CONTHOS 3 - TCD

Thermal Conductivity Hydrogen Gas Analyzer

Key Features

- ⇨Extremely long term stable analysis of H_2 and noble gases in binary and quasi-binary gas mixtures with lowest ranges up to 0 – 5000 ppm
- ⇨Extremely suppressed ranges up to 99.5 - 100%
- ⇨Ultra-fast response time $T_{90} \leq 3$ sec
- ⇨Highly corrosion resistant TCD cell with Al_2O_3, glass and quartz for process gases with Cl_2, HCl, SO_2, H_2O
- ⇨Cross compensation of up to 3 components for reduction of intereference

Typical Applications

- ⇨Metallurgical process gases such as blast furnace, converter steel or direct reduction
- ⇨Steel industry: Heat treatment & hardening
- ⇨Petrochemistry: Gas processing to synthesis gas, reformer gas & coal gasification
- ⇨Monitoring of gas purity, pressure swing adsorption, gas turbine cooling gas, LEL/UEL as well as inert gases
- ⇨H_2 and O_2 purity in water electrolysis

Description

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.

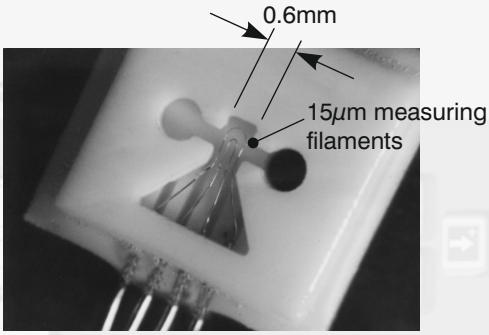
LFE´s unique principle modifies this "classical" method by spatially and electrically decoupling the heated element from the temperature sensing element. The specially designed geometry of the TCD cell in conjunction with the decoupling effectively suppresses undesired competing thermal effects (i.e. 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 (Al_2O_3), glass and SiO_x-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

	CONTHOS 3E 19" rack housing	CONTHOS 3F field housing	CONTHOS 3F - Ex p ATEX-compliant Ex p system	CONTHOS 3F - HT high temperature version
	for mounting in 19" cabinet	purgeable steel housing for wall mounting; with separate compartments for the electronic components and the analytical components		
Dimensions (H x W x D)	133 x 483 x 427 mm (3U / 84HP)	434 x 460 x 270 mm	490 x 460 x 270 mm	502 x 460 x 270 mm
Protection class	IP40	IP65		
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	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 ($\Delta\lambda$) 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% H_2 in N_2 or 99.5-100% H_2 in N_2 (or equivalent $\Delta\lambda$) largest range: 0 - 100% H_2
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 τ_{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 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% H_2 equivalent per 100 mbar
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

	CONTHOS 3E 19" rack housing	CONTHOS 3F field housing	CONTHOS 3F - Ex p ATEX-compliant Ex p system	CONTHOS 3F - HT high temperature version
TC-Detector	Al_2O_3-ceramic and sapphire, glass and SiO_x-coated Pt-measuring filaments high corrosion- and temperature-resistance			
Internal gas lines	standard: PTFE optional: stainless steel tubing (SS 321; similar to 1.4541) and 1.4571	standard: PTFE optional: stainless steel tubing (SS 321; similar to 1.4541)	stainless steel tubing (SS 321; similar to 1.4541)	
Sample-gas connectors	Standard: stainless steel (SS 316; similar to 1.4401) Standard: Swagelok® connectors for ø6mm tubing			
	Optional: Swagelok® connectors for ϕ¼" tubing Optional: NPT ¼" (female)	Optional: Swagelok® connectors for ϕ¼" tubing		Optional: Swagelok® connectors for ϕ¼" tubing
	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_{Load} = 600Ω 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 = 50Ω)
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)
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
Modbus interface (optional)	• Modbus RTU - RS485 • Modbus TCP
Service interface	non-isolated serial interface for accessing the instrument's configuration via a proprietary PC software

Note:

