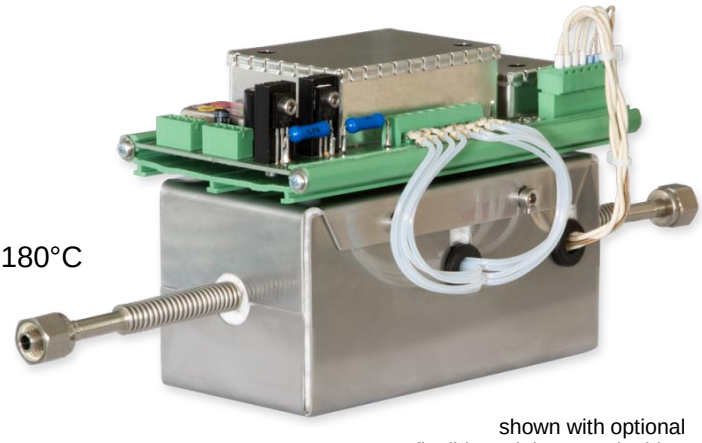
LFE
Process Analytical
Instrumentation

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

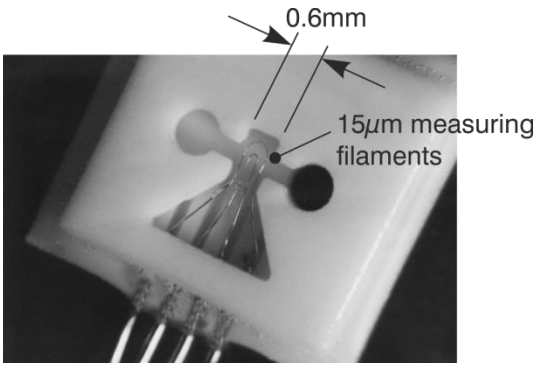
LFE's Thermal Conductivity Detector

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.

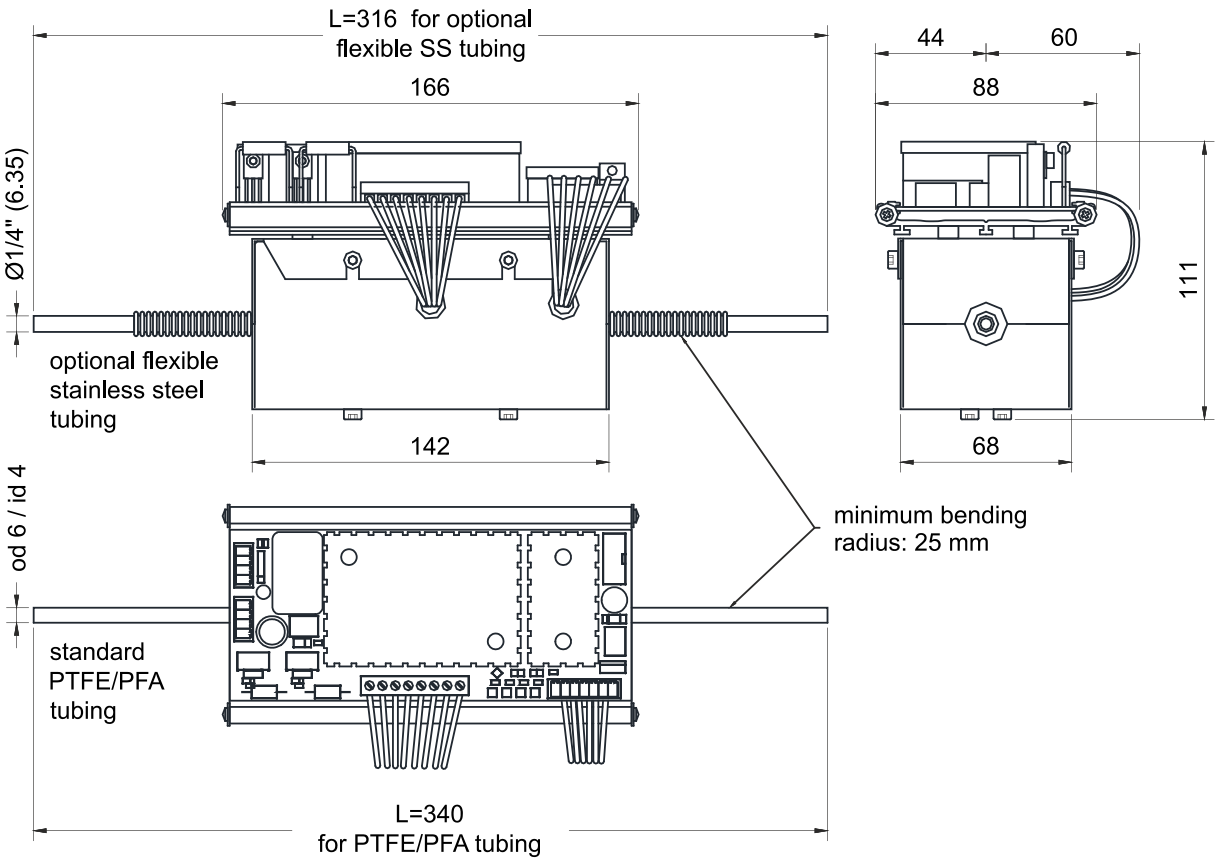
NOTE 2: The technical data is valid for analyzer operation with pure bottled gases. Instrument specifications are based on binary or quasi-binary gas mixtures. Deviations from the above data can occur in conjunction with process gases depending upon the gas quality and the degree of sample handling.

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

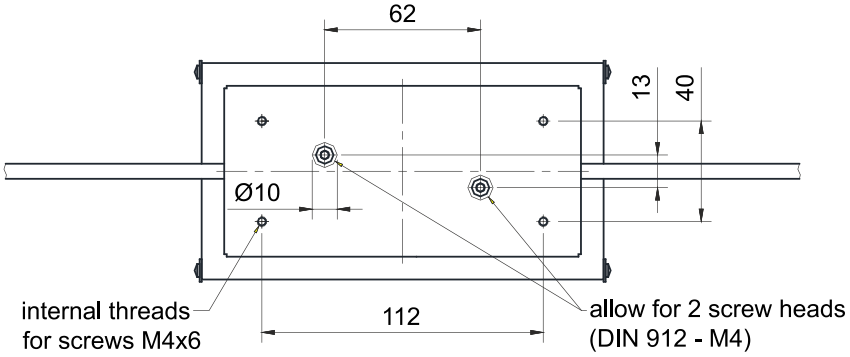
NOTE 4: The LFE OEM TCD may not be employed for the analysis of ignitable gas mixtures. The customer must ensure compliance with applicable regulations when using the unit with flammable or toxic gases or when installing within hazardous areas.

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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