



Fast Natural Gas / Biogas Analyser

- 2 minutes analysis time
- small 19" footprint
- ppb - % levels using TCD, FID, PFPD, PDD, VUV-LUMA
- highest accuracy

AN305W0325C

GAS offers custom configured GC analysers for many application fields for over 40 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.

Although Natural Gas and Biogas have different origins, a number of analysed components are identical, yet concentration levels can vary. GAS CompactGC^{4.0} offers fast, sensitive and accurate analysis for both sample types. Depending on sample origin, additional channels are available, for instance for hydrocarbons, ammonia and ppb level sulphur components.

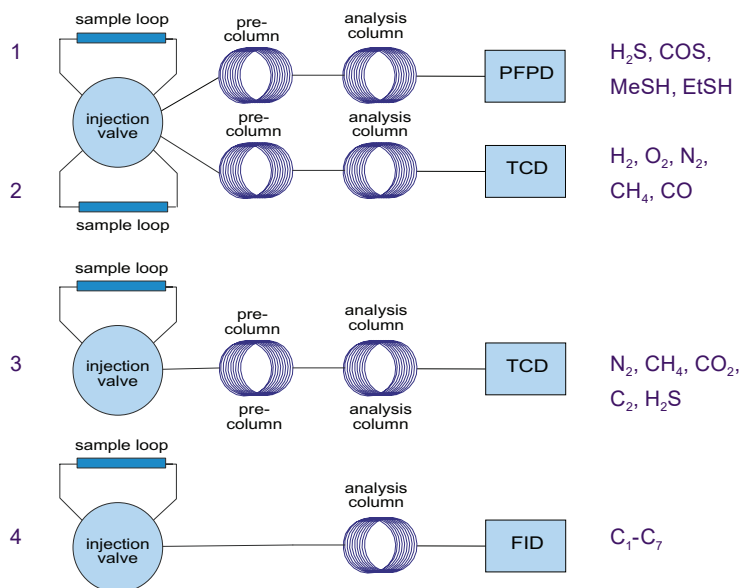


Figure 1. Diagram NG/Biogas analyser



Figure 2. CompactGC^{4.0}

1-4 channel CompactGC^{4.0}

Figure 1 and 2 show a 4 channel CompactGC^{4.0} for the analysis of natural gas and biogas. Channel 2 and 3 measure permanent gases and light hydrocarbons using 2 TCD's. Channel 1 offers sensitive and selective analysis of volatile sulphur components like H₂S, COS and mercaptans down to 20 ppb using Pulsed Flame Photometric Detector. On channel 4, C₁-C₇ hydrocarbons (including isomers) are measured using FID from low ppm to high percentage. This channel can also be configured for the analysis of terpenes and siloxanes. Reduced configurations are available when less components are required, for instance a single channel TCD instrument for CH₄ and CO₂. Other channel options include for example: specific channel for ammonia measurement or temperature programmed analysis for enhanced hydrocarbon analysis.

Fast

CompactGC^{4.0} offers fast NG/Biogas analysis. The typical run to run time is 2 minutes (dependent on number of analysed components).

Small 19" footprint. Robust

The standardised 19" enclosure offers a small footprint, and the analyser can be combined with other instruments in a 19" rack. Robust diaphragm process valves guarantee unattended operation for many years.

Data processing and Calorific Value calculation

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 necessary. This results in a reliable and user friendly workflow. Calculation and reporting start automatically after each run (figure 11).

Results

Figure 4 shows analysis of H₂, O₂, N₂, CH₄ and CO using Molsieve column and TCD, while figure 5 shows CO₂, ethane and H₂S on Rt-QBond column. H₂S is analysed down to 25 ppm on this channel. For lower levels, figure 7 proves ppb level low sulphur component analysis on PFPD; the limit of detection is 50 ppb. Figure 6 demonstrates C₁-C₆ hydrocarbon analysis on Rtx-1 column and FID. C₇ can be analysed as well on this channel (runtime > 2 minutes), using isothermal column temperature. Hydrocarbons up to C₂₀ can be analysed with the optional temperature programmable oven.

Component	%	Component	%
N2	4	n-C4	0.2
CH4	balance	neo-C5	0.05
CO2	1.5	i-C5	0.05
C2	4	n-C5	0.05
n-C3	1	n-C6	0.05
i-C4	0.2		

Figure 3. Calibration standard used for figure 4,5,6.