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CONTHOS 3 - TCD Ex p

ATEX Thermal Conductivity Hydrogen Gas Analyzer

Key Features

- ⇨Extremely long term stable analysis of H_2 and noble gases in binary and quasi-binary gas mixtures with lowest and extreme suppressed ranges: 99.5 -100%
- ⇨Ultra-fast response time $T_{90} \leq 3$ sec
- ⇨Highly corrosion and temperature resistant TCD detector with Al_2O_3, glass and quartz
- ⇨ATEX Ex p version for ex zones 1 and 2
- ⇨Extremely low purge gas consumption

Typical Applications

- ⇨Metallurgical process gases such as blast furnace with flammable gases in hazardous areas
- ⇨Steel industry: Heat treatment & hardening
- ⇨Monitoring of gas purity, pressure swing adsorption and LEL/UEL
- ⇨Petrochemistry: Flammable gases in hazardous areas - Gas processing to synthesis/ reformer gas & coal gasification
- ⇨H_2 and O_2 purity in water electrolysis
- ⇨Monitoring of hydrogen in turbogenerators

Description

The CONTHOS 3 - TCD Ex p state-of-the-art thermal conductivity gas analyzer is an analytical instrument developed for online industrial use in hazardous areas.

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

- ⇨High temperature version of thermal conductivity detector - thermostat controlled temperature from 50°C to max. 120°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 - TCD Ex p gas analyzer open up new areas of application for the thermal conductivity principle in hazardous areas also including the measuring of flammable gases.

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. The CONTHOS 3 - TCD Ex p is used in ex zone 1 and 2 fields such as:

- ⇨in corrosive process gases in the chemical and petrochemical industry
- ⇨in thermostat controlled applications up to 120°C
- ⇨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.

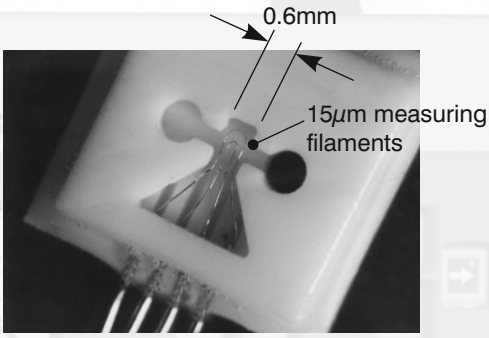
LFE´s unique principle modifies this "classical" method by spatially and electrically decoupling the heated element from the temperature sensing element. The specially designed geometry of the TCD cell in conjunction with the decoupling effectively suppresses undesired competing thermal effects (i.e. 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 responsebehavior

⇨ corrosion and temperature resistant

⇨made of aluminum-oxide (Al_2O_3), glass and SiO_x-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

CONTHOS 3F - TCD HT

high temperature
version

Technical Data

Enclosure & electrical data

	CONTHOS 3E 19" rack housing	CONTHOS 3F field housing	CONTHOS 3F - Ex p ATEX-compliant Ex p system	CONTHOS 3F - HT high temperature version
	for mounting in 19" cabinet	purgeable steel housing for wall mounting; with separate compartments for the electronic components and the analytical components		
Dimensions (H x W x D)	133 x 483 x 427 mm (3U / 84HP)	434 x 460 x 270 mm	490 x 460 x 270 mm	502 x 460 x 270 mm
Protection class	IP40	IP65		
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	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 ($\Delta\lambda$) 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% H_2 in N_2 or 99.5-100% H_2 in N_2 (or equivalent $\Delta\lambda$) largest range: 0 - 100% H_2
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 τ_{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 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% H_2 equivalent per 100 mbar
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

	CONTHOS 3E 19" rack housing	CONTHOS 3F field housing	CONTHOS 3F - Ex p ATEX-compliant Ex p system	CONTHOS 3F - HT high temperature version
TC-Detector	Al_2O_3-ceramic and sapphire, glass and SiO_x-coated Pt-measuring filaments high corrosion- and temperature-resistance			
Internal gas lines	standard: PTFE optional: stainless steel tubing (SS 321; similar to 1.4541) and 1.4571	standard: PTFE optional: stainless steel tubing (SS 321; similar to 1.4541)	stainless steel tubing (SS 321; similar to 1.4541)	
Sample-gas connectors	Standard: stainless steel (SS 316; similar to 1.4401) Standard: Swagelok® connectors for ø6mm tubing			
	Optional: Swagelok® connectors for ϕ¼" tubing Optional: NPT ¼" (female)	Optional: Swagelok® connectors for ϕ¼" tubing		Optional: Swagelok® connectors for ϕ¼" tubing
	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_{Load} = 600Ω 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 = 50Ω)
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)
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
Modbus interface (optional)	• Modbus RTU - RS485 • Modbus TCP
Service interface	non-isolated serial interface for accessing the instrument's configuration via a proprietary PC software

