Anton Paar

Carbo 2100

Online CO_2 Analyzer
for Beverages

::: Unique Density & Concentration Meters

Carbo 2100
Online CO_2 Analyzer

Consistent and accurate CO_2 content is one of the main quality factors in the production of beer, sparkling wine, soft drinks, and mineral water.

Manufacturers of beverages are well aware that not only the taste, but also product safety can be affected by the CO_2 content. Consumers are continually demanding more consistent beverage quality at lower cost. This can only be attained if breweries and bottling companies run at optimum quality levels from the first minute of production to the last.

The Carbo 2100 Online CO_2 Analyzer for monitoring and controlling the beverage production process is an essential prerequisite for fulfilling such demands.

Measuring principle

The measuring principle is based on Henry's law: The volume of gas dissolved in a liquid is proportional to the partial pressure of that gas at a given temperature.

The Carbo 2100 Online CO_2 Analyzer combines the classical method of CO_2 analysis according to Henry's law with Anton Paar's „Impeller" principle and the Volume Expansion Method.

A measuring chamber is filled with sample, tightly sealed and expanded. The volume expansion generates a vacuum in the measuring chamber. The rapid rotation of the Impeller causes the pressure and temperature equilibrium between the liquid and gas phase to be reached within seconds.

The CO_2 content is determined from the equilibrium pressure and temperature. As the equilibrium pressure is reached so quickly, it can be measured directly and does not need to be extrapolated (as is the case with other CO_2 measuring systems). This explains the superior accuracy and measuring speed of the Carbo 2100 Online CO_2 Analyzer.

After opening the measuring chamber, the sample is quickly replaced. The Impeller generates a high flow rate, accelerating sample replacement and thoroughly rinsing the entire sampling path.

Highlights:

- Only electrical power and a pressurized air supply are required for operation
- Drift-free measuring principle (requires no periodic re-adjustments)
- Extremely short measuring cycles, high accuracy
- No interference from dissolved air
- Suitable for aseptic applications
- Extremely robust design

Familiar with Reliability

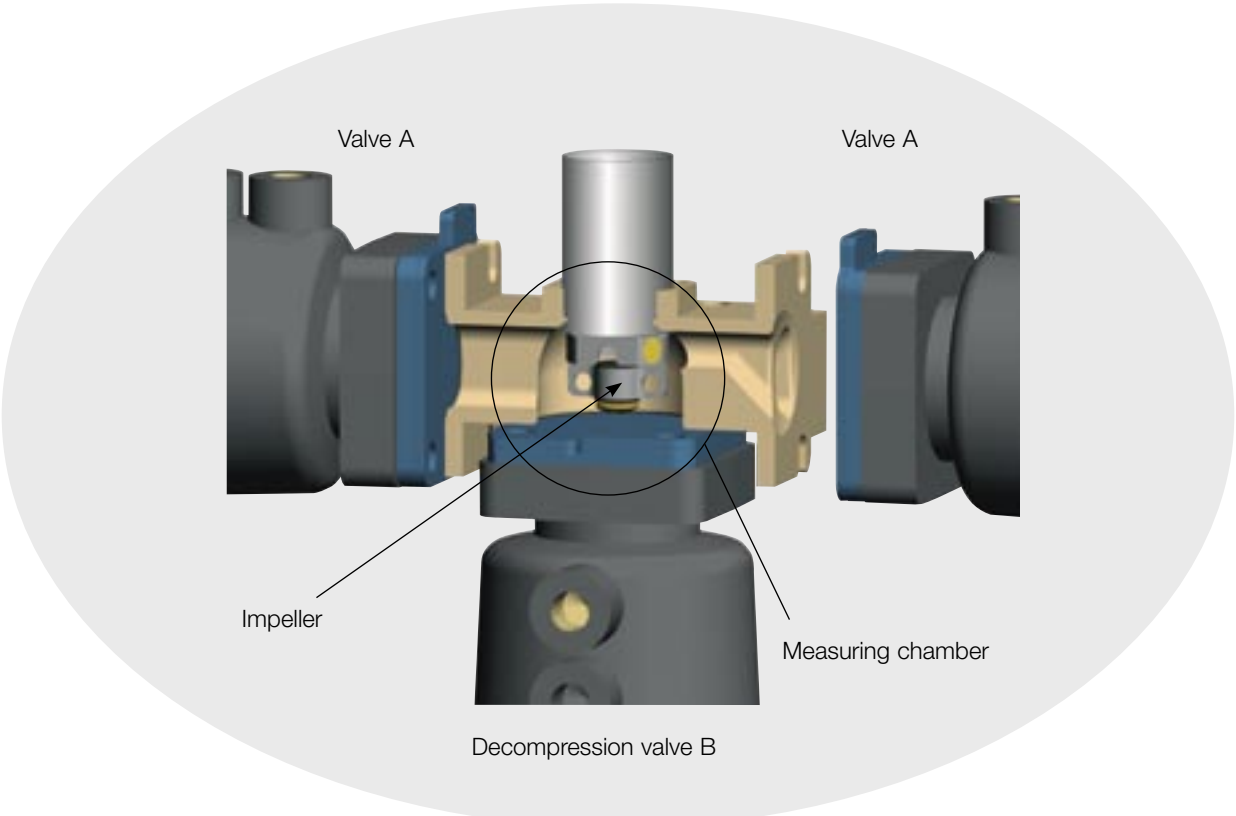
The classical method of CO_2 analysis, using pressure and temperature measurements according to Henry's law, is the most commonly used method throughout the world, both for lab and online measurements. Disadvantages earlier attributed to the method, such as slow, inconsistent analysis results and interferences from other dissolved gases, have been eliminated by the „Impeller" principle invented by Anton Paar.

