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Monitoring of volatile organic compounds

Online gas chromatograph – GC 5000 VOC

Optimized for monitoring of low boiling ozone precursors

The GC 5000 VOC has been developed for the continuous monitoring of emission and immission levels of organic pollutants in ambient air in the range of C₁-C₆. The instrument is characterized by its compact design and its outstanding detection sensitivity in the ppt range.

In particular the analyzer can be applied for continuous monitoring of ozone precursors in the range of C₁-C₆ according to the EU guideline 2002/3/EC of February 12th 2002, the VDI guideline 2100 and the guidelines of the Technical Assistance Document EPA/600-R-98/161 of the American environmental protection agency EPA of September 30th 1998.

A system for continuous monitoring of the complete range of ozone precursors from C₂-C₁₂ can be configured by combining the GC 5000 VOC and the GC 5000 BTX.

Advanced sample enrichment technology

The standard version of the GC 5000 VOC features a dual-stage enrichment module for pre-concentration of organic compounds. In the first stage, the volatile organic compounds will be collected using special adsorption materials. Subsequently the analytes are released by means of thermal desorption technique. In the following second stage the released components will be focused on a trap prior to final sample introduction.

This dual-stage sample enrichment technique allows for adequately high quantities of suitable adsorption materials in order to retain even extremely volatile organic compounds, such as ethene or ethine, without any compromise in regard to the air sampling volume.

When the focusing trap is fired for sample introduction, the analytes will be transferred to the analytical column in a small and concentrated plug of vapor. Subsequent focusing of the released organic compounds therefore provides for distinct and well separated peaks in the chromatogram.

Best value for price

For limited budgets the VOC analyzer is also available in a basic version using a single-stage enrichment module. After pre-concentration of the air sample, the analytes will directly be transferred to the analytical column by means of thermal desorption technique.

In order to provide fair peak separation efficiency, lower quantities of adsorption materials must be used in a single-stage enrichment module. This results in lower breakthrough volumes compared to dual-stage sample enrichment. Using the GC 5000 VOC basic thus quantitative pre-concentration and subsequent analysis of extremely volatile organic compounds will be limited to sampling volumes not exceeding 150-200 ml.

Impressive analytical performance

Both versions – the GC 5000 VOC and the GC 5000 VOC basic – feature fully automated air sampling using a low-maintenance membrane pump downstream of the enrichment module. While sampling the air volume will be measured precisely using a thermal mass flow sensor. As the output signal of this sensor refers directly to the standard conditions, measurement of the sampling volume is not affected by pressure and temperature fluctuations.

Pre-concentration of the sample is always done at temperatures above the freezing point. This avoids freezing of the enrichment module even in case of high humidity of the air sample.

In particular while monitoring low boiling organic compounds, variations in humidity may cause major interferences in the chromatogram due to peak shifting. In order to avoid this, both - the GC 5000 VOC and the GC 5000 VOC basic - feature a stripping-column device. Humidity and high boiling compounds will be retained in a polar pre-column and back-flushed subsequently. This provides extremely stable retention times and reliable peak identification without the need of prior drying of the sample gas. Furthermore the back-flushing of high-boiling organic compounds protects the analytical column resulting in extended durability.

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A display and control panel will optionally be available and allows for intuitive touch screen operation providing direct access to all maintenance and diagnostic functions. All parameters and analytical methods can be edited in a convenient manner. The actual operating status of the analyzer as well as chromatograms and results will be displayed on the colour screen.

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Reliable operation in monitoring stations

The online gas chromatograph of the GC 5000 VOC series has especially been developed to be installed in air monitoring stations or mobile labs for continuous monitoring of emission and immission levels. The analyzers and the software are designed for stable and reliable operation without any human intervention.

The powerful analyzer software allows controlling and observing the instrument remotely via Ethernet or modem communications. Furthermore data and status messages can be transmitted via serial communications using common standard protocols.

All system parameters will be observed continuously. Any deviation from normal operation will be recorded and stored into a log file. In case of serious malfunctions or instrument failures immediately an error message will be transmitted. Therefore the gas chromatograph meets the highest demands for safe and unattended operation.