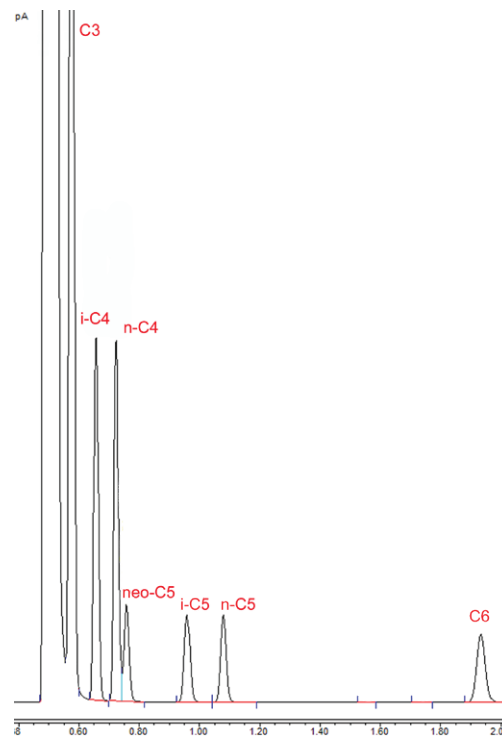
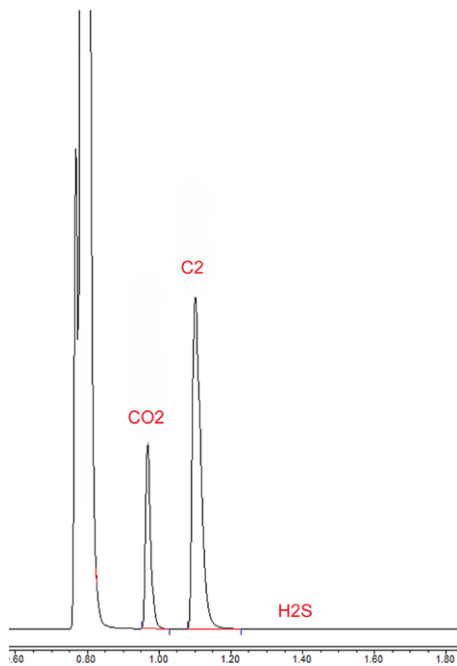
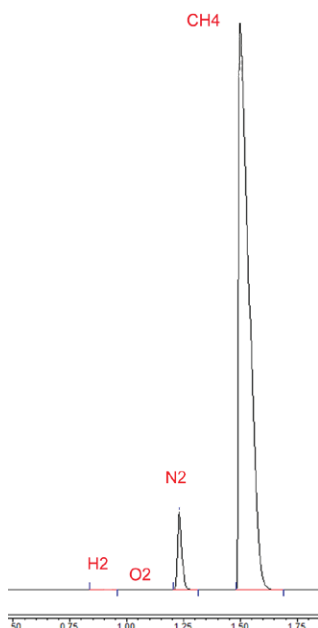


Figure 4. Permanent gases - Molsieve column/TCD

Figure 5. Permanent gases - Rt-QBond column/TCD

Figure 6. Hydrocarbons - Rtx-1 column/FID

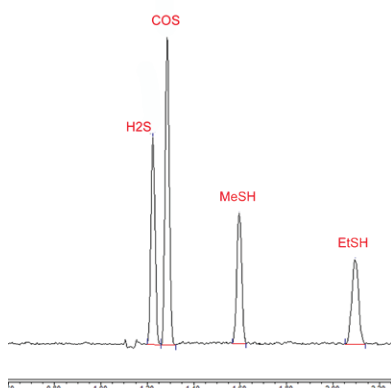


Figure 7. Low sulphur analysed by PFPD

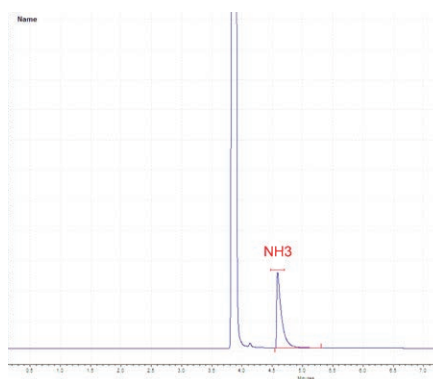


Figure 8. Ammonia (standard 1000 ppm)

Ammonia

Figure 8 displays the optional analysis of ammonia using TCD (1000 ppm calibration standard). The limit of detection is <100 ppm

Figure 9 and 10 demonstrate excellent repeatability (TCD channels).