Thus, the first Online CO_2 Analyzer brought to the market by Anton Paar has already proved itself to be the fastest and most accurate of its kind.

The Carbo 2100 is factory adjusted. There is no recalibration necessary.

Operating cycle

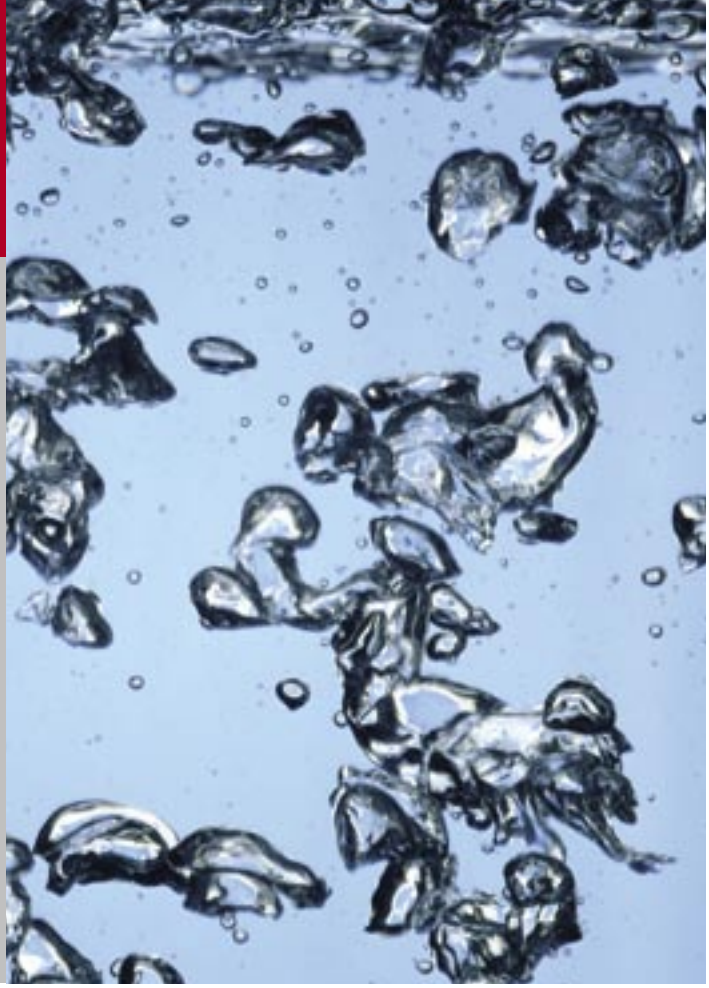
- While the valves (A) of the measuring chamber are open, the sample is rapidly replaced. The Impeller accelerates sample replacement and thoroughly rinses the measuring chamber.
- The valves (A) tightly close the measuring chamber. A bypass allows a continuous flow of product while the chamber is sealed.
- The volume of the measuring chamber is increased by the decompression valve (B), thus generating a gas phase. The Impeller enables the pressure equilibrium to be reached within seconds. The equilibrium pressure and the temperature are measured and converted into CO_2 content.



