Density & concentration / Anton Paar K.G.

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Publication/Creation

Graz : Anton Paar, 1991

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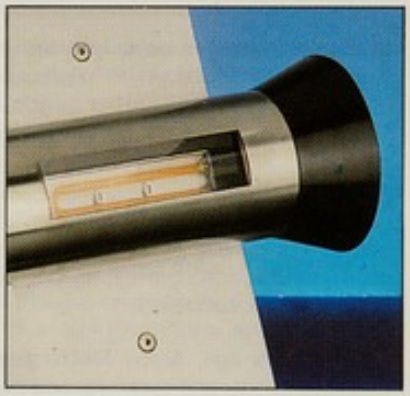
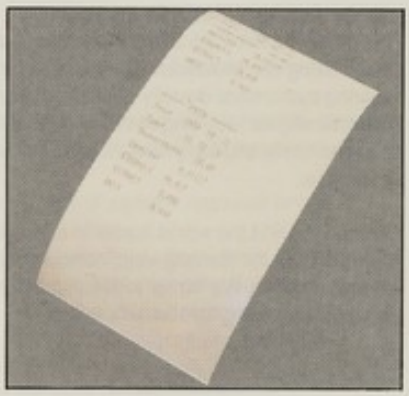
PAAR

DENSITY & CONCENTRATION





RELIABLE PARTNERS FOR RESEARCH AND INDUSTRY

Density and Concentration Measurement

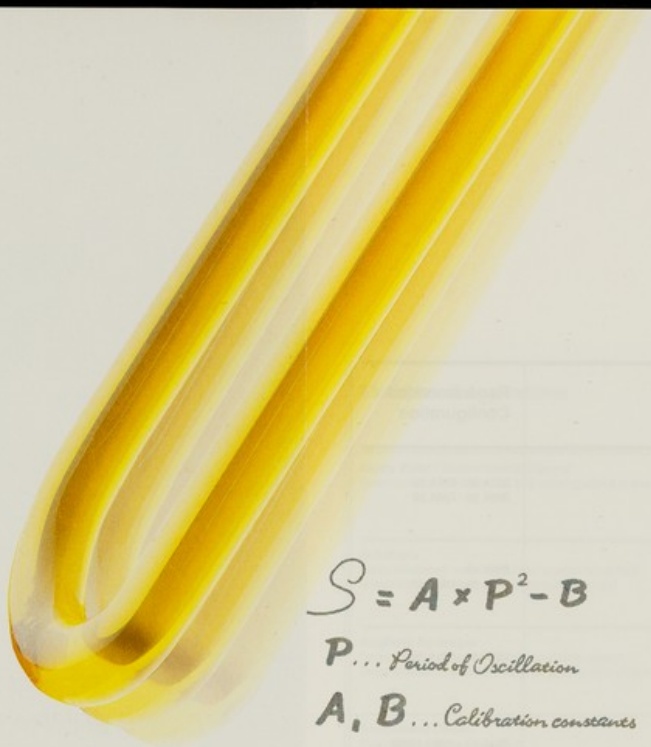
The density of liquids and gases is an important parameter for research and industry. Every day, density measurement is used to solve a variety of problems:

- quality control in the production of industrial liquids and gases
- concentration determination of acids, caustics, solvents and other organic and inorganic solutions
- concentration determination in the food and beverage industries, as in measuring sugar or alcohol concentrations
- maintenance of critical power and control areas, such as emergency power supplies for hospitals, nuclear power plants and submarines
- quality control of petrochemicals and hydrocarbon fuels.

Density (rho) means the relationship "Mass per unit Volume" of any substance. Specific gravity is the most commonly used derived reading, being the measured density divided by the density of water. Out of the density and specific gravity, various concentrations are calculated.

Twenty years ago, Anton PAAR greatly simplified density and specific gravity measurement when DMA 02C, the world's first digital density meter, was introduced.
Since then, over 25,000 customers have been using our products. Our experience in solving customers' density related problems is unparalleled resulting in the design of the most versatile and easy to use density meters available.

