



Anton Paar

Density and Concentration Meters Generation M

DMA 4100/4500/5000 M

::: Unique Density & Concentration Meters



Vibrant Leadership since 1967

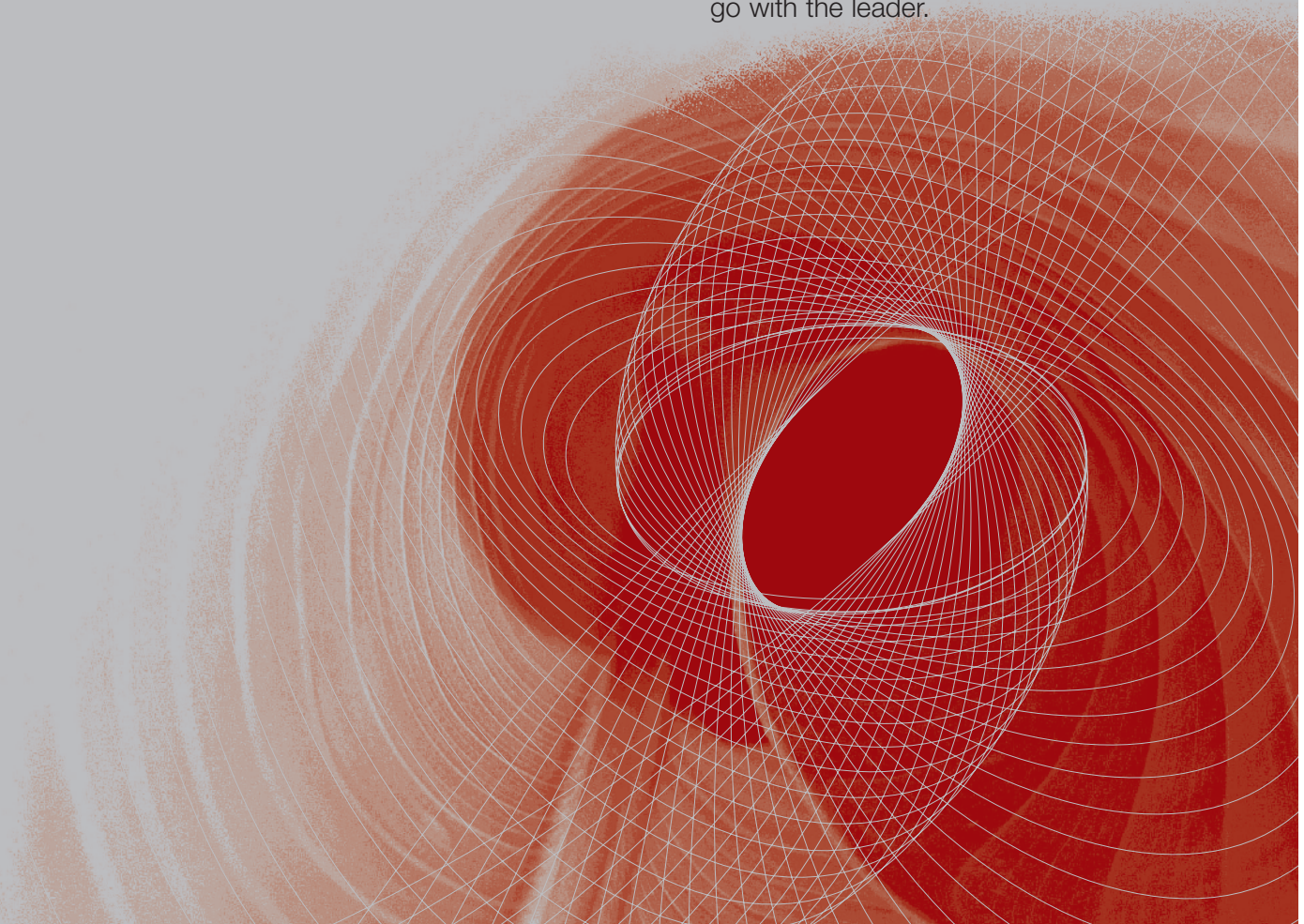
It all started in 1967: Anton Paar launched the first digital density meter with an oscillating U-tube sensor, marking a turning point for density measurement by replacing old-fashioned hydrometers and pycnometers. Hans Stabinger and Hans Leopold, two renowned Austrian scientists, invented the principle and developed the prototypes, and Ulrich Santner, then head of Anton Paar, took over production: The first DMA density meter was born.