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CONTHOS 3 - TCD HT

High Temperature Thermal Conductivity Hydrogen Gas Analyzer

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

- ⇨High temperature analyzer with thermostat controlled gas paths up to 180°C for high dew points
- ⇨High temperature analyzer up to 180°C to avoid possible salification
- ⇨Extremely long term stable analysis of H_2 in binary and quasi-binary gas mixtures
- ⇨Ultra-fast response time $T_{90} \leq 3$ sec
- ⇨Highly corrosion resistant TCD cell with Al_2O_3, glass and quartz for process gases with Cl_2,

Description

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

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.

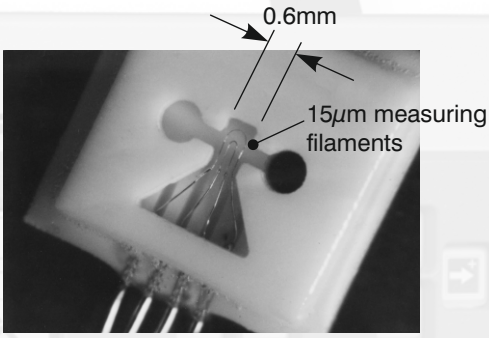
LFE´s unique principle modifies this "classical" method by spatially and electrically decoupling the heated element from the temperature sensing element. The specially designed geometry of the TCD cell in conjunction with the decoupling effectively suppresses undesired competing thermal effects (i.e. free and forced 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 (Al_2O_3), glass and SiO_x-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

CONTHOS 3F - TCD HT

high temperature version

Technical Data

Enclosure & electrical data

	CONTHOS 3E 19" rack housing	CONTHOS 3F field housing	CONTHOS 3F - Ex p ATEX-compliant Ex p system	CONTHOS 3F - HT high temperature version
	for mounting in 19" cabinet	purgeable steel housing for wall mounting; with separate compartments for the electronic components and the analytical components		
Dimensions (H x W x D)	133 x 483 x 427 mm (3U / 84HP)	434 x 460 x 270 mm	490 x 460 x 270 mm	502 x 460 x 270 mm
Protection class	IP40	IP65		
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	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 ($\Delta\lambda$) 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% H_2 in N_2 or 99.5-100% H_2 in N_2 (or equivalent $\Delta\lambda$) largest range: 0 - 100% H_2
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 τ_{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 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% H_2 equivalent per 100 mbar
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

	CONTHOS 3E 19" rack housing	CONTHOS 3F field housing	CONTHOS 3F - Ex p ATEX-compliant Ex p system	CONTHOS 3F - HT high temperature version
TC-Detector	Al_2O_3-ceramic and sapphire, glass and SiO_x-coated Pt-measuring filaments high corrosion- and temperature-resistance			
Internal gas lines	standard: PTFE optional: stainless steel tubing (SS 321; similar to 1.4541) and 1.4571	standard: PTFE optional: stainless steel tubing (SS 321; similar to 1.4541)	stainless steel tubing (SS 321; similar to 1.4541)	
Sample-gas connectors	Standard: stainless steel (SS 316; similar to 1.4401) Standard: Swagelok® connectors for ø6mm tubing			
	Optional: Swagelok® connectors for ϕ¼" tubing Optional: NPT ¼" (female)	Optional: Swagelok® connectors for ϕ¼" tubing		Optional: Swagelok® connectors for ϕ¼" tubing
	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_{Load} = 600Ω 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 = 50Ω)
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)
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
Modbus interface (optional)	• Modbus RTU - RS485 • Modbus TCP
Service interface	non-isolated serial interface for accessing the instrument's configuration via a proprietary PC software

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.