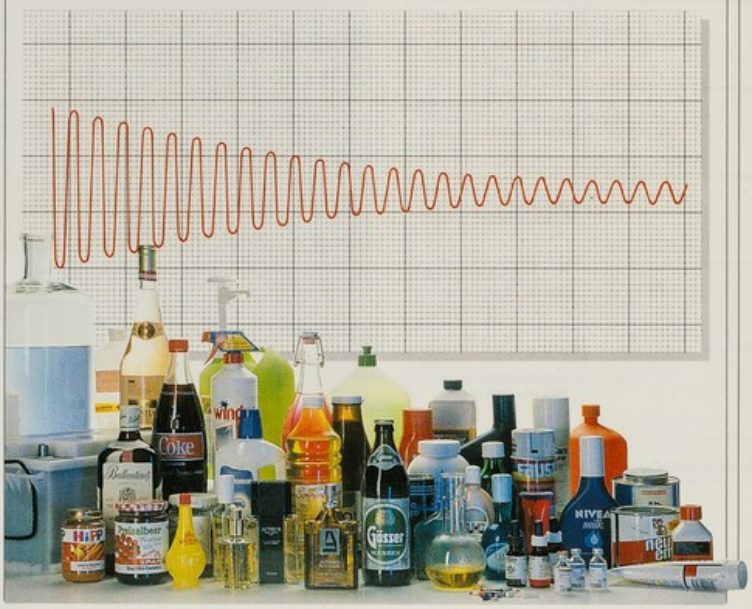
Anton PAAR is the world leader in supplying instruments for density and concentration measurement. We solve today's problems while anticipating tomorrow's needs.



$$S = A \times P^2 - B$$

P... Period of Oscillation

A, B... Calibration constants



The Anton PAAR Oscillating U-Tube Method

The Anton PAAR method of density measurement, developed by H. Stabinger and H. Leopold, is based on the law of harmonic oscillation. Due to its accuracy and versatility it has become the standard method of density measurement worldwide.

A hollow U-shaped tube is electromagnetically forced into harmonic oscillation. The period of oscillation is dependent on the density of the sample in the tube. Therefore, by measuring the period of oscillation, the density or density related values are automatically calculated.

Superior to any Other Method

The old way of determining density with Pycnometer or Hydrometer is no longer suitable for today's Research-, Production- and Quality Control Laboratories due to complicated filling and weighing procedures as well as the time taken for the temperature equilibrium.

Benefits of the Anton PAAR Method:

- Reliable results with accuracies up to 1×10^{-6} [g/cm³] are available within minutes.
- Filling of the measuring tube is very simple: manually by means of a syringe or fully automatic with Filling and Rinsing System or Sample Changer.
- A precise internal thermostat ensures correct measurement temperature.
- 0.7 ml of sample required only.
- For density measurement under extreme conditions, external measuring cells for high and low temperatures as well as for high pressures are available.
- Virtually maintenance-free.

DMA 38


DMA 35
PAAR

DMA 35


PAAR
DENSITY
METER
DMA 35
TEMPERATURE (C)
DENSITY (g/cm³)

DMA 58

DMA 48

Examples of Applications	Recommended Configuration
Photographic Baths	
Control of the fixing bath concentration	**DMA 35 / DMA 38**
Control of the activator in photographic developers	**DMA 35 / DMA 38**
Electrochemistry	
Determination of ironchloride-concentration in etching baths	**DMA 48**
Control of metal/salt concentration in production	**DMA 38 / DMA 48**
Soldering Machines	
Control of dilution concentration of fluxing agents	**DMA 35 / DMA 38**
Medicine	
Effects of drugs on blood density	**DMA 58 + DMA 602M**
Determination of haematocrit content in blood	**DMA 58**
Urine diagnosis	**DMA 48**
Milk	
Quality control on raw milk	**DMA 35**
Control of fat content	**DMA 48 + SP3**
Control of solid content in skimmed milk (Whey)	**DMA 48**
Control of water content in milk evaporators	**DMA 48 + SP3**
Food Industry	
Quality control of dressings	**DMA 48**
Water content in sauces	**DMA 48 + SP3**
Nuclear Industry	
Concentration of radioactive substances	**DMA 58**
Determination of concentration of D_2O in H_2O	**DMA 58 + SP3**
Paper Industry	
Determination of green and black liquor	**DMA 58 + DMA 512**
Petrochemistry	
Quality control of petrochemical distillates	**DMA 48 + SP3**
Mass determination on raw oils	**DMA 58 + DMA 512**
Pharmacy	
Determination of salt content in infusion solvents (production control)	**DMA 58 + SP3**
Quality control of infusion solutions	**DMA 58 + SP3**
Sugar Industry	
Determination of sugar content of molasses on extraction	**DMA 48**
Determination of concentration of liquid sugar	**DMA 48**

