The CONTHOS 3 TCD HT is a high temperature thermal conductivity gas analyzer specially developed by LFE for on-line monitoring based on extractive methods for hot and wet gas analysis in process industry applications. The special outstanding technical features of LFE's high temperature gas analyzer are:

- High temperature resistance and thermostat control of all gas paths being in contact with the sample gas - thermostat control from 70°C to max. 180°C
- High temperature version of thermal conductivity detector - thermostat controlled temperature from 70°C to max. 180°C
- Control of the heated gas paths in the analyzer including alarm signals for the safe compliance with a minimum temperature for hot gas analysis
- High corrosion resistance in the entire sample gas path
- Extraordinarily high long-term stability
- Intuitive user-interface based on NAMUR recommendations
- Optional dynamic interference correction of up to 3 gases in conjunction with external, selective gas analyzer channels

Typical Applications

- Metallurgical process gases such as nitration and nitrocarburizing
- Heat treatment & hardening with hydrogen, ammonia and carbon dioxide
- Chemical processes with hydrogen as well as acidic and alkaline components
- Monitoring of processes with hydrogen, water vapor and high dew points

Key Features

- Extremely long term stable analysis of H₂ in binary and quasi-binary gas mixtures
- Ultra-fast response time T₉₀ ≤ 3 sec
- Highly corrosion resistant TCD cell with Al₂O₃, glass and quartz for process gases with Cl₂,

Description

The technical features of the CONTHOS 3 TCD HT gas analyzer open up new areas of application for the thermal conductivity principle for measurement of hot and wet sample gases where “cold” extractive analysis methods cannot be considered.

The high temperature version includes the complete thermostat control of the TCD detector as well as all gas paths and connectors within the analyzer for temperatures above the sample gas dew-point in conjunction with external heated gas lines for gas inlet and gas outlet.

The LFE CONTHOS 3 TCD HT gas analyzer has proven itself in many years of continuous operation of hot extractive gas analysis in fields such as:

- in corrosive process gases in the chemical and petrochemical industry
- in thermostat controlled applications with high dew-points
- in thermostat controlled applications avoiding the formation of salts through acidic and alkaline sample gas components
LFE's Thermal Conductivity Detector (TCD)

In conventional gas analyzers utilizing the principle of thermal conductivity, a heated object is suspended in a volume containing the sample gas. Electrical energy passed through the object results in the object heating up and attaining an equilibrium temperature which is primarily dependent upon the thermal conduction properties of the surrounding gas. This temperature is normally measured directly as a change in the electrical resistance of the heated object itself.

LFE’s unique principle modifies this "classical" method by spatially and electrically decoupling the heated element from the temperature sensing element. The specially designed geometry of the TCD cell in conjunction with the decoupling effectively suppresses undesired competing thermal effects (i.e. free and forced convective effects). The result is an instrument whose quick, stable response requires no compromise between gas flow and response time.

Model Variations

- **CONTHOS 3E - TCD**
  - 19"-rack housing
  - (protective class IP40)

- **CONTHOS 3F - TCD**
  - field-housing
  - (protective class IP65)

- **CONTHOS 3F - TCD**
  - Ex p
  - explosion protected
  - ATEX version for ex zone

- **CONTHOS 3F - TCD HT**
  - high temperature version

Options

- Up to 3 switchable ranges: independently configurable, suppressed & absolute (non-suppressed)
- Dynamic interference correction of accompanying components in multi-component gas mixtures in conjunction with external, selective gas analyzers
- Digital I/O board for remote range switching, range identification, threshold contacts, etc.
- RS-485 interface with Modbus RTU protocol
- TC detector with flowing reference cell (CONTHOS 3E & 3F)

Features

- micro-miniaturized for quick response behavior
- corrosion and temperature resistant
- made of aluminum oxide (Al₂O₃), glass and SiO₂-coated platinum sensor filaments

In conventional gas analyzers utilizing the principle of thermal conductivity a heated object is suspended in a volume containing the sample gas. Electrical energy passed through the object results in the object heating up and attaining an equilibrium temperature which is primarily dependent upon the thermal conduction properties of the surrounding gas. This temperature is normally measured directly as a change in the electrical resistance of the heated object itself.