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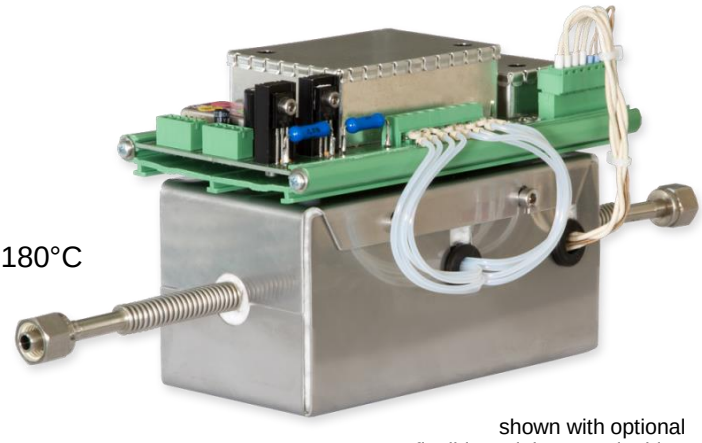
CONTHOS-3-TCD-HT_PDS_en_2021-02

LFE
Process Analytical
Instrumentation

LFE OEM TCD - Thermal Conductivity Detector

Key features

- Quick response - T90 ≤ 3 sec
- Extremely suppressed ranges
- High corrosion resistance
- High temperature capability up to 180°C
- Infallible containment
- Integration into Ex d housings



shown with optional
flexible stainless steel tubing

LFE's unique thermal conductivity detector is the heart of LFE's CONTHOS process TCD gas analyzer and has proven itself since 1979 in a wide range of applications. The TCD combines quick response, high corrosion-resistance and high-temperature capability without compromise. Further features are its extraordinary measurement stability, low range capabilities as well as highly suppressed ranges.

OEM TCD

LFE's thermal conductivity detector is available in an OEM (original equipment manufacturer) version which can be implemented into a customer's gas analyzer (system). The TCD OEM version can be integrated into in a standalone instrument or be used to complement other analysis principles such as for example NDIR/UV, Laser, or FTIR.

Due to its high temperature capability LFE's OEM TCD can be integrated into thermostat controlled analyzer systems (e.g. 80 - 120°C) or close-coupled to customer high-temperature systems (up to 180°C). Such a combination of high-temperature NDIR/UV with LFE's high-temperature TCD has been approved in several tough process control applications from a well-established process analyzer company with high-temperature solutions between 80° and 180°C since 1985.

Meanwhile the OEM version of the LFE TCD has been optimized making it attractive for more companies to round off their gas analysis portfolios.

A special infallible (fail-safe) OEM version of the TCD is available for flammable and even explosive gases requiring special measures to be fulfilled.

Typical Applications

- Metallurgical process gases - blast furnace
- Steel - heat treatment & hardening
- Petrochemistry - synthesis & reformer gas
- Gas purity - PSA, LEL/UEL & inert gas
- H_2 & O_2 purity – water electrolysis
- Synthesis & reformer gas
- Coal, wood & biogas gasification
- Corrosive process gases with Cl_2, H_2S and HCl
- Processes with H_2, water vapor and high dew points
- Processes in hazardous areas

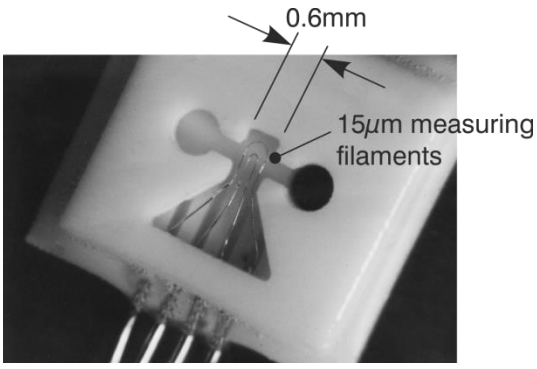
LFE's Thermal Conductivity Detector

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 prop-erties 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 SiOx-coated platinum sensor filaments



Technical data

Electrical interface

Power requirements	24 VDC; 25 VA max. (during initial heat-up phase)
Data / service interface	RS232 or Ethernet (Telnet protocol) in conjunction with isolated logic level converter • Data block (proprietary protocol) includes raw value, system values such as TCD temperature, detector status and CRC • Data in binary or plain text form • Data block transmission on request or continuously

Dimensions and Weight

Dimensions	refer to dimensional diagram
Weight	1.2 kg

Materials in contact with sample gas

	Model with synthetic tubing	Model with optional stainless steel tubing
TC Detector	Al_2O_3 ceramic and sapphire, glass and SiO_x-coated Pt measuring filaments (high corrosion and temperature resistance)	
Gas lines	PTFE / PFA	SS 321; similar to 1.4541

Measuring characteristics

Note: The technical data is valid for operation of the OEM TCD within LFE's CONTHOS gas analyzer.