Since then Anton Paar has gained the reputation of being a first-rate partner for industry and research. The company's continuous focus on the development of innovative products famous for their high precision and efficiency has made Anton Paar the world leader in density and concentration measurement. At the same time an outstanding sales, service and application support network has been established.

Continuously advanced generations of the famously robust DMA density meters became available, developed in cooperation with Labor für Messtechnik Dr. Hans Stabinger GmbH. The current models provide a patented reference oscillator (AT 399051), a built-in high-precision platinum thermometer and full-range viscosity correction.

The new Generation M density meters combine the DMAs' known excellent measuring capabilities with unparalleled levels of user confidence and comfort. A host of new features provides complete confidence in the sample filling and measurement process and therefore in the quality of the measurement results.

From groundbreaking innovation in 1967 to the latest Generation M, Anton Paar always exercises vibrant leadership in digital density measurement. Be sure to go with the leader.


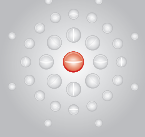








Results of Worldwide Value

Industry	Statement	Use
Beverages	“DMA has been established in our industry for years.”	<ul style="list-style-type: none"> ▶ Determination of sugar content (g/L, °Brix), alcohol content (%v/v, °Proof) ▶ Determination of extract content (°Plato, °Balling) ▶ Beer quality control ▶ Quality control of soft drinks (°Brix)
Pharma & Cosmetics	“DMA complies with our quality guidelines.”	<ul style="list-style-type: none"> ▶ Quality control of raw materials and final products ▶ Determination of specific gravity and density (g/cm³, g/mL) of medicinal formulations ▶ Filling volume determination
Petroleum	“DMA is absolutely ideal for our highly viscous samples.”	<ul style="list-style-type: none"> ▶ Quality control of raw materials and final products (API, kg/m³) ▶ Quality control of additives ▶ Blending checks
Flavors & Fragrances	“Small sample volume requirements are ideal for us, of course.”	<ul style="list-style-type: none"> ▶ Quality control of raw materials and final products (g/cm³) ▶ Specification checks ▶ Filling volume determination
Chemicals	“DMA is astoundingly resistant - an absolute must for our industry.”	<ul style="list-style-type: none"> ▶ Quality control of raw materials (°Baumé, g/cm³, kg/m³) and final products ▶ Concentration determination of acids and bases (%w/w, %m/m, mol/L) ▶ Solids content determination of dispersions ▶ Reaction process control
Research and Development	“The temperature scan saves us a lot of time.”	<ul style="list-style-type: none"> ▶ Determination of partial specific volume ▶ Determination of density gradient for ultracentrifuging ▶ Density/temperature profile ▶ Determination of molarity (mol/L) and normality (N)
Calibration Offices, Testing Agencies	“We have been using DMA for more than twenty years.”	<ul style="list-style-type: none"> ▶ Determination of alcohol content (%v/v, °Proof) for fiscal reasons ▶ Filling volume determination ▶ Stability monitoring of density standards
Biofuels	“In short: optimal quality control for an optimal product.”	<ul style="list-style-type: none"> ▶ Quality control of raw materials and final products ▶ Production control (%v/v, °Proof, g/cm³) ▶ Blending checks

DMA is also used in the food industry, semiconductor industry, biotechnology, plastics industry, automotive industry

Countless analytical methods prevail in today's quality and production control: One of the easiest, fastest and most significant is density measurement. It requires very little sample, does not change the sample's composition and consumes no chemicals. Density measurement determines concentrations from 0 % to 100 % with the utmost precision and allows you to always offer first-rate product quality.

