The CONTHOS 3 state-of-the-art thermal conductivity gas analyzer is an analytical instrument developed for on-line monitoring in process industry applications.

The special outstanding technical features of LFE’s microprocessor controlled gas analyzer are:

- Thermal conductivity detector - thermostat controlled temperature from 50°C to max. 180°C
- High corrosion resistance in the entire sample gas path
- Low detection limit in the lower ppm range
- Response highly independent of the gas flow
- Extraordinarily high long-term stability
- Intuitive user-interface based on NAMUR recommendations
- Automatic self-diagnosis
- Optional dynamic interference correction of up to 3 gases in conjunction with external, selective gas analyzer channels

The technical features of the unique CONTHOS 3 gas analyzer open up new areas of application for the thermal conductivity principle, as well as help to eliminate weak points in present analysis problem solving. The selected thermostat temperature of the detector can help minimize the cross interference of possible accompanying gas components. Furthermore, accompanying gases can be measured by means of suitable external measuring methods and an interference correction of these components can be carried out.

First developed in 1979 the LFE CONTHOS gas analyzer has proven itself in many years of continuous operation in fields such as:

- in corrosive process gases in the chemical and petrochemical industry
- in metallurgical applications such as process gas and hardening & heat treatment
- in all of the “classical” applications of the TCD principle with outstanding measurement performance
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 convectional effects). The result is an instrument whose quick, stable response requires no compromise between gas flow and response time.

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

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)

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 1 & 2

CONTHOS 3F - TCD HT
high temperature version
### 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>
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</thead>
<tbody>
<tr>
<td>19” rack housing</td>
<td>field housing</td>
<td>ATEX-compliant Ex p system</td>
<td>high temperature version</td>
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</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 for purgable steel housing for wall mounting; with separate compartments for the electronic components and the analytical components.

- **Protection class**: IP40 for CONTHOS 3E; IP65 for CONTHOS 3F.

- **Electrical hazardous area class**: Protection type “px” for zones 1 & 2 according to EN 60079. Ex protective class of system: II 2 G, Ex p II T4.

- **Weight**: approx. 10 kg for CONTHOS 3E; approx. 25 kg for CONTHOS 3F; approx. 30 kg for CONTHOS 3F - Ex p; approx. 25 kg for CONTHOS 3F - HT.

- **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. Diagrams can occur in conjunction with process gases depending upon the gas quality and the degree of gas handling.

- **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 \( t_{90} \)**: ≤ 3 sec (at 60 l/h gas flow and minimum signal dampening level).

- **Influence of gas flow**:
  - between 3 - 30 l/h: < 0.5% of range span for a gas flow change of ±10 l/h
  - between 30 - 60 l/h: < 1% of range span for a gas flow change of ±10 l/h

- **Pressure influence**: The TCD principle has a normally negligible pressure dependency. At very low ranges it can be seen as a proportional signal offset.

- **Detection limit \( 1 \)**: ≤ 0.5% of span (at signal dampening level: 1 sec).

- **Linearity/ Accuracy \( 1 \)**: ≤ 0.5% of span.

- **Reproducibility \( 1 \)**: ≤ 0.5% of span.

- **Response drift \( 1 \)**:
  - 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

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 ex-proof 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.
## Technical Data (continued)

### Materials in contact with sample gas

<table>
<thead>
<tr>
<th></th>
<th>CONTHOS 3E</th>
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</thead>
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<tr>
<td>TC-Detector</td>
<td>Al$_2$O$_3$-ceramic and sapphire, glass and SiO$_2$-coated Pt-measuring filaments high corrosion- and temperature-resistance</td>
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<tr>
<td>Internal gas lines</td>
<td>standard: PTFE optional: stainless steel tubing (SS 321; similar to 1.4541)</td>
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<tr>
<td>Sample-gas connectors</td>
<td>Optional: Swagelok® connectors for 3/8&quot; tubing Optional: NPT 3/8&quot; (female) Optional: PFA connectors for synthetic tubing DN 4/6 (only in conjunction with PTFE tubing)</td>
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### 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 (optional) | 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 (optional) | Digital inputs: 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 (Note: The digital I/O board cannot be used in conjunction with the RS-485 serial interface hardware.) |
| RS-485 (optional) | 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 |

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**Note:**
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