LFE’s unique principle modifies this "classical" method by spatially and electrically decoupling the heated element from the temperature sensing element. The specially designed geometry of the TCD cell in conjunction with the decoupling effectively suppresses undesired competing thermal effects (i.e. free and forced convective effects). The result is an instrument whose quick, stable response requires no compromise between gas flow and response time.

LFE's Thermal Conductivity Detector (TCD)

- micro-miniaturized for quick response behavior
- corrosion and temperature resistant
- made of aluminum oxide (Al₂O₃), glass and SiO₂-coated platinum sensor filaments

In conventional gas analyzers utilizing the principle of thermal conductivity a heated object is suspended in a volume containing the sample gas. Electrical energy passed through the object results in the object heating up and attaining an equilibrium temperature which is primarily dependent upon the thermal conduction properties of the surrounding gas. This temperature is normally measured directly as a change in the electrical resistance of the heated object itself.

LFE’s unique principle modifies this "classical" method by spatially and electrically decoupling the heated element from the temperature sensing element. The specially designed geometry of the TCD cell in conjunction with the decoupling effectively suppresses undesired competing thermal effects (i.e. free and forced convective effects). The result is an instrument whose quick, stable response requires no compromise between gas flow and response time.
The stability data is valid for analyzer operation with pure bottled gases. The CONTHOS may not be employed for the analysis of ignitable gas-mixtures.

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 ex-proof nor intrinsically safe in terms of explosion protection.

Technical Data

Enclosure & electrical data

<table>
<thead>
<tr>
<th>CONTHOS 3E</th>
<th>CONTHOS 3F</th>
<th>CONTHOS 3F - Ex p</th>
<th>CONTHOS 3F - HT</th>
</tr>
</thead>
<tbody>
<tr>
<td>19&quot; rack housing</td>
<td>field housing</td>
<td>ATEX-compliant Ex p system</td>
<td>high temperature version</td>
</tr>
<tr>
<td>for mounting in 19&quot; cabinet</td>
<td>purgeable steel housing for wall mounting; with separate compartments for the electronic components and the analytical components</td>
<td>Protection type ‘px’ for zones 1 &amp; 2 according to EN 60079</td>
<td>high temperature version</td>
</tr>
</tbody>
</table>

Dimensions (H x W x D): 133 x 483 x 427 mm (3U / 84HP) for mounting in 19" cabinet; 434 x 460 x 270 mm; 490 x 460 x 270 mm; 502 x 460 x 270 mm

Protection class: IP40

Electrical hazardous area class:

- CONTHOS 3E: IP40
- CONTHOS 3F: IP65
- CONTHOS 3F - Ex p: Protection type ‘px’ for zones 1 & 2 according to EN 60079
- CONTHOS 3F - HT: Ex protective class of system: II 2 G, Ex p II T4

Weight:

- approx. 10 kg
- approx. 25 kg
- approx. 30 kg
- approx. 25 kg

Power requirements:

- 100-240 VAC (48-62Hz; nominal voltage range: 88-253 VAC; 100 VA max. during warm-up period)

Measuring characteristics

Measuring principle:

- Thermal conductivity (TCD). Difference in thermal conductivity (Δλ) of various gases

Measuring ranges:

- Up to 3 linearized, independently configurable, switchable ranges. Suppressed output ranges within the corresponding reference range can be easily configured.
- Range switching is accomplished manually, automatically and/or remotely via optional digital inputs.

- lowest range: 0 - 0.5% H₂ in N₂ or 99.5-100% H₂ in N₂ (or equivalent Δλ)
- largest range: 0 - 100% H₂

Calibration:

- Manual: 2-point (zero / span) calibration

- Option: automatic or remote calibration in conjunction with the optional digital I/O-board or RS-485

Warm-up time:

- dependent upon TCD operating temperature as well as the ambient temperature:
  - 70°C: approx. 20 min.; 180°C: approx. 90 min.

Response time t90:

- ≤ 3 sec (at 60 l/h gas flow and minimum signal dampening level)
- ≤ 0.5% of range span for a gas flow change of ±10 l/h
- ≤ 1% of range span for a gas flow change of ±10 l/h

Influence of gas flow:

- Higher flow rates up to e.g. 120 l/h are possible. At these higher flow rates it is recommended that the analyzer be calibrated at the operating flow rate.

