LFE
Process Analytical
Instrumentation

CONTHOS 3

Thermal Conductivity Gas-Analyzer

The CONTHOS 3 state-of-the-art thermal conductivity gas-analyzer is an analytical instrument developed for online industrial use.

Some of the outstanding technical features of LFE's 3rd-generation, microprocessor based gas-analyzer are:

- high-temperature TC-detector (TCD), temperature controlled from 50°C to max. 180°C continuous operating temperature.
- high corrosion-resistance of components in contact with medium
- unusually quick response time: typically ≤ 2s
- response highly independent of the gas flow
- unusually high long-term response stability
- intuitive user-interface based on NAMUR[1] – recommendations
- automatic self-diagnosis
- optional dynamic interference correction of up to 3 gases

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 problems.

Choosing the TCD-operating-temperature above that of the dew-point of the sample-gas can, in conjunction with external and internal heated gas lines (field housing only), alleviate the need for a sample-gas cooler.

First developed in 1979 the LFE's CONTHOS gas analyzers have proven themselves in many years of continuous operation in such fields as:

- in the iron and steel industry
- in corrosive process gases in the chemical industry
- in all of the "classical" applications of the TCD-principle

Model variations

- CONTHOS 3E: 19"-rack housing (protective class IP40)
- CONTHOS 3F: field-housing (protective class IP65)
- CONTHOS 3F-Exp: explosion protected (ATEX) version in conjunction with purge-gas pressure monitor

Options

- 2nd & 3rd switched ranges: independently configurable, suppressed & non-suppressed
- interference correction in conjunction with external, selective gas analyzers for multiple gas constituents
- digital I/O-board for external range switching, threshold contacts, etc.
- RS-485 interface with Modbus RTU protocol
- heated gas lines within analyzer housing (max. 140°C; field housing only)
- TC-detector with flowed reference cell

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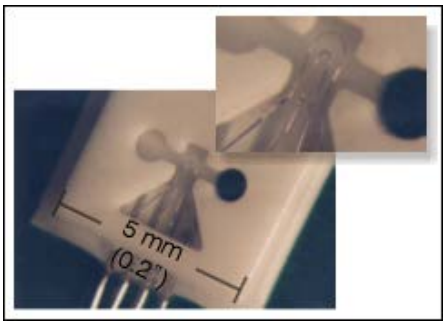
Detector Design



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 a detector whose quick, stable response requires no compromise between gas flow and response time.

Features:

- micro-miniaturized for quick response
- corrosion- and temperature- resistant (made of aluminum-oxide (Al_2O_3), glass and platinum)

General technical data

	CONTHOS 3E 19"-rack housing	CONTHOS 3F Field-housing	CONTHOS 3F EXP Ex p-ATEX system
Housing			
	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	IP65	
Dimensions (H x W x D)	3HU / 84TE 133 x 483 x 427mm	434 x 460 x 266mm	486 x 565 x 266mm
Power	100-240VAC (48-62Hz) 100VA max. (during warm-up period)		
Sample gas connectors	Swagelok® (SS 316) Standard: for tubing ϕ6mm (Option: for tubing ϕ¼")		
	Option : NPT-¼" female		
	Option: PFA connectors		

Data display, inputs and outputs

User interface	LC-display (40 characters x 16 lines) + bar graph User interface based on NAMUR recommendation Plain text description of instrument status on the LC-display as well as digital status output Language: switchable btwn. English & German
Analog signal output	2 independently configurable, isolated analog outputs: R_{Load} = 600Ω max. Output levels configurable: 0-20 mA, 4-20mA, 4-20mA (with superimposed instrument status according to NAMUR recommendation NE43) as well as test signal levels (0mA, 4mA, 10mA, 12mA & 20 mA)
Digital outputs (instrument status)	Collective instrument status via floating contacts (28V max.; 350mA max.) : INSTRUMENT FAULT | MAINTENANCE REQUIRED | MAINTENANCE
Analog inputs (optional)	3 isolated, configurable analog inputs for interference correction 0 – 20mA or 4 – 20mA (R_i = 50Ω)
Digital I/O [2] (optional)	Digital inputs: 8 configurable inputs (6 – 24VDC; 10mA max.) • remote range switching • external triggering of offset- and gain 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 outputs (floating relay contacts 28V max.; 350mA max.) • threshold monitoring (1 threshold per measuring range)

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	• feedback as to the current range • calibration gas selection • mapping of user defined input to a digital output
RS-485 (optional)	with Modbus communications protocol; isolated interface (cannot be used in conjunction with digital I/O board)
Service interface (RS-232)	non-isolated serial interface for accessing the instrument's configuration via a proprietary PC software

Materials in contact with sample gas

TC-Detector	Al_2O_3-ceramic and sapphire, Platinum and glass (Pt-measuring filaments optionally available with SiO_x-coating) high corrosion- and temperature-resistance
Sample-gas connectors	standard : stainless steel (SS 316) optional : PFA-connectors
Sample gas lines	standard: PTFE optional: stainless steel tubing (SS 321)

Analytical-/ Operational Data

Measuring principle	Difference in thermal conductivity ($\Delta\lambda$) of various gases
Measured quantity	Concentration of a particular gas component in binary and quasi-binary mixtures. In many applications involving multi-component gases the inherent non-selectivity of the thermal conductivity principle can be minimized using interference correction techniques. Physical interference reduction is sometimes possible with certain applications due to the wide temperature range of the CONTHOS' TC-detector.
Measuring ranges	Up to 3 independently configurable, switchable ranges. The reference response of each range is factory linearized (4^{th}-degree polynomial). Suppressed output ranges within the corresponding reference range can be easily configured. Range switching is accomplished manually, automatically and/or externally (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
Response time τ_{90}	approx. 2 sec. (dependent upon gas flow and analyzer configuration) (integration time configurable)
Precision	≤ 0.5% F.S.O. (typically better than ± 0.2% F.S.O.)
Accuracy	better than ± 0.5% F.S.O. (typically better than ± 0.3% F.S.O.)
Calibration	Manual: 2-point (offset/span) calibration Option: automatic or semi-automatic calibration in conjunction with the optional digital I/O-board or RS-485
Interference correction	3 correction channels for static and/or dynamic interference correction (dynamic correc tion 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.

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.

Specifications subject to change without notice

[1] NAMUR commission: Standardization commission for measuring and control technology in the German chemical industry (sub-committee for operability of microprocessor-controlled process analytical- instrumentation)

[2] Not in conjunction with RS485 serial interface

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