To ascertain proper analyzer operation, each controller as well as the operating system and the software will continuously be observed. In case of a system crash the computer will automatically reboot and the gas chromatograph starts in a self-acting manner the next analysis cycle.

Range of applications

- Ambient air monitoring, immissions and emissions control
- Aliphatic hydrocarbons from C₂ (ethane, ethene, ethine, propane, propene, 1,3-butadiene, ...)
- Chlorinated hydrocarbons from C₁ (chlormethane, chlorethane, dichlormethane, vinyl chloride, ...)

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TECHNICAL DATA

General

Enclosure	19" plug-in case
Height	6 height units
Depth	600 mm
Weight	appr. 33 kg
Mounting	designed for cabinet/rack mounting, telescopic slide mounting recommended
Ambient temperature	0°C to 40°C
Humidity	5% to 95% relative humidity, non-condensing
EMC	CE-marking, conformity with EMC-guideline 89/336/EEC

Instrument supply

Power supply	220 - 250 VAC
Line frequency	50 - 60 Hz
Power consumption	max. 800 W
Carrier gas	N ₂ , GC grade, min. 3 bar
Supply gases	Combustion air, GC Grade, min. 3 bar H ₂ , GC Grade, min. 3 bar
Supply connections	1/8" bulkhead union
Pressure control	Integrated pressure regulators, electronic readout of carrier gas pressure, manometer for indication of combustion air pressure
Flow control	MFC for precise flow control of hydrogen supply

Sampling

Sampling	Low-maintenance membrane pump for automated sampling
Volume measurement	MFC with thermal flow sensor for precise measurement and control of sample volume irrespective of fluctuations in atmospheric pressure and temperature
Sampling time	0-99 min (adjustable)
Flow rate	10-50 sccm/min (adjustable)
Sample volume	Typical 200-800 sccm (adjustable)

Sample Enrichment – GC 5000 VOC

Enrichment module	Dual-stage enrichment module for sample pre-concentration, thermal desorption and subsequent focusing of organic components from C ₁ to C ₆
Enrichment temperature	Typical 10°C (adjustable)
Desorption temperature	Max. 350°C (adjustable)
Heating-up rate (Desorption)	Max. 40°C/s
Focusing temperature	Typical 30°C (adjustable)
Sample introduction temperature	Max. 350°C (adjustable)

Sample Enrichment – GC 5000 VOC basic

Enrichment module	Single-stage enrichment module for sample pre-concentration and thermal desorption of organic components from C ₂ to C ₆
Enrichment temperature	Typical 10°C (adjustable)
Desorption temperature	Max. 350°C (adjustable)
Heating-up rate	Max. 40°C/s

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Valve oven

Oven liner	Stainless steel
Internal dimensions	H 210 mm x W 80 mm x D 55 mm
Heated valve block	Temperature controlled, adjustable from 30-150°C
Valves	GC 5000 VOC: 3 electrically actuated 6-Port VALCO valves GC 5000 VOC basic: 1 electrically actuated 6-Port VALCO valve

Column oven

Oven liner	Stainless steel
Internal dimensions	H 210 mm x W 210 mm x D 55 mm
Pre-column	Polar fused silica capillary column, length 15-30 m, depending on cycle time required
Analytical column	Fused silica capillary column, length 25-50 m, depending on cycle time required
Heating	Forced air
Temperature range	40°C to 210°C
Temperature control	Closed loop PID, setpoint resolution 1°C
Temperature program	3 linear heating ramps, 4 isothermal holds
Heating rate	1°C/min to 25°C/min, setpoint resolution 1°C/min
Oven cooling	Fast cooling down time due to forced air cooling

Detector

FID	FID – Flame Ionization Detector <ul style="list-style-type: none">• Stable signal output due to temperature controlled detector block• Linear detector response• Amplifier output 0-5 VDC• Requires H₂ and combustion air supply
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Communication

Communication ports	Ethernet, RS-232 / RS-485, 4 x USB, PS2, VGA
Protocols	GESYTEC II, other protocols on request

Options

	<ul style="list-style-type: none">• Display and control panel with intuitive touch-screen operation• Various I/O modules with analog output and digital I/O• Calibration gas selector (Sample, Cal1, Cal2)• Combustion air supply for FID (dry-running compressor with exchangeable charcoal filter)
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