The overall performance data for a particular implementation may depend on the chosen system integration, interfacing and signal processing options.

Measuring principle	Thermal conductivity (TCD) Difference in thermal conductivity ($\Delta\lambda$) of various gases
Measured quantity	Concentration of a particular gas component in binary and quasi-binary mixtures.
Gas interference	For the analyzer configuration, the knowledge of the sample gas composition is necessary. In complex (non-binary) gas mixtures, the measurement results may be affected by interfering components. Through the use of dynamic interference correction, the interference effects can be suppressed under certain circumstances. This must be implemented by the customer within his system or in conjunction with the appropriate optional interface expansion modules. Physical interference suppression is sometimes possible with certain gas combinations due to the wide temperature range of the CONTHOS' TC detector.
Measuring ranges	Measured value signal output as raw value 2^{nd} and 3^{rd} ranges as option Optimized suppressed output ranges can be configured by the factory. lowest range: 0 - 0.5% H_2 in N_2 or 99.5-100% H_2 in N_2 (or equivalent $\Delta\lambda$) largest range: 0 - 100% H_2
Calibration	The device outputs RAW values that are neither fine-calibrated nor linearized. The customer must provide the appropriate algorithms.
Detector operating temperature	TCD standard operating temperature: 70°C. Depending on the application, the operating temperature can be factory set to 60-180°C.
Warm-up time	Dependent upon TCD operating temperature as well as the ambient temperature: 70°C: approx. 20 min.; 140°C: approx. 90 min. For very small measuring ranges a longer warm-up time (overnight) is recommended.
Response time τ_{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 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. Strong gas flow fluctuations should be avoided.
Pressure drop	approx. 0.7 mbar at 60 l/h N_2
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% H_2 equivalent per 100 mbar
Detection limit [1]	≤ 0.5% of span (at signal dampening level: 1 sec)
Reproducibility [1]	≤ 0.5% of span
Response drift [1]	Zero: ≤ 1% of span per week Span: ≤ 1% of span per week
Influence of inclination	no influence

[1] at constant temperature and pressure

Sample gas requirements

Sample gas temperature	min.: +5°C max.: 10°C below detector thermostat temperature (typically 70°C)
Sample gas dew point	Dew point low enough so as to prevent condensation in the gas paths under all ambient temperature conditions
Particles in sample gas	The sample gas must be free of particles and aerosols.
Sample gas pressure	max. 300 mbar above atmospheric pressure
Sample gas flow	minimum: 3 l/h maximum: 120 l/h recommended: 30 - 60 l/h

NOTE 1: All application and implementation details such as e.g. ranges and interfacing options must be clarified with manufacturer and evaluated for feasibility.

