



Natural Gas Analyser

- ASTM D1945, D1946, ISO 6974, 6975, 6976, GPA 2261, 2177, 2186, 2286
- Calorific value / Wobbe index (ISO 6976)
- Robust and flexible design

AN 202WA0120H

GAS offers custom configured GC analysers for many application fields for over 45 years. GAS analysers are designed to meet many standardised methods from GPA, ASTM, UOP, ISO, EN and others. The efficient configurations are based on proven GC technology, resulting in robust instruments with an optimal return on investment.

Accurate natural gas analysis is important for many companies, from large gas suppliers to small end users, because large volumes of natural gas are involved, and therefore small differences in BTU value have major effects on profits and costs.



Figure 1. NGA-2A Extended

NGA configurations

GAS offers various Natural Gas Analysers, from single valve / single detector instruments to comprehensive multi-channel analysers. The configuration depends on requirements like standardised methods and components to be analysed.

NGA-2A Extended

Configuration 'NGA-2A Extended' is often used and covers many NGA requirements. The 2-channel instrument has 3 valves, packed and capillary columns, TCD and FID detection. See figure 1 and 2. The TCD channel analyses CO₂, C₂ and H₂S on Hayesep column and H₂, O₂, N₂, CH₄ and CO on Molsieve column, see figure 4. On the FID channel hydrocarbons from C₁ up C₈ and higher (i.e. C₂₀) are measured, including baseline separation of neo-pentane, see figure 5. Robust diaphragm valves with extended lifetime are mounted in an independently heated valve oven. Micropacked columns (for TCD channel) are located in this valve oven as well, while a capillary column (on FID channel) is placed in the GC oven with temperature programming, allowing optimal settings for both channels. The analyser is based on Thermo GC1300 with modular injectors and detectors, providing high flexibility and high uptime (figure 3).

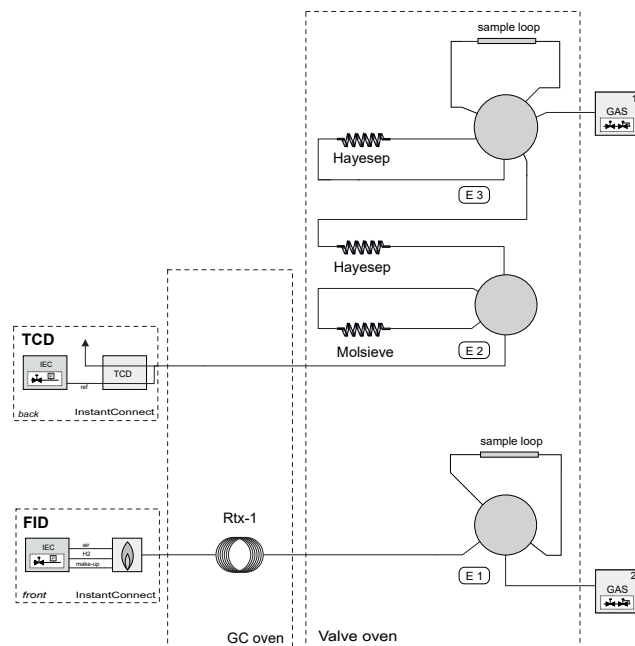


Figure 2. Diagram NGA-2A extended

Data processing and Calorific Value calculation

All required calculations according to ISO 6976 like Calorific Value, Gross heating value, density and compression factor are fully integrated in Chromeleon data system, therefore data export to external software is not needed. The result is a reliable, user friendly and workflow based system. Calculation and reporting start automatically after each run (figure 6). Figure 7 shows the excellent repeatability.

