GLOBAL™ ANALYSER SOLUTIONS

G·A·S

APPLICATION NOTE 228WA1214A

# Biogas Analyser

GPA 2261, 2177, 2186, 2286
ISO 6974, 6975
ASTM D1945, D1946, D6228

**G·A·S offers custom configured GC analysers for the petrochemical and energy application field. We have over 35 years of experience in designing and building turnkey analysers. Our analysers are designed to meet many accepted standard methods (like GPA, ASTM, UOP, ISO, etc) in the Oil and Gas industry. The efficient hardware configurations are based on proven GC technology, resulting in robust instruments with an optimal return on investment.**

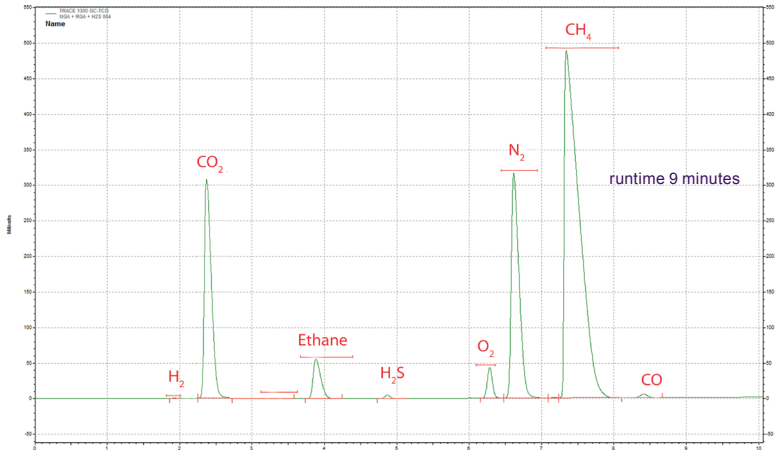
**Biogas is produced through biological processes, and its role is growing in sustainable energy production. The main components are methane and carbon dioxide with additional gases like hydrocarbons, permanent gases and sulfur components. Depending on production source, aromatics, terpenes and siloxanes are present as well. G·A·S offers several solutions for analysing these components.**

## Biogas analysis based on GC1300

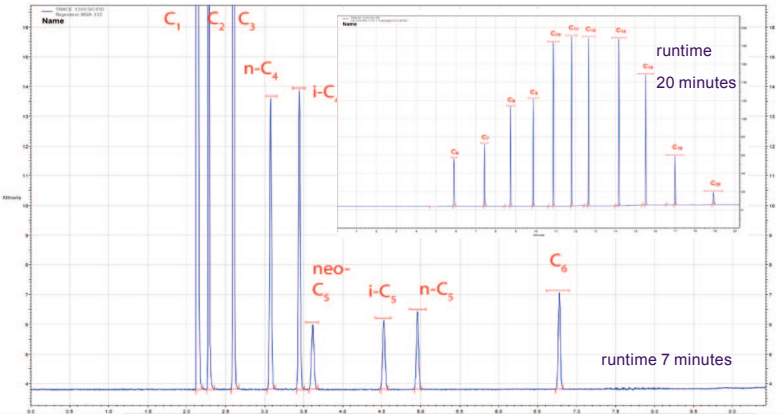
Biogas analysers are available in many different configurations, from single valve/detector instruments to complex multi-channel analysers, depending on components of interest and required accuracy and analysis time. Our analysers comply with standardised methods for Natural Gas analysis like GPA (2261, 2177, 2186, 2286), ISO (6974), ASTM (D1945 and D1946, D6228) and others.

## Extended analysis

Chromatogram 1 shows the analysis of Biogas using a single TCD detector. All main components like $CO_2$, $C_2$, $H_2S$, $O_2$, $N_2$, $CH_4$ and CO are effectively analysed in this way. $H_2$ is measured as well, although an additional channel with optimal carrier gas ($N_2$, Ar) is preferred for this component. The analyser can be further extended with a dedicated channel for hydrocarbons, using FID detection. Chromatogram 2 shows $C_1$ to $C_{20}$ normal and iso paraffins including neo-pentane. Other isomers like aromatics are analysed as well. The instrument is equipped with an independent heated valve oven with robust diaphragm valves which offer extended lifetime compared to rotary valves. Micro-packed columns (TCD channel) are located in the valve oven, while a capillary column (FID channel) is placed in the GC oven using temperature programming, allowing optimal settings for both channels. Table 1 shows excellent quantitative results.