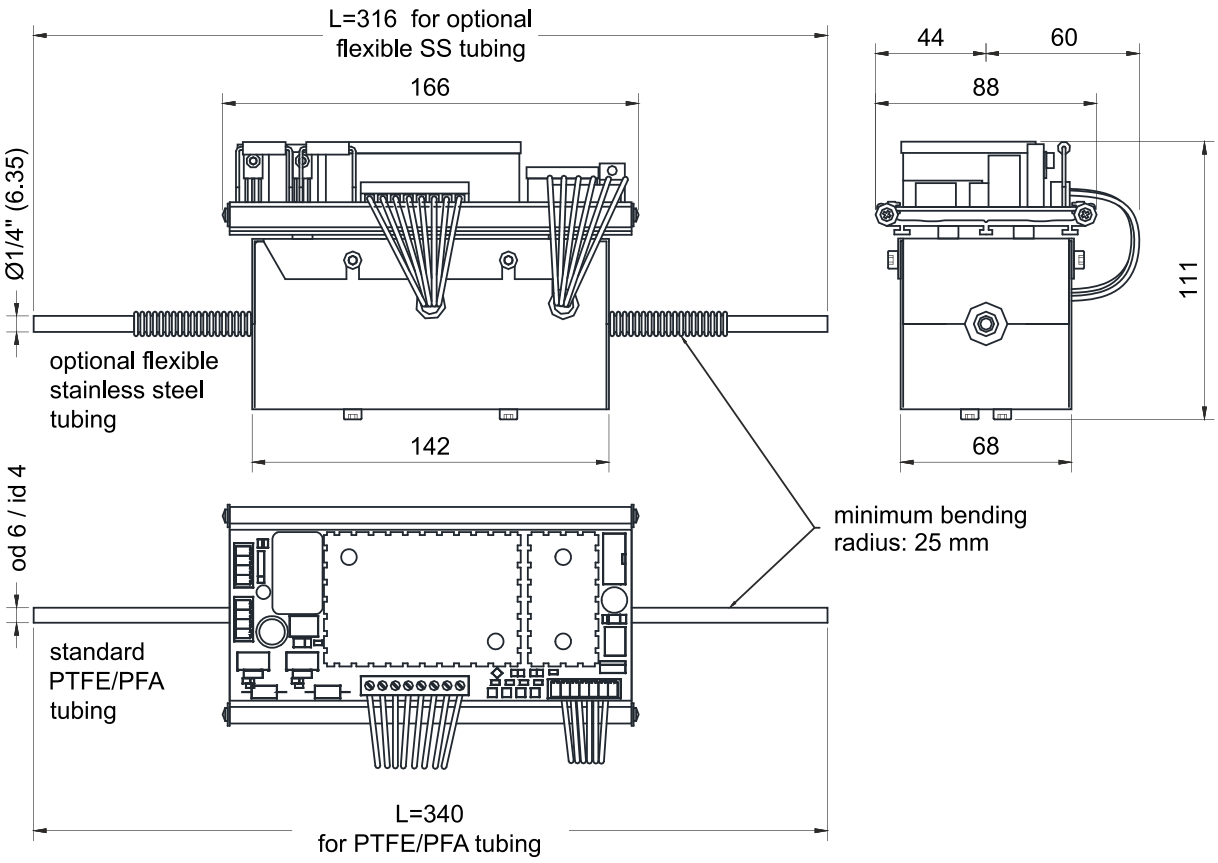
NOTE 2: The technical data is valid for analyzer operation with pure bottled gases. Instrument specifications are based on binary or quasi-binary gas mixtures. Deviations from the above data can occur in conjunction with process gases depending upon the gas quality and the degree of sample handling.

NOTE 3: The LFE OEM TCD is neither explosion-proof nor intrinsically safe in terms of explosion protection.

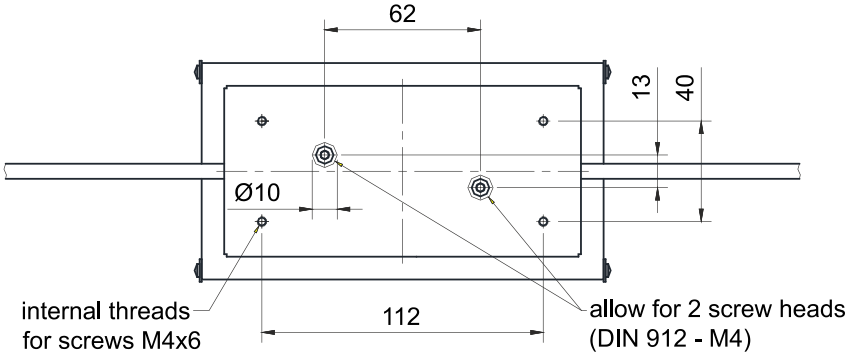
NOTE 4: The LFE OEM TCD may not be employed for the analysis of ignitable gas mixtures. The customer must ensure compliance with applicable regulations when using the unit with flammable or toxic gases or when installing within hazardous areas.

NOTE 5: The customer must ensure that the sample gas is dry and free of particulates.

Dimensions



Bottom view
(for design of suitable mounting plate)



Technical specifications are subject to change without notice.

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