Pressure influence:

- The TCD principle has a normally negligible pressure dependency. At very low ranges it can be seen as a proportional signal offset.
- Gas specific order of magnitude: < 0.02% H₂ equivalent per 100 mbar

Detection limit:

- ≤ 0.5% of span (at signal dampening level: 1 sec)

Linearity/ Accuracy:

- ≤ 0.5% of span

Reproducibility:

- ≤ 0.5% of span

Response drift:

- Zero: ≤ 1% 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

Ambient temperature in operation:

- allowed temperature range: +5 to +45°C

Influence of inclination:

- no influence

Notes:

1. at constant temperature and pressure

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.
Technical Data (continued)

Materials in contact with sample gas

<table>
<thead>
<tr>
<th>CONTHOS 3E</th>
<th>CONTHOS 3F</th>
<th>CONTHOS 3F - Ex p</th>
<th>CONTHOS 3F - HT</th>
</tr>
</thead>
<tbody>
<tr>
<td>19&quot; rack housing</td>
<td>field housing</td>
<td>ATEX-compliant Ex p system</td>
<td>high temperature version</td>
</tr>
</tbody>
</table>

**TC-Detector**

- Al₂O₃-ceramic and sapphire, glass and SiO₂-coated Pt-measuring filaments
- high corrosion- and temperature-resistance

**Internal gas lines**

- standard: PTFE
- optional: stainless steel tubing (SS 321; similar to 1.4541)

**Sample-gas connectors**

- Standard: stainless steel (SS 316; similar to 1.4401)
- Optional: Swagelok® connectors for ¼" tubing
- Optional: NPT ¼" (female)
- Optional: PFA connectors for synthetic tubing DN 4/6 (only in conjunction with PTFE tubing)

**Data display, inputs and outputs**

**User Interface**

- LC-display (40 characters x 16 lines) + bar graph
- Plain text description of instrument status as well as digital status output
- Language: switchable between English & German

**Analog signal output**

- 2 independently configurable, galvanically isolated analog outputs (with common ground; \( R_{\text{load}} = 600\Omega \) max)
- Available output levels: 0 - 20 mA, 4 - 20 mA, 4 - 20 mA with superimposed instrument status (NAMUR NE43 compliant) as well as test signal levels (0, 4, 10, 12 & 20 mA)

**Digital outputs**

- 1 to 3 (instrument status)
  - Instrument status (NAMUR NE107-compliant) via floating contacts (28V max., 350mA max.)
  - FAILURE (DO 1) | MAINTENANCE REQUIRED (DO 2) | FUNCTION CHECK (DO 3)

**Analog inputs**

- 3 galvanically isolated, configurable analog inputs for interference correction
  - 0 – 20mA or 4 – 20mA (\( R_i = 50\Omega \))

**Interference correction**

- 3 correction channels for static and/or dynamic interference correction (dynamic correction only in conjunction with the optional analog inputs or RS-485)
- with the optional analog inputs or RS-485)

**Digital I/O**

- 8 configurable, optically isolated inputs (6 – 24 VDC; 10mA max.)
- remote range selection
- remote triggering of zero and span calibration
- remote triggering and cancelling of automatic calibration
- switching of interference correction analog inputs to a secondary input range
- mapping of user defined input to a digital output

**Digital outputs**

- 7 configurable, floating relay contacts (28V max., 350mA max.)
- threshold monitoring (1 threshold per measuring range)
- feedback as to the current range
- calibration gas selection
- mapping of user defined input to a digital output

**RS-485**

- with Modbus communications protocol; galvanically isolated interface
- (Note: The RS-485 serial interface hardware cannot be used in conjunction with the digital I/O board.)

**Service interface**

- non-isolated serial interface for accessing the instrument’s configuration via a proprietary PC software

(Note: The digital I/O board cannot be used in conjunction with the RS-485 serial interface hardware.)

Note:

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail.

LFE does not accept responsibility for potential errors or possible lack of information in this document.