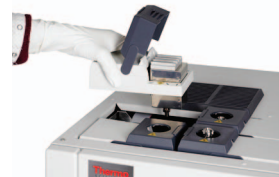


Figure 3. Modular injector/detector technology

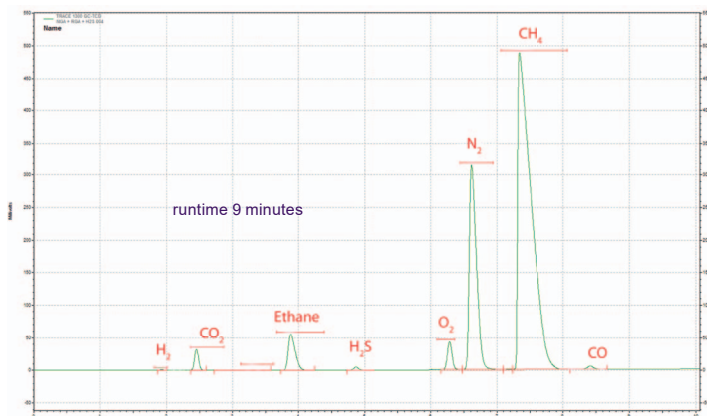


Figure 4. Chromatogram TCD channel NGA-2A Extended analyser

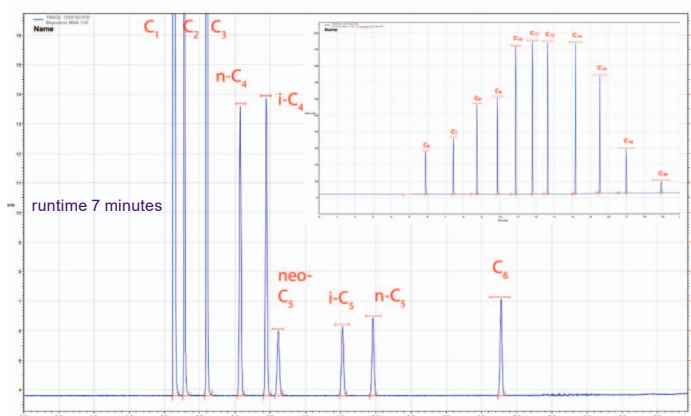


Figure 5. Chromatogram FID channel NGA-2A Extended analyser

GLOBAL™
ANALYSER
SOLUTIONS **GAS**

Natural gas calculation pack for Chromleon V2.1

Natural gas calculations

Instrument	Trace1300 NGA	Sequence name	Data G.A.S. NGA pack
Instrument Method	initial gas injection	Data Vault	ChromleonLocal
Processing Method	New Processing Method	Report Template	G.A.S. NGA Report Template
Data File	NGA mix repro TCDs	Seq. Line	10
Injection Date	08/Jul/2014	Peaks	9
Injection Time	13:21		
Calculation Type	Total		

Physical property report for the dry gas - combustion at 15°C according to ISO 6976

Metering at 0°C and 101.325kPa

	Molar basis	Mass basis	Volumetric basis	Calories	Wobbe Index	BTU
Sup. Calorific Value	897.41 kJ/mol	49.60 MJ/kg	40.15 MJ/m ³	9587.52 kcal/m ³	50.74 MJ/m ³	1077.55 BTU/ft ³
Inf. Calorific Value	809.73 kJ/mol	44.75 MJ/kg	36.23 MJ/m ³	8650.79 kcal/m ³	45.78 MJ/m ³	972.27 BTU/ft ³
Mean mol weight	18.093 g/mol					
Compression factor	0.9972					
Relative Density	0.6261					
Density	0.8094 kg/m ³					

Metering at 15°C and 101.325kPa

	Molar basis	Mass basis	Volumetric basis	Calories	Wobbe Index	BTU
Sup. Calorific Value	897.41 kJ/mol	49.60 MJ/kg	38.04 MJ/m ³	9084.12 kcal/m ³	48.09 MJ/m ³	1020.97 BTU/ft ³
Inf. Calorific Value	809.73 kJ/mol	44.75 MJ/kg	34.32 MJ/m ³	8196.57 kcal/m ³	43.39 MJ/m ³	921.22 BTU/ft ³
Mean mol weight	18.093 g/mol					
Compression factor	0.9977					
Relative Density	0.6258					
Density	0.7669 kg/m ³					

Metering at 20°C and 101.325kPa

	Molar basis	Mass basis	Volumetric basis	Calories	Wobbe Index	BTU
Sup. Calorific Value	897.41 kJ/mol	49.60 MJ/kg	37.39 MJ/m ³	8928.14 kcal/m ³	47.27 MJ/m ³	1003.44 BTU/ft ³
Inf. Calorific Value	809.73 kJ/mol	44.75 MJ/kg	33.73 MJ/m ³	8055.83 kcal/m ³	42.65 MJ/m ³	905.40 BTU/ft ³
Mean mol weight	18.093 g/mol					
Compression factor	0.9978					
Relative Density	0.6257					
Density	0.7538 kg/m ³					

Notes:

Composition report (mol %)

Component Name	Retention min	Area pA*min	Amount mol%
Propane	1.537	48.055	1.000
2-Methylpropane	1.918	12.705	0.200
n-Butane	2.240	12.784	0.200
2,2-Dimethylpropane	2.400	3.985	0.050
2-Methylbutane	3.381	3.887	0.050
n-Pentane	3.866	3.909	0.050
n-Hexane	5.709	4.688	0.050
Carbon Dioxide	3.053	9.390	1.499
Ethane	4.913	24.868	4.000
Nitrogen	8.215	24.166	3.998
Methane	9.517	395.946	89.035
Dihydrogen sulphide	4.170	0.022	0.001
Carbonyl Sulphide	4.863	0.001	0.001
Methylmercaptan	8.075	0.048	0.001