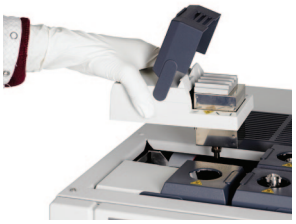



Chromatogram 1. Analysis of Biogas, GC Trace 1300-TCD




Chromatogram 2. Extended Biogas analysis, GC Trace 1300-FID

Bio gas analyser based on Thermo GC TRACE 1310



InstantConnect Injector and Detector technology

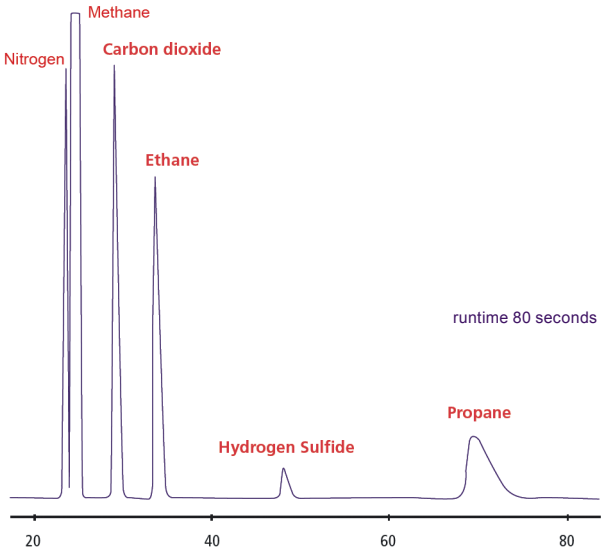
Robust process diaphragm valve for extended lifetime

# Biogas

## Biogas analysis based on CompactGC$^{4.0}$

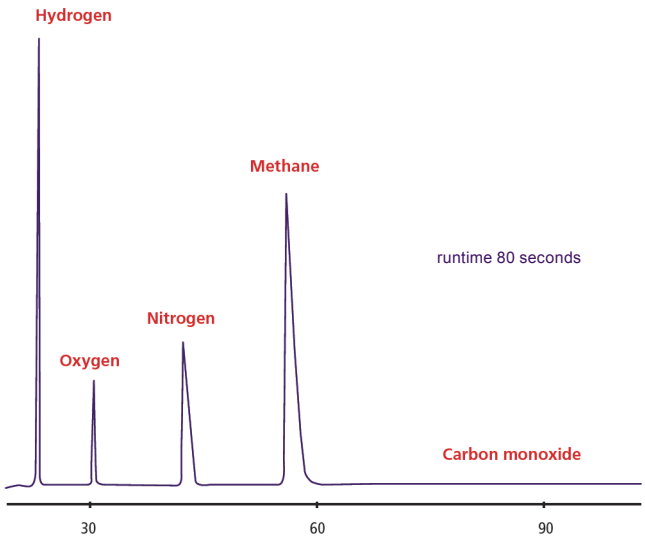
Biogas analysis on CompactGC$^{4.0}$ offers results in only 80 seconds. Chromatogram 3 shows fast analysis of the main components like $N_2$, $CH_4$, $CO_2$, $C_2$, $H_2S$ and $C_3$. Additional channels are available for:

- ▲ separation of $H_2$, $O_2$, $N_2$ and CO (chromatogram 4)
- ▲ extended hydrocarbon analysis up to $C_9$ using TCD or FID
- ▲ ppb analysis of sulfur components like $H_2S$, COS and mercaptanes using PFPD detection (chromatogram 5)
- ▲ Ammonia




Chromatogram 3. Analysis of Biogas, CompactGC$^{4.0}$ -TCD

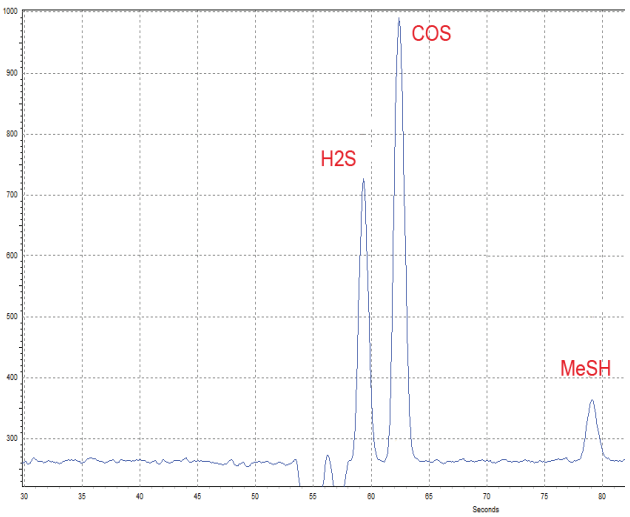
Bio gas analyser based on G·A·S CompactGC$^{4.0}$