Inj. No.	Injection Name Selected Peak:	Ret.Time min				Area mV*min			
		TCD_Ch_3				TCD_Ch_3			
		H2	O2	N2	CH4	H2	O2	N2	CH4
96	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00673	0.05408	0.05680	
97	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00674	0.05413	0.05689	
98	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00674	0.05411	0.05682	
99	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00672	0.05414	0.05689	
100	tm1 inclu ssr0 for 6 sec	0.821	0.963	1.254	1.559	0.00671	0.05409	0.05681	
101	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00673	0.05412	0.05685	
102	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00674	0.05410	0.05684	
103	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00674	0.05416	0.05683	
104	tm1 inclu ssr0 for 6 sec	0.821	0.963	1.254	1.559	0.00672	0.05406	0.05683	
105	tm1 inclu ssr0 for 6 sec	0.821	0.963	1.254	1.559	0.00673	0.05410	0.05686	
Maximum		0.821	0.963	1.254	1.559	0.00674	0.05416	0.05689	
Average		0.820	0.963	1.254	1.559	0.00673	0.05411	0.05684	
Minimum		0.820	0.963	1.253	1.559	0.00671	0.05406	0.05680	
Standard Deviation		0.000	0.000	0.000	0.000	0.00001	0.00003	0.00003	
Relative Standard Deviation		0.04%	0.03%	0.03%	0.02%	0.15%	0.05%	0.05%	

Figure 9. Example repeatability Molsieve/TCD channel

Inj. No.	Injection Name Selected Peak:	Ret.Time min				Area mV*min			
		TCD_Ch_3				TCD_Ch_3			
		H2	O2	N2	CH4	H2	O2	N2	C
96	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00673	0.05408	0.05680	
97	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00674	0.05413	0.05689	
98	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00674	0.05411	0.05682	
99	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00672	0.05414	0.05689	
100	tm1 inclu ssr0 for 6 sec	0.821	0.963	1.254	1.559	0.00671	0.05409	0.05681	
101	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00673	0.05412	0.05685	
102	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00674	0.05410	0.05684	
103	tm1 inclu ssr0 for 6 sec	0.820	0.963	1.253	1.559	0.00674	0.05416	0.05683	
104	tm1 inclu ssr0 for 6 sec	0.821	0.963	1.254	1.559	0.00672	0.05406	0.05683	
105	tm1 inclu ssr0 for 6 sec	0.821	0.963	1.254	1.559	0.00673	0.05410	0.05686	
Maximum		0.821	0.963	1.254	1.559	0.00674	0.05416	0.05689	
Average		0.820	0.963	1.254	1.559	0.00673	0.05411	0.05684	
Minimum		0.820	0.963	1.253	1.559	0.00671	0.05406	0.05680	
Standard Deviation		0.000	0.000	0.000	0.000	0.00001	0.00003	0.00003	
Relative Standard Deviation		0.04%	0.03%	0.03%	0.02%	0.15%	0.05%	0.05%	

Figure 10. Example repeatability Rt-QBond/TCD channel

Specification

Standard Methods:	ISO 6974, 6976, 19739. ASTM D1945, D3588-98, D5303, D6228. GPA 2261, 2172. GOST
Configuration:	1-4 channel analyser based on GAS CompactGC ^{4.0}
Detectors:	TCD, FID, PFPD, PDD
Optional:	Configuration/channels depend on requirements. For example: - additional channels (max. 4) for ammonia, trace H₂, siloxanes, terpenes, heavier hydrocarbons and others - stream selection valve - stop flow valve
Sample tubing:	Sulfinert® tubing for inert sample path (sulphur analysis)
Application:	Custom configured analyser for the analysis of gaseous natural gas and biogas samples, containing hydrocarbons, permanent gases, sulphur components and others
Sample requirements:	See our pre-installation guide for additional requirements
Analysis Time:	2 minutes up to C ₆ ; extended runtime for heavier components
Minimum detectability:	TCD channel: < 50 ppm FID channel: < 10 ppm PFPD channel: < 100 ppb
Accuracy:	Dependant on external calibration and repeatability
Repeatability:	< 0.1 % RSD for CH ₄ . (See tables on page 3)
Data systems:	Chromeleon, OpenLab
Calculations:	Calorific value (sup. and inf.), mean molecular weight, compression factor, relative density, density, Wobbe index, BTU, and others on request.

Natural gas calculations

Instrument	Trace1300 NGA	Sequence name	Data G.A.S. NGA pack
Instrument Method	Initial gas injection	Data Vault	ChromeleonLocal
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					

Report

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	399.946	89.035
Dihydrogen sulphide	4.170	0.022	0.001
Carbonyl Sulfide	4.863	0.001	0.001
Methylmercaptan	8.075	0.048	0.001

Figure 11. Calorific value re



Figure 11. Calorific value report by Chromeleon.



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