Description	Standards	
Anton Paar's long standing experience as a measuring specialist for the beverage industry (soft drinks, beer, spirits, etc.) and the highly precise results DMA delivers in next to no time have established it as the benchmark for this field.	<ul style="list-style-type: none"> ▶ AOAC, international ▶ OIV, international ▶ ASBC, TTB (USA) ▶ MEBAK, EBC international 	
DMA meets the strict regulations in the pharmaceutical and cosmetic industries – with electronic signatures, various user levels and internal write protection.	<ul style="list-style-type: none"> ▶ European and US Pharmacopoeia ▶ 21CFR part 11 ▶ cGLP/GMP 	
A thorough, fast viscosity correction and a measuring range up to 90 °C make DMA the perfect density meter for highly viscous samples such as bitumen, heavy fuel oil, or crude oil.	<ul style="list-style-type: none"> ▶ DIN 51757, ISO 12185 ▶ ASTM D 1250, ASTM D 4052, ASTM D 5002, ASTM D 5931 	
Since DMA only requires a minimal amount of expensive sample for its density measurement in order to deliver highly precise results after very short measuring times, the instrument is highly valued in the flavors & fragrances industry.		
DMA is renowned worldwide for its robustness. The chemical industry relies on it. Apart from this, all common density/concentration tables are stored in the instrument, and new substances are easily programmed as a table or a polynomial. The use of DMA has considerably reduced the workload in the chemical industry.	<ul style="list-style-type: none"> ▶ ISO 2811-3, ISO 15212 	
The main reasons for R&D departments to choose DMA are the great accuracy, the small sample volume requirement and the temperature scan by means of the reference oscillator: The automatic temperature change right down to one-hundredth-steps guarantees easy, time-saving work.	<ul style="list-style-type: none"> ▶ ISO 15212 	
With density measurement results as accurate as up to $\pm 5 \times 10^{-6} \text{ g/cm}^3$, a temperature accuracy of $\pm 0.01 \text{ }^\circ\text{C}$ and a sample volume requirement of only 1 mL, DMA is the high-precision reference instrument with the least sample consumption for calibration offices.	<ul style="list-style-type: none"> ▶ AOAC, international ▶ OIV, international ▶ ASBC, TTB (USA) ▶ HM Customs and Excise (GB) 	
Bioethanol producers use DMA because its unprecedented accuracy assures considerable savings. The biodiesel industry chooses the instrument for its robustness and thorough, fast viscosity correction.	<ul style="list-style-type: none"> ▶ EN 14214, ISO 12185 ▶ ASTM D 4806, ASTM D 4052 	

ry, battery production.



Generation M – A Step Ahead

Imagine a density meter that you can be sure about. Be sure that the sample is filled correctly, the measurement is performed to the highest standards and the results leave no room for doubt. With Generation M, Anton Paar continues its leadership in providing the most accurate digital density meters on the market.

Generation M density meters embody decades of experience. They build on the robust design and renowned features of past DMA generations: the integrated reference oscillator, built-in high precision platinum thermometer, and full-range viscosity correction. Generation M features all of this – and more.

These new features of Generation M provide complete confidence in the sample filling and measurement process and therefore in the outstanding quality of the measurement results:

FillingCheck™: Your density meter automatically detects filling errors or bubbles in the sample, alerts you and documents the incident. You can be sure of correct sample filling, whatever the conditions.

U-View™: Check the sample filling process on screen or recall stored images of the entire filled-in sample any time later. The stored images allow you to later verify correct sample filling and measurements, particularly when using automatic sampling systems. So you can safely walk away and let the instrument do the work.

ThermoBalance™ eliminates the need for multi-temperature calibrations and allows you to quickly perform accurate measurements at very different temperatures. It compensates for drifts due to temperature stress, even when filling samples at temperatures very different from the measuring temperature, and provides stable readings over extended periods of time. Generation M density meters are the only instruments to provide you with all of these capabilities.

Compliance: Generation M fully complies with 21 CFR Part 11 and cGLP/GMP requirements. All adjustments, measurement results and reports are completely protected. Reports can be electronically signed. You can export measuring and adjustment data including date and time, serial number, user name, sample identification and other vital information.





