Key Features

- Oxygen specific analysis utilizing paramagnetic sensor
- Magnetomechanical measuring principle (dumbbell principle)
- Temperature controlled for increased stability and performance
- Up to 3 measuring ranges
- Optional paramagnetic cells for corrosive gases and solvents
- Optional intrinsically safe measuring cell for flammable gases

Typical Applications

- Fast response process gas measurement
- Flue gas control
- Inertization plants
- Biogas measurement
- Air separation, gas purity
- Power plants, metallurgical, chemistry, petrochemistry

Description

The CONTHOS 3 PMD state-of-the-art process gas analyzer is an analytical instrument developed for use in process industry. Some of the outstanding technical features of LFE’s 3rd generation, microprocessor-controlled gas analyzer for oxygen analysis are:

- Temperature controlled paramagnetic sensor
- Magnetomechanical measuring principle ("dumbbell" type)
- High selectivity to O₂
- Fast response time: time constant < 5 sec

- Excellent precision and outstanding performance for ranges from 0 - 1 vol.% O₂ up to 0 - 100 vol.% O₂
- Optional automatic pressure compensation
- Intuitive user-interface based on NAMUR recommendations
- Automatic self-diagnosis
- Optional paramagnetic cells for corrosive gases and solvents
- Optional intrinsically safe measuring cell for flammable gases
The basic measuring principle of the CONTHOS 3 PMD is rotational displacement. The photocells are part of a paramagnetic control loop which subsequently drives current through windings arranged around the dumbbell. The current through the windings generates an electromagnetic counter moment which moves the dumbbell back to its null position.

This property causes oxygen molecules to be attracted more strongly into an inhomogeneous magnetic field than other gases. The required current level is proportional to the oxygen concentration and as such is passed on to the CONTHOS signal processing unit.

Options

- Maximum 3 switchable ranges: independently configurable; suppressed ranges as special solution on request
- Automatic pressure compensation (from 800 to 1200 mbar absolute; extended pressure range on request)
- Digital I/O board for remote range switching, threshold contacts, etc.
- RS-485 interface with Modbus RTU protocol
- Interference correction in conjunction with external, selective gas analyzers for multiple gas constituents

Oxygen Sensor

The basic measuring principle of the CONTHOS 3 PMD makes use of the fact that oxygen has a paramagnetic susceptibility that is significantly greater than other gases. This property causes oxygen molecules to be attracted much more strongly into an inhomogeneous magnetic field than other gases.

The paramagnetic sensor employed in the CONTHOS 3 PMD is of the so-called "dumbbell" type utilizing the magnetomechanical measuring principle. Two miniaturized, nitrogen filled gas spheres configured in a dumbbell shape are symmetrically suspended in a strong, inhomogeneous magnetic field. Any oxygen contained in the surrounding (sample) gas is drawn into the magnetic field thereby displacing the glass spheres and forcing the dumbbell to rotate outward. The resulting torque is proportional to the oxygen concentration.

A mirror mounted on the rotational axis of the dumbbell reflects a beam of light onto a pair of photocells which detect any rotational displacement. The photocells are part of a control loop which subsequently drives current through windings arranged around the dumbbell. The current through the windings generates an electromagnetic counter moment which moves the dumbbell back to its null position.

The required current level is proportional to the oxygen concentration and as such is passed on to the CONTHOS signal processing unit.
Technical Data

Enclosure & electrical data

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- **CONTHOS 3E PMD**
  - **3HE/84TE housing** for mounting in 19" cabinet
  - Purgeable steel housing for wall mounting; with separate compartments for the electronic components and the analytical components
  - Protection class: IP40
  - Dimensions (H x W x D): 3HU / 84TE (133 x 483 x 427 mm)
  - Weight: approx. 10 kg
  - Power requirements: 100-240 VAC (48-62Hz; nominal voltage range: 88-253 VAC; 100 VA max. during warm-up period)
  - Sample gas connectors: Standard: Swagelok® (SS 316) for tubing o.d 6 mm, Option: Swagelok® (SS 316) for tubing o.d. ¼"

- **CONTHOS 3F PMD**
  - Field housing

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### Measuring characteristics

**Measuring principle**
- Paramagnetic sensor ("dumbbell" type)

**Measured quantity**
- Oxygen concentration in gas mixtures

**Gas interference**
- Note: Although the paramagnetic susceptibility of O₂ is much greater than other gases, these can also exhibit lower degrees of paramagnetic susceptibility and therefore as interfering components possibly influence the accuracy of the analysis. For this reason the gas matrix should be evaluated.

**Measuring ranges**
- Up to 3 independently configurable, switchable ranges. Suppressed ranges as special solution on request.
- Range switching is accomplished manually, automatically and/or remotely (via optional digital inputs).
  - lowest range: 0 - 1% O₂
  - largest range: 0 - 100% O₂

**Response time T₉₀**
- < 5 sec (dependent upon gas flow and analyzer configuration; integration time configurable)

**Influence of gas flow**
- between 30 – 60 l/h: < 1% of range span for a gas flow of change of ±10 l/h

**Detection limit**
- < 1% of span

**Reproducibility**
- < 1% of span

**Linearity**
- < 1% of span

**Response drift**
- Zero: < 2% of span per week
- Span: < 1% of span per week

**Ambient temperature influence**
- Zero: < 1% of span per 10 K
- Span: < 1% of span per 10 K

**Calibration**
- Manual: 2-point (offset/span) calibration (The optimal span gas concentrations should be chosen between 75 and 100 % of the corresponding range).
- Option: automatic or remote calibration in conjunction with the optional digital I/O board or RS-485

**Pressure compensation**
- Optional: from 800 to 1200 mbar absolute; extended pressure range on request

**Interference correction**
- for static and/or dynamic interference correction (dynamic correction only in conjunction with the optional analog inputs or RS-485).
  - One of the prerequisites for dynamic interference correction is the availability of a selective signal, proportional to the particular gas component to be corrected for. The processing of analyzer ranges with a suppressed zero range is not possible.

1 at constant temperature and pressure
The stability data is valid for analyzer operation with pure bottled gases. Instrument accuracy is based on binary or quasi-binary gas mixtures. Deviations from the above data can occur in conjunction with process gases depending upon the gas quality and the degree of gas handling. Unless otherwise specified the CONTHOS gas analyzer is neither exempt nor intrinsically safe in terms of explosion protection.

The CONTHOS may not be employed for the analysis of ignitable gas mixtures. The customer must ensure compliance with applicable regulations when using the analyzer with inflammable or toxic gases or when installing within explosion endangered environments. The customer must ensure that the sample gas is dry and free of particulates.

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