Clear and Clean

The design of the Carbo 2100 measuring chamber is perfectly suited for all beverage types, even under strict aseptic conditions.

The impeller is driven by magnetic coupling to eliminate hygienic trouble spots. Diaphragms, measuring chamber and connections are cleaned during regular CIP routines.



Negligible interference from dissolved air

Why does the Volume Expansion Method work?

The patented Volume Expansion Method makes use of the fact that the solubility of CO_2 in beverages is much higher than the solubility of air. When expanding the volume of the measuring chamber, the partial pressure of air decreases much more than that of CO_2. Therefore, the large volume expansion of the Carbo 2100 reduces the influence of air to a negligible amount. The necessary large volume expansion (to use this effect) is only possible with the patented Anton Paar impeller technique.

Measuring the equilibrium pressure and temperature in the measuring chamber enables the determination of the CO_2 concentration without the influence of dissolved air.

The CO_2 is measured correctly – negligible influence of air.

10% air saturation of the sample leads to a pressure increase of only 0.02 bar because the CO_2 solubility is approx. 70 times higher than the air solubility.

CO_2
2 bar

CO_2 + air
2.02 bar

2.36 Vol CO_2

2 bar at 10.31°C

CO_2 [vol]	2.36	✓
[°C]	10.31	CARBO #007
[bar]	2.00	Sample name

p_gas measured 1.98 bar

CO_2 + 10% air saturation (2.4 ppm)

2 bar CO_2 + 0.1 bar air

CO_2 [vol]	2.38	✓
[°C]	10.31	CARBO #008
[bar]	2.02	Sample name

p_gas measured 2.02 bar

System Configuration

The Carbo 2100 transducer is connected to the mPDS 2000V3 evaluation unit.
In addition, the mPDS 2000V3 can accommodate Anton Paar density or concentration transducers and standard process transmitters for flow, pressure, etc.

Specifications

CO_2 transducer	Measuring range	0 to 20 g/l (0 to 10 Vol)
	Accuracy	0.05 g/l (0.025 Vol)*
	Repeatability	0.01 g/l (0.005 Vol)
	Measuring temperature range	-5 to +30 °C (23 to 86 °F)
	Maximum temperature	121 °C (250 °F)
	Pressure	max. 10 bar (145 psi)
	Cycle time	15 seconds
	Air supply	6 - 10 bar dry and clean compressed air
	Dimensions (W x H x D)	330 x 500 x 150 mm (13 x 19.7 x 5.9“)
	Classification	IP 65 (NEMA 4)
	Sample connection	Thread G3/8“ ISO 228 (parallel) Optional: Online Fitting DIN 11851 or VARIVENT™
	(*after adjustment on-site) Patents pending	
mPDS 2000V3 evaluation unit	Display	Graphic LCD
	External product selector	256 products, 8 bits
	4 analog inputs	4 to 20 mA insulated
	4 digital inputs	e.g. filler stop
	3 analog outputs	4 to 20 mA active
	8 digital outputs	For alarms, etc.
	Serial interfaces	RS 232, RS 485
	Power requirements	AC 85 to 260 V, 48 to 62 Hz, 30 VA
	Dimensions (W x H x D)	208 x 160 x 300 mm (8.2 x 6.3 x 11.8”)
	Classification	IP 55 (front)

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Instruments for:

Density and concentration measurement

Rheology and viscometry

Sample preparation

Colloid science

X-ray structure analysis

CO_2 measurement

High-precision temperature measurement

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