Anton Paar GmbH, founded in 1922, is a family-owned, highly innovative company with more than 1300 employees worldwide. Using the latest technologies, Anton Paar GmbH is a renowned producer of a variety of high-quality, high-performance instruments and a contract manufacturer of high-precision parts and system components.

Tools such as CNC machining, SMD electronics, orbital welding and laser technologies are used at Anton Paar according to strict ISO 9001 guidelines.

Worldwide partnerships and a reliable distribution network in over 110 countries with well-trained sales and service engineers provide fast and efficient support to all Anton Paar customers.

Anton Paar and the oscillating U-tube principle

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 density meter was born.

Anton Paar’s instruments for process applications

Anton Paar has supplied process instruments to industry for over 30 years. We offer a wide range of instruments and accessories to meet the requirements of customers in a variety of industrial branches.

These products have gained a great reputation for their quality, reliability and accuracy. They are used throughout the world in highly demanding applications and even in hazardous areas.
Anton Paar’s process instrumentation ensures the continuous control of product quality and product specifications within tight tolerance limits.

A variety of wetted parts, materials and process connections are available to suit each application. A team of application specialists offers expert advice based on long experience, and assists in solving new application tasks.

### Applications

#### Density measurement

- Food
- Beverages (extract, alcohol, °Brix, etc.)
- Sugar
- Oleum
- Hydrochloric acid
- Phosphoric acid
- Nitric acid
- Boric acid
- Sodium hydroxide

#### Precise density and concentration measurement of ...

- Ammonia
- Sulfuric acid up to 90 %
- Hydrogen peroxide
- Glucose
- Ethanol
- Starch solutions
- Hydrocarbons
- Fuels
- Lubricants
- Liquefied petroleum gas

#### Sound velocity measurement

- Food
- Beverages (extract, alcohol, °Brix, etc.)
- Sugar
- Alkalis
- Solvents
- Emulsions
- Reaction monitoring
- Sulfuric acid above 90 %

#### Precise sound velocity and concentration measurement of ...

- Oleum
- Acetic acid
- Sodium hydroxide
- Potassium hydroxide solution
- Oil in refrigerants
- Acids in particular measuring ranges
- Phase separation
- Interphase detection

#### Combined density and sound velocity measurement

- Food
- Beverages (extract, alcohol, °Brix, etc.)
- Sucrose/inverted sugar/water
- Formaldehyde/methanol/water

#### Precise concentration measurement of ...

- Sodium chloride/sodium hydroxide/water
- Sulfuric acid/oleum concentrations
- Emulsions
- Reaction monitoring
Anton Paar’s process instruments can be used in various combinations. We have optimal standard solutions configured for many applications, flexible and adaptable to suit individual requirements. A complete monitor combines the sensor with an mPDS evaluation unit and an application-specific software program.

**Typical applications**

The following are standard systems consisting of a combination of the units listed in this booklet.

**Sulfuric Acid Monitor**
- Measures sulfuric acid concentration from 0 to 100 %
- Fully resistant tantalum or gold-plated sensor

**Oleum Monitor**
- Measures oleum concentration from 0 to 65 % free SO$_3$
- Fully resistant gold-plated sensor

**API Petroleum Monitor**
- Specific gravity, API gravity and density at 15 °C/60 °F

**Rolling Oil Monitor**
- Measures oil concentration continuously
- Optional pressure compensation

**Phase Change Monitor**
- Detection of phase changes and liquid/liquid interfaces

**Formaldehyde Monitor**
- Measures formaldehyde and methanol concentration

**Cobrix 5 Beverage Analyzer**
- Continuous measurement of °Brix, % Diet, CO$_2$, alcohol, sugar inversion, original extract and additional parameters
- Inline or bypass version available
- For all soft drinks, beer types, wine, juices and FABs (alcopops)
- Flexible positioning of the evaluation unit up to 250 m away from the sensor

**Brix Monitor**
- High-precision °Brix measurement of soft drinks, syrups and fruit juices

**Beer Monitor**
- High-precision measurement of alcohol, real and original extract
- Optional CO$_2$ measurement for maximum system accuracy

**Alcohol Monitor**
- High-precision measurement of alcohol in ethanol-water mixtures
- PTB type approval (optional)

**Density Monitor**
- Density at measuring temperature and temperature-compensated density
For many liquid mixtures, the speed of sound is directly proportional to the concentration of the components. Therefore, sound velocity measurement can often be used for concentration measurement of 2-component mixtures. The sound velocity is also a characteristic property of a liquid and can be used for material characterization.

Features and benefits

- High resolution and repeatability
- Fast response to changes in concentration or temperature provides accurate drift-free measurement
- Robust design
- Automatic conversion into concentration readings by mPDS 1100/mPDS 5 Evaluation Unit
- ATEX certificate (optional)

SPRn sound velocity sensors – Measuring principle

The sample flows perpendicular to a sound signal. The speed of sound is measured between a transmitter and a receiver and temperature compensation is achieved using an integrated Pt 1000 temperature sensor.