The following features of Generation M density meters provide you with the highest levels of comfort and ease of use:

User-friendliness: The easy-to-use touchscreen allows you to perform your tasks quickly and efficiently. Save time with the favorites button to access your most frequently needed menu functions. Assign different user levels to prevent any accidental changes. Symbols on the screen show you vital information, such as measurements in progress, **FillingCheck™** alerts and the current status of an automatic sample changer.

Adaptable configurations: Use the function keys below the touchscreen, a mouse or an external keyboard if you are working in a harsh environment. Enter sample identifications through a keyboard, a bar code reader, or via other means. Connect a large PC monitor or touchscreen to read the results or operate the instrument from afar. Choose from common density units such as g/cm^3 , kg/m^3 , pound/gallon and employ "customer tables" to calculate concentrations in units such as %w/w, %m/m.

Automatic air adjustments: Rest assured that the local air pressure for air adjustments is correctly accounted for.

Convenient data handling: Store your results in the instrument for as long as you want, and use the various interfaces for data export via memory stick, printer or Ethernet services. Reports are provided in popular formats such as PDF, TXT and XLS.

Plug & play sample changers: Space-saving automatic sample changers manage sample viscosities up to 35,000 mPa.s. Select an automatic sample changer according to the characteristics of your samples, plug it in and the density meter automatically recognizes it. Measure large numbers of samples automatically and perform your other important tasks while the instrument works for you. **FillingCheck™** will alert you if any problem has occurred, while **U-View™** allows you to verify results at a later time.

Five Steps to Success

(1) Select method:

Select the desired measuring method. There are ten industry-specific methods provided which can be adapted to your specific needs. When selecting a different method leads to a change in measuring temperature, **ThermoBalance™** achieves stable readings in minimal time.

(2) Enter sample identification:

Enter a sample name or number via touchscreen or a connected keyboard or bar code reader. You can pre-configure the sample list before carrying out measurement series, particularly when using an automatic sample changer.

(3) Fill sample:

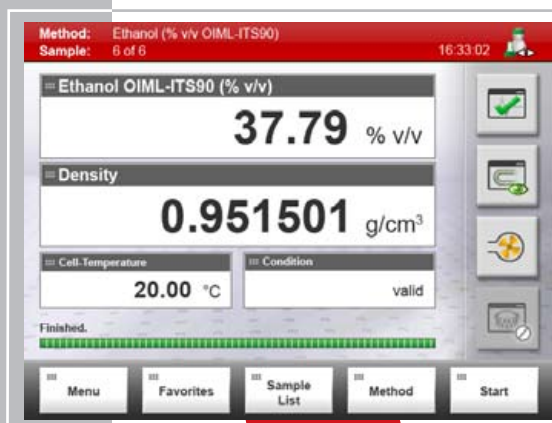
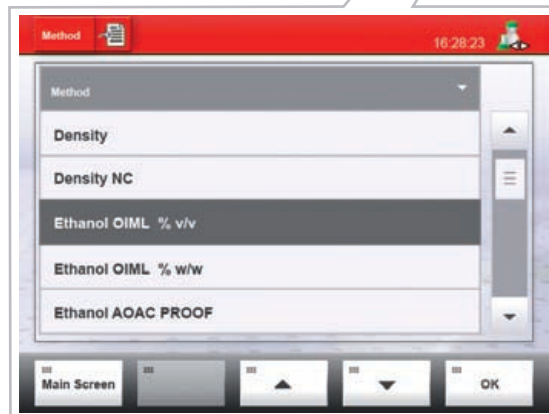
Fill the sample into the measuring cell. **FillingCheck™** automatically detects filling errors or air bubbles in the filled-in sample and alerts you. With the models DMA 4500 M and DMA 5000 M, **U-View™** displays live images of the sensor with the filled-in sample and stores images in the memory for later verification.

(4) Start measurement:

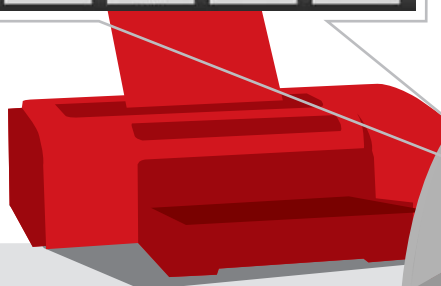
Start the measurement with the push of a button – the results are ready in next to no time. You can observe the readings throughout the measurement on the screen. Errors related to sample viscosity are continuously corrected.