Examples of Applications	Recommended Configuration
Waste Water / Environmental Control Determination and control of acid concentrations in flue gas desulphurisation	**DMA 38**
Softdrinks Determination of sugar content for production control Determination of sugar content for quality control	**DMA 48 + SP1** **DMA 58 + SP1**
Alcoholic Beverages Determination of alcohol/extract for quality control Determination of alcohol/extract for government offices	**DMA 48 + SP3** **DMA 58 + SP3**
Government Offices Evaluation of density standards Quality control in wine laboratories	**DMA 58** **DMA 58**
Batteries Control of acid concentration in batteries	**DMA 35 / DMA 38**
Manufacturing Determination of water content in hydraulic oils Determination of water content in cooling liquids	**DMA 35 / DMA 38** **DMA 48**
Breweries Determination of wort content Determination of alcohol	**DMA 48** **DMA 58**
Chemical Industry Research on polymer structures (polymerization) Pesticides and Fungicides (dilution series)	**DMA 58** **DMA 58 + SP3**
Distilling Determination of the degree of distillation	**DMA 58**
Paints Determination of dilution (Vol %) of incoming goods Determination of dilution of paints on silk-screenmachines Determination of dilution of inks in ink-jet printers	**DMA 48** **DMA 48** **DMA 48 / DMA 38**
Research Determination of partial specific volume Kinetic behaviour of liquids Determination of the density gradient in ultracentrifugation	**DMA 58 + DMA 602** **DMA 58** **DMA 58 + SP3**

Technical Data

Density Meters	DMA 35	DMA 38	DMA 48	DMA 58
Measuring range [g/cm³]	0.5 ... 1.999	0 ... 3	0 ... 3	0 ... 3
Precision [g/cm³]	± 5 x 10^{-4}	± 2 x 10^{-4}	± 5 x 10^{-5}	± 5 x 10^{-6}
Accuracy [g/cm³] proper calibration required	± 1 x 10^{-3}	± 1 x 10^{-3}	± 1 x 10^{-4}	± 1 x 10^{-5}
Sample size [ml]	2	0.7	0.7	0.7
Temperature range [°C]	0 ... +40	+15 ... +40	–10 ... +70	–10 ... +70
Temperature equilibrium [min]	–	0.5 ... 3.5	0.5 ... 3.5	1 ... 5
Temperature accuracy [°C]	± 0.5	± 0.5	± 0.1	± 0.01
Thermostatisation	temperature compensated	internal	internal	internal
Precision of thermostat [K]	–	± 0.1	± 0.01	± 0.005
Reference temperature sensor (additional)	–	–	–	1
Pressure [bars]	up to 0.5	up to 10	up to 10	up to 10
Display of additional density related values (°Brix, %Alcohol, API, Concentration etc. customized programming)	–	1	3	3
Interfaces	–	2 x RS 232	2 x RS 232	2 x RS 232
Dimensions [mm]	80 x 280 x 85	280 x 210 x 270	510 x 275 x 210	510 x 275 x 210
Weight [kg]	0.5	10	25	25

External Cells	DMA 401	DMA 512	DMA 602
Precision [g/cm³]	± 1 x 10^{-4}	± 1 x 10^{-3}	± 1.5 x 10^{-4}
Sample size [ml]	0.7	1	0.7
Temperature range [°C]	–10 ... +60	–10 ... +150	–200 ... +150
Pressure [bars]	up to 50	up to 400	up to 50
Dimensions [mm]	140 x 380 x 95	250 x 425 x 130	250 x 425 x 130
Weight [kg]	10	20	21

Other external cells available on request.

Accessories	Sample Changer		FRS	Printer
	SP1	SP3		
	for aqueous solutions with low viscosities	for oil etc. up to 1000 mPas; for measurements with sealed vials	Filling and Rinsing system for DMA48 / DMA58	for DMA38 DMA48 / DMA58
Dimensions [mm]	580 x 385 x 380	580 x 385 x 380	built into the instrument	240 x 176 x 82
Weight [kg]	20	21	2	2

Patents: Austrian patent No. 280662, German patent No. 1648953, UK patent No. 1189083, French patent No. 1579521, US patent No. 3523446. Further patents pending.

We also supply systems for on-line measurement of density and concentration.

Specifications subject to change without notice. 3 / 91

PAA
Scientific instruments Precision machines

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Instruments for – density/concentration – preparation for electr
– rheology – fibre testing
– X-ray structure analysis – medical equipment
– preparation for trace analysis – astronomy ... and oth

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