SPRn 4115/SPRn 4215 Sound Velocity Sensor

- Typical applications: original extract of beer, purity of liquids, interface detection, concentration of bulk chemicals, etc.
- Inline installation, fork-type sensor
- Material (wetted parts): Stainless Steel 316 Ti, gold coated, Hastelloy C276 or Monel 400
- L version (long shaft 100 mm) for installation in tanks
- Gold coating for sulfuric acid applications
- 2T sensors: stable measurement values at production stop, high gas bubble tolerance

SPRn 4214 Sound Velocity Sensor

- Typical applications: concentration determination of wort chemicals, refrigerants
- Bypass installation, tube-type sensor
- Material (wetted parts): Hastelloy C276
- LS version for samples with low sound velocity, e.g. freons
The Anton Paar oscillating U-tube method

A U-shaped metal or glass tube is 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 can be calculated to a high level of accuracy.

Density sensors - Measuring principle

Sample flows continuously through the vibrating U-tube sensor. The characteristic frequency of vibration is measured and the separate evaluation unit instantly translates the signal into a density or concentration value. Temperature compensation is achieved using an integrated temperature sensor.

L-Dens 427

- Typical applications: storage, transport and delivery of petroleum and ethanol products
- Compact design
- Frequency output, Modbus, HART, 4 - 20 mA analog signal, mPDS output
- Inner diameter: 6.6 mm
- ATEX and FM approval
DPRn 417/DPRn 427/DPRn 427 (S) Density Sensor
- Typical applications: beverages, soft drinks, chemicals, oil, etc.
- Recommended for applications requiring the highest precision
- Materials (wetted parts): Hastelloy C276, Stainless Steel 316 Ti or Incoloy 825
- Inner diameter: 6.6 mm
- PTB type approval for fiscal measurement (optional)
- Measurement at high temperatures up to 150 °C (optional)
- Stainless steel housing (optional)

DPRn 407/ DPRn 427 Ta Density Sensor
- Typical applications: aggressive or high-purity liquids, sulfuric acid, HCl, other acids, etc.
- Material (wetted parts): borosilicate glass, PVDF, tantalum
- Inner diameter: 7 mm

Features and benefits
- The most accurate measurement on the market
- The high linearity provides exceptional accuracy over a wide density range
- Rapid response to changes in concentration or temperature provides real-time results and drift-free measurement
- Extremely high resolution and repeatability
- Robust design for continuous operation
- Selection of wetted parts materials to suit most applications
- Automatic conversion into specific gravity, °Brix, % alcohol, % H₂SO₄, API gravity and many other concentration readings by mPDS 1100/mPDS 5 Evaluation Unit
- ATEX certified sensors available

DPRn 422 Density Sensor
- Typical applications: high pressure up to 200 bar and/or low flow rates
- Material (wetted parts): Hastelloy C276
- Inner diameter: 2.8 mm

Accessories
- **Online Fitting**: for easy installation of DPRn 417/427, DSRn 427, DTR 427.
- **Inline Pump 5**: quick and easy inline installation in lines where stop conditions occur. For DPRn 427 (S) and DSRn 427 (S).
- **Inline Adapter**: quick and easy inline installation in lines with sufficient and continuous flow. For DPRn 427 (S) and DSRn 427 (S).

DPRn 4122 Density Sensor
- Typical applications: high flow rates or less homogeneous samples
- Material (wetted parts): Stainless Steel 316Ti
- Large inner diameter: 22 mm
- Various flanges and clamps available

Developed in cooperation with Labor für Messtechnik Dr. H. Stabinger GmbH, Graz
To determine three concentrations in a 3-component mixture density and sound velocity are determined simultaneously. The data are then processed using polynomial formulas. Examples: Beer (alcohol/extract/water), formaldehyde/methanol/water. The density/sound velocity concept is also applied for product characterization and purity control.

Features and benefits

- High resolution and repeatability, rapid response and accurate measuring results
- Designed to withstand the rough conditions of the industrial environment
- Requires mPDS 5 Evaluation Unit
- ATEX certified sensors available

Density & sound velocity sensors – Measuring principle

The sample flows continuously through a single combined sensor measuring the speed of sound and the density simultaneously. Temperature compensation is achieved using a Pt 1000 temperature sensor.

DSRn 427 Density/Sound Velocity Sensor

- Typical applications: concentration of bulk chemicals such as formaldehyde/methanol/water; fresh °Brix and degree of inversion of soft drinks; alcohol, real and original extract of beer
- Material (wetted parts): Hastelloy C276 or Incoloy 825

DSRn 427 (S) Density/Sound Velocity Sensor with stainless steel housing

- Typical applications: fresh °Brix and degree of inversion of soft drinks (Brix Monitor), alcohol, real and original extract of beer (Beer Monitor)
- Material (wetted parts): Hastelloy C276
- Stainless steel housing
- Inline Pump 5 or Inline Adapter for inline installation without additional bypass components (optional)
mPDS Evaluation Units and Software

The mPDS evaluation units process measuring signals from DPRn density sensors, SPRn sound velocity sensors and DSRn density/sound sensors. Concentration conversions are carried out by the powerful software. The flexible hardware provides analog and digital inputs, analog outputs, alarm capabilities, large displays, etc.