Chromatogram 4. Extended Biogas analysis. CompactGC$^{4.0}$-TCD

| TRACE 1300 GC-TCD Sample ID | CO2 Area | Ethane Area | Nitrogen Area | Methane Area |
|---|---|---|---|---|
| Reprotest NGA 111 | 2226454 | 5898353 | 5345064 | 90507939 |
| Reprotest NGA 112 | 2217093 | 5902294 | 5346925 | 90445635 |
| Reprotest NGA 113 | 2215965 | 5903676 | 5346602 | 90526422 |
| Reprotest NGA 114 | 2227435 | 5904121 | 5345091 | 90517862 |
| Reprotest NGA 115 | 2213580 | 5897482 | 5346060 | 90501697 |
| Reprotest NGA 116 | 2217296 | 5901460 | 5349411 | 90488306 |
| Reprotest NGA 117 | 2222737 | 5903879 | 5349656 | 90549145 |
| Reprotest NGA 118 | 2219658 | 5908502 | 5350448 | 90595649 |
| Reprotest NGA 119 | 2223410 | 5902305 | 5351021 | 90504111 |
| Reprotest NGA 120 | 2217703 | 5904050 | 5353904 | 90638117 |
| Reprotest NGA 121 | 2225062 | 5898589 | 5345321 | 90599110 |
| Reprotest NGA 122 | 2219024 | 5902849 | 5351045 | 90574361 |
| Reprotest NGA 123 | 2224970 | 5902603 | 5350286 | 90568154 |
| Reprotest NGA 124 | 2226904 | 5901536 | 5349733 | 90598430 |
| Reprotest NGA 125 | 2223668 | 5904325 | 5345351 | 90531033 |
| Reprotest NGA 126 | 2232354 | 5907475 | 5351045 | 90639410 |
| Reprotest NGA 127 | 2224065 | 5903110 | 5350234 | 90640979 |
| Reprotest NGA 128 | 2219309 | 5904037 | 5352404 | 90670039 |
| Reprotest NGA 129 | 2216183 | 5913463 | 5352165 | 90560228 |
| Reprotest NGA 130 | 2221801 | 5909808 | 5346745 | 90588078 |
| Min: | 2213580 | 5897482 | 5345064 | 90445635 |
| Max: | 2232354 | 5913463 | 5353904 | 90670039 |
| Mean: | 2221734 | 5903696 | 5348926 | 90562235 |
| Std Dev: | 4782 | 3839 | 2770 | 59659 |
| %RSD: | 0.22 | 0.07 | 0.05 | 0.07 |

Table 1. Repeatability Biogas analysis (GC Trace 1300)




Chromatogram 5: 0.8 ppm $H_2S$, 1.3 ppm COS and 350 ppb MeSH in Biogas

## Terpenes and Siloxanes by GC-MS

Since Biogas is produced by cracking many different feedstocks, a wide range of additional components like siloxanes, terpenes, aromatics and others will be present; they will influence the properties of natural gas after blending. These components are selectively analysed at low ppb level by GC-MS, using GC 1300-ISQ mass spectrometer.

GC Trace 1300 with ISQ mass spectrometer

# Specifications

### GC HARDWARE

| | |
|---|---|
| Standard Methods: | GPA 2261, 2177, 2186, 2286; ISO 6974, 6975; ASTM D1945, D1946, D6228 |
| Configuration: | 1-2 channel instrument based on Thermo TRACE 1300 GC or CompactGC$^{4.0}$ |
| Optional: | Additional channels for hydrogen, extended hydrocarbons, sulfur and others<br>Stop flow valve, back pressure regulator, stream selection valves. |
| Sample tubing: | Sulfinert® tubing for inert sample path (sulfur analysis). |
| Application: | Custom configured analyser for the analysis of gaseous natural gas samples, containing hydrocarbons, permanent gases, sulfur and other components. |
| Sample requirements: | See our pre-installation guide for additional requirements. |
| Analysis Time: | 9 minutes up to $C_8$; 20 minutes up to $C_{20}$ (GC Trace 13x0); 80 seconds (CompactGC$^{4.0}$) |
| Minimum detectability: | Better than 0.01% for all individual components. Sulfur components: <100 ppb (PFPD) |
| Dynamic Range: | 4 decades for all components (TCD); 7 decades when analysed on FID. |
| Accuracy: | Dependant on external calibration and repeatability. |
| Repeatability: | < 0.1 % RSD for $CH_4$. (See tabel on page 3). |

### SOFTWARE:

| | |
|---|---|
| Calculations: | Chromeleon, ChromCard, OpenLab and EZChrom Elite datasystems.<br>Calorific value (sup. and inf.), mean molecular weight, compression factor, relative density, density, Wobbe index, BTU, and others on request. |

For more information:

G·A·S is an INTERSCIENCE company

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G·A·S is the preferred solution partner of

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