(5) Read the results:

Read the results directly from the display, the printout or a connected PC monitor. The results can also be transferred to a PC, LIMS or data storage device.



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Measuring Density and Concentration

Anton Paar's DMA density meters combine the groundbreaking oscillating U-tube principle, the integrated reference oscillator, highly accurate platinum thermometers and a full-range viscosity correction to provide exceptional measurement performance. The new features of DMA Generation M add an outstanding level of user confidence and comfort.

This is how the density measurement works:

The oscillating U-tube sensor is filled with 1 mL of sample. The instrument electronically excites the U-tube sensor to simultaneously oscillate at the fundamental resonant frequency and its harmonics. The oscillation characteristics are measured, with the integrated reference oscillator providing the pace. The reference oscillator is positioned in close thermal contact with the oscillating U-tube. This unique positioning enables the reference oscillator to compensate for all drifts arising from temperature stress applied to the U-tube sensor. From these measurements the density is determined with utmost accuracy and the viscosity influence is corrected.

The following DMA models are available:

DMA 4100 M

- ▶ Accuracy of density measurement: 0.0001 g/cm³
- ▶ FillingCheck™
- ▶ ThermoBalance™

DMA 4500 M

- ▶ Accuracy of density measurement: 0.00005 g/cm³
- ▶ FillingCheck™
- ▶ U-View™
- ▶ ThermoBalance™

DMA 5000 M

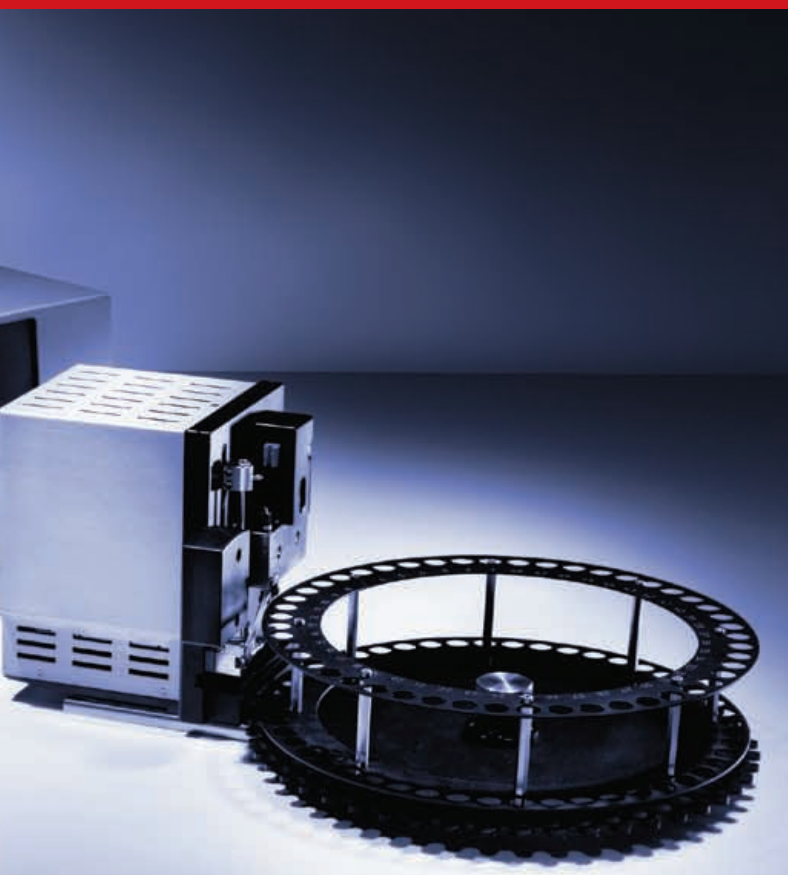
- ▶ Accuracy of density measurement: 0.000005 g/cm³
- ▶ FillingCheck™
- ▶ U-View™
- ▶ ThermoBalance™
- ▶ Temperature scan



Automatic Sample Filling

The plug & play sample changers of Generation M are designed to fit into the density meter, which saves you space on the lab bench. Measure large numbers of samples automatically and perform your other important tasks while the instrument works for you. **FillingCheck™** will alert you if any problem has occurred, while **U-View™** allows you to verify results any time later.