Figure 6. Calorific Value Report by Chromleon

TRACE 1300 G-C-TCD	CO2	Ethane	Nitrogen	Methane
Sample ID	Area	Area	Area	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	59859
%RSD:	0.22	0.07	0.05	0.07

Figure 7. Example repeatability NGA-2A Extended

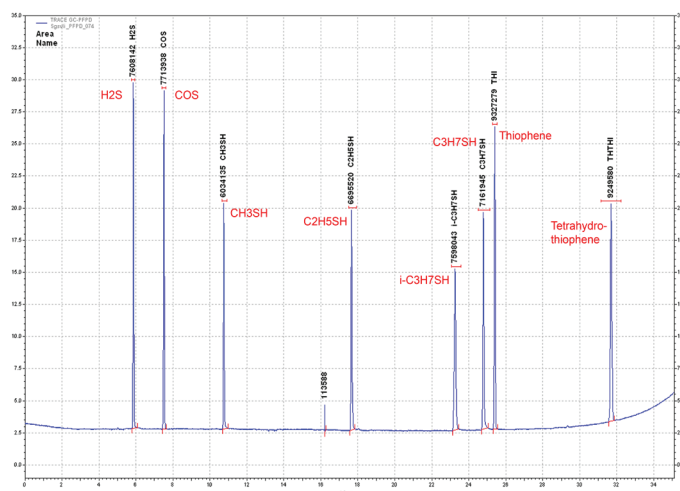


Figure 8. Optional channel for low sulphur using PFPD.
(5 ppm standard)



Figure 9. Fast NGA on CompactGC^{4.0}

NGA Options

- NGA 1: (1 valve, 1 TCD); C₁-C₅, C₆+, N₂, CO₂ (ISO 6974-4)
- NGA 3: (3 valves, 1 TCD); C₁-C₅, C₆+, O₂, N₂, CO₂, H₂S (ASTM D1945)
- Additional channel for low level sulphur using FPD, PFPD (figure 8) or mass spectrometer (figure 10)
- Additional channel with carrier gas argon or nitrogen for helium and hydrogen analysis
- Stop flow valve or back pressure regulator to control the pressure in the sample loop (precise and repeatable volume)
- Stream selection valve for analysing different samples and calibration gases
- Mass Spectrometer for ppb level detection of sulphur components, siloxanes and terpenes. (figure 10)
- CompactGC^{4.0}: Fast NGA on a small footprint (2 minutes runtime), see figure 9 (application note available)

Specification

NGA configuration:	NGA-2A Extended
Standardised methods:	ASTM D1945, D1946, ISO 6974, 6975, 6976, GPA 2261, 2177, 2186, 2286
GC instrument:	2 channel instrument based on Thermo TRACE GC 1300
Optional:	<p>Addition channel for low level sulphur using FPD, PFPD (figure 8) or mass spectrometer (figure 9)</p> <p>Additional channel with carrier gas argon or nitrogen for helium and hydrogen analysis</p> <p>Stop flow valve or back pressure regulator</p> <p>Stream selection valve for analysing different samples and calibration gases</p> <p>Mass Spectrometer for ppb level detection of sulphur components, siloxanes and terpenes (figure 9)</p> <p>CompactGC: Fast NGA on a small footprint (2 minutes runtime), figure 9</p>
Sample tubing:	NGA 1: (1 valve, 1 TCD); C ₁ -C ₅ , C ₆ +, N ₂ , CO ₂ (ISO 6974-4)
Application:	<p>NGA3: (3 valves, 1 TCD); C₁-C₅, C₆+, O₂, N₂, CO₂, H₂S (ASTM D1945)</p> <p>Sulfinert® tubing for inert sample path (H₂S analysis)</p> <p>Custom configured analyser for the analysis of gaseous natural gas samples, containing hydrocarbons, permanent gases and sulfur (H₂S)</p>
Sample requirements:	See our pre-installation guide for additional requirements
Analysis Time:	9 minutes up to C ₈ ; 20 minutes up to C ₂₀
Minimum detectability:	Better than 0.01% for all individual components. H ₂ S: 0.05%
Dynamic Range:	Four decades for all components
Accuracy:	Dependant on external calibration and repeatability
Repeatability:	< 0.1 % RSD for CH ₄ (see table on page 3)
Datasystem:	Chromeleon, OpenLab
Calculations:	Calorific value (sup. and inf.), mean molecular weight, compression factor, relative density,



Figure 10. NGA with XXL valve oven, mass spectrometer and stream selector

**GLOBAL™
ANALYSER
SOLUTIONS**

G·A·S

MADE
IN
HOLLAND

GAS is an
Interscience company