The optionally available PC software DAVIS is a custom-tailored tool for data acquisition and control.

**mPDS 1100 Evaluation Unit**
- Connects to a DPRn density or SPRn sound velocity sensor
- Concentration conversions for common applications such as °Brix, °Plato, % alcohol, API gravity, specific gravity, etc.
- Determines the density and concentration of 2-component liquids
- Option: intrinsically safe DPRn/SPRn input
- Option: Profibus DP

**mPDS 5 Evaluation Unit**
- Connects to a DPRn, SPRn or DSRn sensor
- Additional connection for an Anton Paar Carbo 510 CO₂ Analyzer
- Large 8.4" color touchscreen, 640 x 480 pixel
- Multiple line monitoring (2 lines)
- Choice of several screen layouts:
  - small and large numeric output fields
  - graphical output fields
- 999 different products with alphanumeric names
- Easy adjustment with reference values
- Different user levels
- Different bus systems

**DAVIS Data Visualization Software**

The DAVIS software is an interactive Windows™-based software for data acquisition and control.

- DAVIS for mPDS 1100
- DAVIS 5 for mPDS 5
- Graphical real-time trend indication
- Storage of all data and alarms
- Statistical analysis
- Network capability
- Protocol reporting and printing
- Remote maintenance and operation
In position for production monitoring
L-Vis 510 is installed directly in the pipe or stirring tank. No bypass is required. It is simple to retrofit the inline viscometer into existing plants. The process liquid flows through the sensor; the viscosity and temperature are measured simultaneously and both are displayed on the screen.

Maintenance intervals greatly depend on the production liquid: L-Vis 510 is maintenance-free when measuring lubricants and oils; measurement of suspensions requires regular maintenance. Due to Anton Paar’s worldwide network of subsidiaries and sales partners, a certified Anton Paar service engineer is on call wherever you are.

Features and benefits
- Temperature and viscosity measured inline
- New measuring principle, only available from Anton Paar
- Stable results, even under adverse flow conditions
- For suspensions, lubricants, starch adhesives and many more process liquids

Measured values
- Dynamic viscosity
- Process temperature

Calculated values
- Dynamic viscosity at reference temperature (Arrhenius function)
- Kinematic viscosity at process temperature
- Kinematic viscosity at reference temperature

Typical applications
- Suspensions (ceramics, wall paints, plasterboards, roof tiles, waterbased paints, drilling fluids, battery paste, etc.)
- Oils and lubricants
- Starch Adhesives (corrugated box boards, paper bags, paper boxes, carton sealing, paper tube winding, laminated paper board, gummed tape coating, gummed paper coating, textile coating)
- Viscose

Installation and operating terminal position
Integrated operating terminal
Smart Sensor
Remote operating terminal
### Specifications

<table>
<thead>
<tr>
<th>Sensor</th>
<th>DPRn 417</th>
<th>DPRn 427 (S)</th>
<th>DPRn 407</th>
<th>DPRn 422</th>
<th>DPRn 407</th>
<th>DPRn 427 (S)</th>
<th>DPRn 4115 A 2T</th>
<th>DPRn 4115 2T Varvent</th>
<th>DPRn 4115 L 2T</th>
<th>DPRn 424 (LS)</th>
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<tr>
<td>Wetted parts (other materials on request)</td>
<td>1.4571, 316Ti Hastelloy C276 Incoloy 825 Borosilicate glass 1.4571, 316Ti Hastelloy C276</td>
<td>Hastelloy C276 1.4571, 316Ti Hastelloy C276</td>
<td>Hastelloy C276 1.4571, 316Ti Hastelloy C276</td>
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<td>0 to 3 g/cm³ 800 to 3000 m/s</td>
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<td>1 x 10⁻⁵ 0.1 m/s</td>
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<td>2 x 10⁻⁴ 0.1 m/s</td>
<td>1 x 10⁻⁴ 0.1 m/s</td>
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<td>max. 15, max. 217</td>
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<td>350 to 800, 100 to 300 (10000 max., 200 max.)</td>
<td>20 to 50, 5 to 12.5 (100 max., 25 max.)</td>
<td>100 to 500, 25 to 125 (10000 max., 200 max.)</td>
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<td>300 to 1000, 50 to 375 (2500 max., 625 max.)</td>
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<td>555 x 274 x 139</td>
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### Transmitter

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<th>DTR 407</th>
<th>DTR 4132</th>
<th>DTR 427</th>
<th>DTR 427 ta</th>
<th>DTR 422</th>
<th>STR 4115 A</th>
<th>STR 4115 Varvent</th>
<th>STR 4115 L</th>
<th>STR 4115 A 2T</th>
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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