Use the sample list to assign a separate method to each sample, if required. Interrupt the pre-configured sequence to insert a priority sample whenever you want, thus providing you with unprecedented flexibility and efficiency.



These Xsample filling equipments from Anton Paar will meet your specific requirements:

Xsample 22 Sample Filling Unit

With peristaltic pump. For low-viscous samples and non-corrosive samples.

Xsample 122 Sample Changer

With peristaltic pump. For low-viscous samples and non-corrosive samples. Magazine for 24 or 48 sample vials.

Xsample 52 Sample Handling Unit

With piston pump for measuring samples with completely diverse features in direct succession.

Xsample 352 Filling and Rinsing Unit

With piston pump and overpressure for precise filling of highly viscous or highly volatile samples.

Xsample 452 Sample Changer

With piston pump and overpressure for precise filling of highly viscous or highly volatile samples. Magazine for 48 or 24 sample vials.

Anton Paar for You

Combined forces

The density meters and sample changers are produced by Anton Paar and advanced in close cooperation with Dr. Hans Stabinger, the inventor of the oscillating U-tube. The research and development team is geared to state-of-the-art science and practice. Over 40 years of experience, powerful instruments and a contemporary operational concept – made by Anton Paar.

Vast application knowledge

Anton Paar customers benefit from the vast and profound application knowledge of Anton Paar's specialists. New applications are continuously developed.

