1 x VGA

* according to ISO 5725

** under ideal conditions and for low densities/viscosities

*** for newtonian fluids only

