Overview

Up to 4 gas components can be measured continuously with the ULTRAMAT 23 gas analyzer with paramagnetic oxygen cell: maximum three infrared-active gases, plus O_2 ("dumbbell" measuring cell).

Benefits

- AUTOCAL with ambient air (calibration of IR-active gases at zero point; calibration of O_2 measuring cell at deflection point)
- Cost savings thanks to cleanable sample cells (IR-active components)
- Menu-assisted operation in plaintext
  Operator control without manual, high level of operator safety
- Service information and logbook
  Preventive maintenance; help for service and maintenance personnel, cost savings
- Coded operator level against unauthorized access
  Increased safety
- Open interface architecture (RS 485, RS 232; PROFIBUS, SIPROM GA)
  Simplified process integration;
  remote operation and control

Applications

Field of application

The paramagnetic oxygen sensor is used to measure oxygen in dry gases free of particulates.

Application areas include

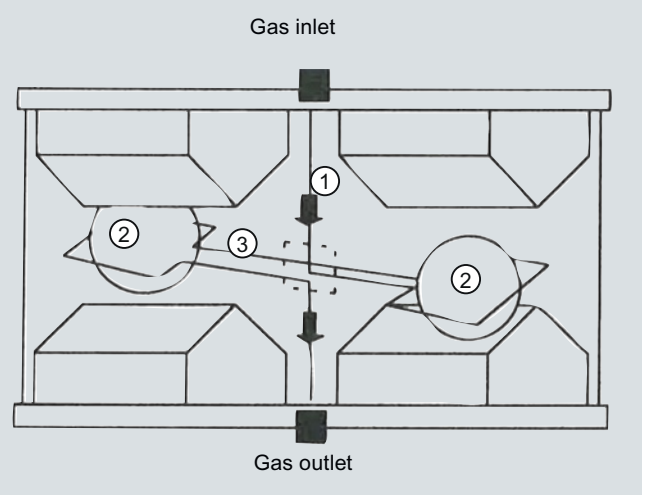
- Flue gas analysis
- Inerting plants
- Room air monitoring
- Medical engineering

Function

Principle of measurement

In contrast to other gases, oxygen is highly paramagnetic. This property is used as the basis for the method of measurement.

Two permanent magnets generate an inhomogeneous magnetic field in the measuring cell. If oxygen molecules flow into the measuring cell (1), they are drawn into the magnetic field. This results in the two diamagnetic hollow spheres (2) being displaced out of the magnetic field. This rotary motion is recorded optically, and serves as the input variable for control of a compensation flow. This generates a torque opposite to the rotary motion around the two hollow spheres by means of a wire loop (3). The compensation current is proportional to the concentration of oxygen.