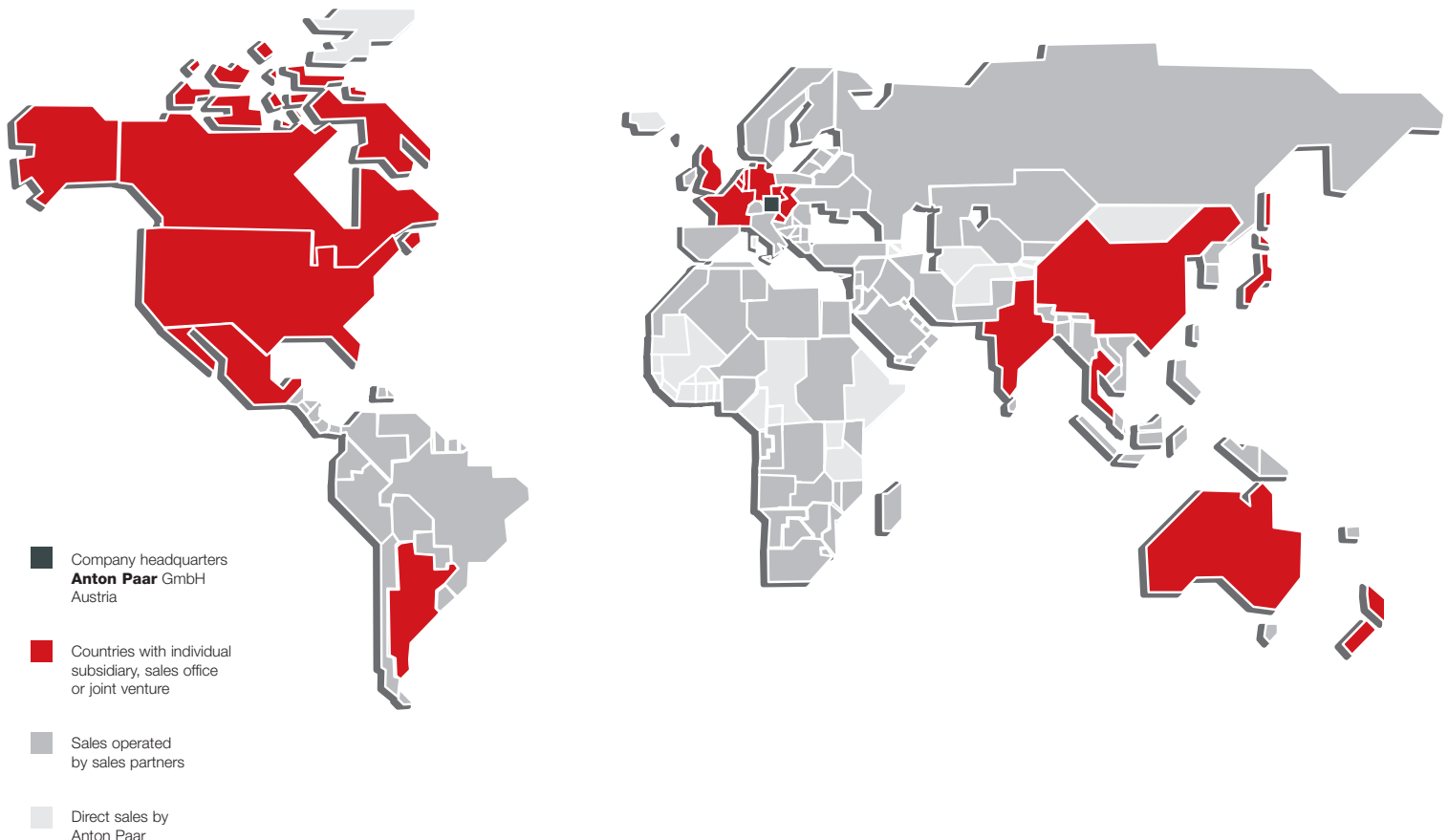
Substantiated expertise

Regular training - in which both application topics as well as technical questions are covered - ensures that the service personnel and sales staff of Anton Paar are always up-to-date, valuable partners to Anton Paar customers.

Custom-tailored after-sales service for you

A sales and service network of trained technicians is dedicated to customer support. The Anton Paar service team is always available, simply place your call.

Company Structure



Specifications

		DMA 4100 M	DMA 4500 M	DMA 5000 M
Measuring range	Density Temperature Pressure	0 to 3 g/cm ³ 0 to 90 °C (32 to 194 °F) 0 to 10 bar (0 to 145 psi)	0 to 3 g/cm ³ 0 to 90 °C (32 to 194 °F) 0 to 10 bar (0 to 145 psi)	0 to 3 g/cm ³ 0 to 90 °C (32 to 194 °F) 0 to 10 bar (0 to 145 psi)
Accuracy	Density Temperature	0.0001 g/cm ³ 0.05 °C (0.09 °F)	0.00005 g/cm ³ 0.03 °C (0.05 °F)	0.000005 g/cm ³ 0.01 °C (0.02 °F)
Repeatability std. dev.	Density Temperature	0.00005 g/cm ³ 0.02 °C (0.04 °F)	0.00001 g/cm ³ 0.01 °C (0.02 °F)	0.000001 g/cm ³ 0.001 °C (0.002 °F)
Typical measuring time/sample*		30 s	30 s	40 s
U-View™		No	Yes	Yes
FillingCheck™		Yes	Yes	Yes
ThermoBalance™		Yes	Yes	Yes
Full range viscosity correction		Yes	Yes	Yes
Minimal sample volume	Approx. 1 mL			
Wetted materials	PTFE, borosilicate glass			
Dimensions (L x W x H)	482 x 340 x 231 mm (19 x 13.4 x 9.1 inches)			
Weight	22.5 kg (49.6 lbs)			
Power supply	AC 100 to 240 V; 50 to 60 Hz; 50 to 80 VA			
Display	6.5 inches, TFT Touchscreen 640 x 480 Px			
Controls	Touchscreen, softkeys, optional keyboard, mouse and bar code reader			
Communication interfaces	4 x USB, Ethernet, VGA, CAN, 2 x S-Bus, 2 x RS-232			
Internal storage	Up to 2 GB			
Special functions	-	-	Adjustment at high density/ viscosity, temperature scan	

* After temperature equilibration



Photos: Croce & Wir



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Instruments for:

Density & concentration
measurement

Rheometry & viscometry

Sample preparation

Microwave synthesis

Colloid science

X-ray structure analysis

Refractometry

Polarimetry

High-precision temperature
measurement

Specifications
subject to change
without notice.

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