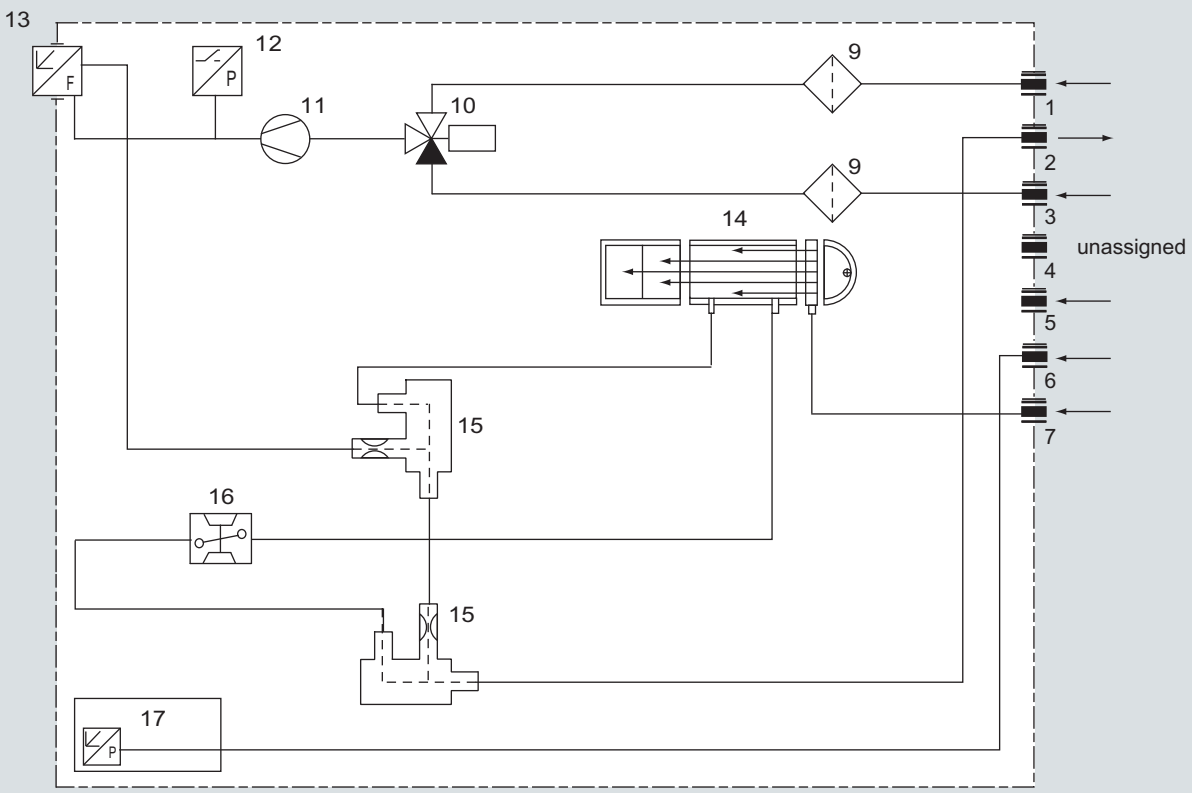
Technical data

General information	
Measured components	Maximum of 4, comprising up to 3 infrared-sensitive gases and an oxygen component
Ranges of measurement	2 per component Min. 0 ... 2% vol O_2 Max. 0 ... 100% vol O_2
Permissible ambient pressure	700 ... 1 200 hPa
Permissible operating temperature	5 ... 45 °C (41 ... 113 °F)
Influencing variables	
Cross-inference (interfering gases)	See table of cross-sensitivities
Zero point drift	Measuring range 2 %: max. 0.1 % with weekly zero adjustment Measuring range 5 %: max. 0.1 % with weekly zero adjustment Measuring range 25 % or greater: max. 0.5 % with monthly zero adjustment
Temperature error	< 2 % /10 K referred to measuring range 5 % < 5 % /10 K referred to measuring range 2 %
Humidity error for N_2 with 90% relative humidity after 30 min	< 0.6 % at 50 °C
Air pressure	< 0.2% of measured value per 1 % pressure change
Measuring response	
Display delay (T90 time)	<60 s
Output signal noise	< 1 % of smallest measuring range
Reproducibility	≤ 1 % of smallest measuring range

Design and operation

The design corresponds to that of the previously released versions of the ULTRAMAT 23.

Gas path



Legends

1	Inlet for sample gas/calibration gas	10	Solenoid valve
2	Gas outlet	11	Sample gas pump
3	Inlet for zero gas	12	Pressure switch
4	Unassigned	13	Flow indicator
5	Enclosure flushing	14	Analyzer unit
6	Inlet for atmospheric pressure sensor	15	Safety condensation trap
7	Inlet of chopper compartment flushing (option)	16	Paramagnetic oxygen sensor
9	Safety fine filter	17	Atmospheric pressure sensor

ULTRAMAT 23, 19" rack-mounted enclosure with internal sample gas pump and paramagnetic oxygen measurement

Cross-sensitivities (with residual gas concentration 100%)

Residual gas	Formula	Deviation at 20 °C	Deviation at 50 °C
Acetaldehyde	C_2H_4O	-0.31	-0.34
Acetone	C_3H_6O	-0.63	-0.69
Acetylene, ethyne	C_2H_2	-0.26	-0.28
Ammonia	NH_3	-0.17	-0.19
Argon	Ar	-0.23	-0.25
Benzene	C_6H_6	-1.24	-1.34
Bromine	Br_2	-1.78	-1.97
Butadiene	C_4H_6	-0.85	-0.93
n-butane	C_4H_{10}	-1.1	-1.22
Iso-butylene	C_4H_8	-0.94	-1.06
Chlorine	Cl_2	-0.83	-0.91
Diacetylene	C_4H_2	-1.09	-1.2
Dinitrogen monoxide	N_2O	-0.2	-0.22
Ethane	C_2H_6	-0.43	-0.47
Ethyl benzene	C_8H_{10}	-1.89	-2.08
Ethylene, ethene	C_2H_4	-0.2	-0.22
Ethylene glycol	$C_2H_6O_2$	-0.78	-0.88
Ethylene oxide	C_2H_4O	-0.54	-0.6
Furane	C_4H_4O	-0.9	-0.99
Helium	He	0.29	0.32
n-hexane	C_6H_{14}	-1.78	-1.97
Hydrogen chloride, hydrochloric acid	HCl	-0.31	-0.34
Hydrogen fluoride, hydrofluoric acid	HF	0.12	0.14
Carbon dioxide	CO_2	-0.27	-0.29
Carbon monoxide	CO	-0.06	-0.07

Residual gas	Formula	Deviation at 20 °C	Deviation at 50 °C
Krypton	Kr	-0.49	-0.54
Methane	CH_4	-0.16	-0.17
Methanol	CH_4O	-0.27	-0.31
Methylene chloride	CH_2Cl_2	-1	-1.1
Monosilane, silane	SiH_4	-0.24	-0.27
Neon	Ne	0.16	0.17
n-octane	C_8H_{18}	-2.45	-2.7
Phenol	C_6H_6O	-1.4	-1.54
Propane	C_3H_8	-0.77	-0.85
Propylene, propene	C_3H_6	-0.57	-0.62
Propylene chloride	C_3H_7Cl	-1.42	-1.44
Propylene oxide	C_3H_6O	-0.9	-1
Oxygen	O_2	100	100
Sulfur dioxide	SO_2	-0.18	-0.2
Sulfur hexafluoride	SF_6	-0.98	-1.05
Hydrogen sulfide	H_2S	-0.41	-0.43
Nitrogen	N_2	0	0
Nitrogen dioxide	NO_2	5	16
Nitrogen monoxide	NO	42.7	43
Styrene	C_8H_8	-1.63	-1.8
Toluene	C_7H_8	-1.57	-1.73
Vinyl chloride	C_2H_3Cl	-0.68	-0.74
Vinyl fluoride	C_2H_3F	-0.49	-0.54
Water (vapor)	H_2O	-0.03	-0.03
Hydrogen	H_2	0.23	0.26
Xenon	Xe	-0.95	-1.02