



APPLICATION NOTE 207WA0914E

# Flash RGA

UOP 539  
DIN 51666  
ASTM D2163

G·A·S offers custom configured GC analysers for complex separations, data processing and reporting. We have over 35 years of experience in designing and building turnkey analysers for many application fields. Our analysers are designed to meet many accepted standard methods (like GPA, ASTM, UOP and ISO) 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.

The Flash Refinery Gas Analyser from G·A·S analyses a wide scope of sample streams in only 200 seconds! Complete characterisation is offered by fast analysis of 32 components. The instrument occupies little space, using the popular 19" standard industrial enclosure. The Flash RGA is based upon Proven GC technology like diaphragm valves, robust GC detectors and standard available columns. The result is a very stable and reliable instrument.



Figure 1. Flash RGA on CompactGC<sup>4.0</sup>

### Benefits:

- ▲ Full Refinery Gas Analysis in only 200 seconds
- ▲ Meets requirements of UOP539, DIN51666, ASTM D2163
- ▲ No additional cooling time: run time = cycle time
- ▲ Proven GC technology: reliable and robust instrument
- ▲ Full digital instrument control

Flash RGA has separate analysis channels for permanent gases and hydrocarbons, similar to standardised benchtop Refinery Gas Analysers. Each channel is equipped with a backflush option to protect the separation column from high boiling components. The backflush fraction is sent to vent on all TCD channels, while it is sent to FID on the hydrocarbon channel for C<sub>6</sub>+ analysis. Figure 2 shows the instrument diagram.

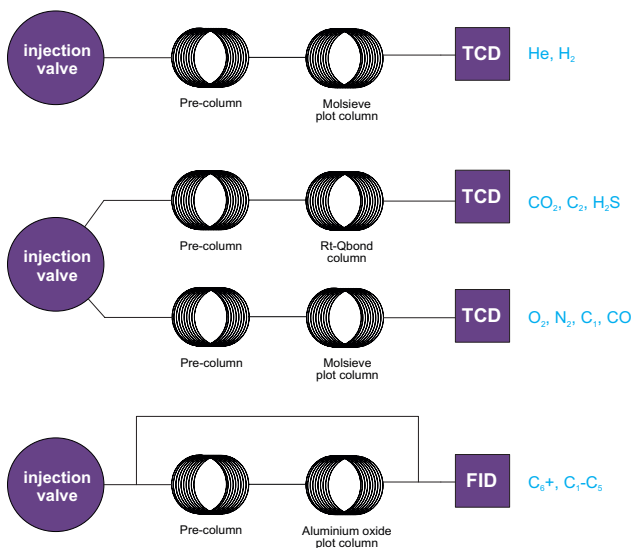


Figure 2. Diagram Flash RGA

**Channel 1** determines helium and hydrogen, using TCD detection and N<sub>2</sub> or Ar carrier gas.

On **Channel 2** carbon dioxide, C<sub>2</sub>-hydrocarbons (ethane, ethylene, acetylene) and hydrogen sulfide are analysed (COS optional), using TCD detection and helium carrier gas.

**Channel 3** is configured for the remaining permanent gases like oxygen, nitrogen, methane and carbon monoxide.

On **Channel 3** C<sub>6</sub>+ is backflushed to the detector, eluting as the first peak in the chromatogram, before C<sub>1</sub>-C<sub>5</sub> hydrocarbon isomers. FID is the preferred detector, helium is used for carrier gas.

- ▲ All gas flows and pressures are digitally controlled.
- ▲ Diaphragm valves are used for sample injection, and are located in an independent heated valve compartment, to avoid sample condensation.
- ▲ Each channel has separate carrier gas control, sample loop size and temperature setting for optimal method programming, resulting in short analysis time.
- ▲ Flash RGA uses standard available capillary columns, that can be exchanged by the user in minutes.

# Results

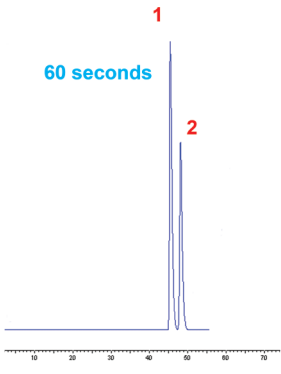


Figure 3. Chromatogram channel 1, TCD

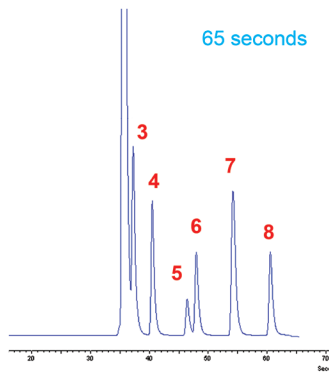


Figure 4. Chromatogram channel 2, TCD

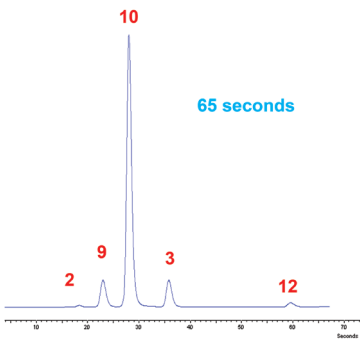


Figure 5. Chromatogram channel 3, TCD

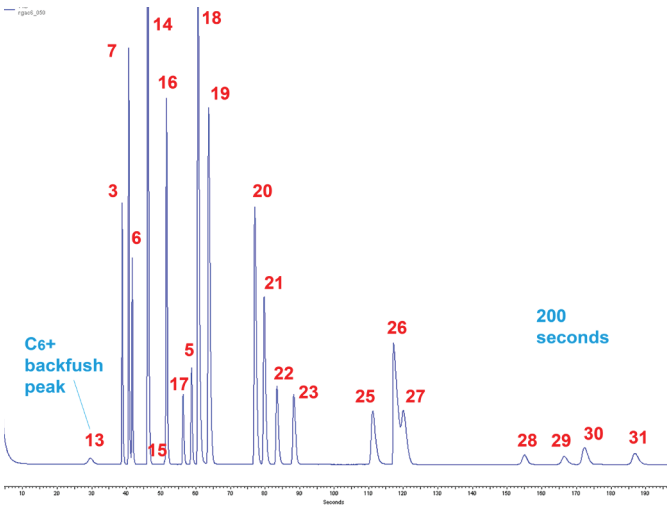


Figure 6. Chromatogram channel 4, FID with C<sub>6</sub>+ backflush peak

1 Helium	17 Propadiene
2 Hydrogen	18 iso-Butane
3 Methane	19 n-Butane
4 Carbon dioxide	20 t-2-Butene
5 Acetylene	21 1-Butene
6 Ethylene	22 Isobutylene
7 Ethane	23 c-2-Butene
8 Hydrogen Sulfide	25 Isopentane
9 Oxygen	26 1,3-Butadiene
10 Nitrogen	27 n-Pentane
12 Carbon monoxide	28 t-2-Pentene
13 C <sub>6</sub> +	29 2-me-2-Butene
14 Propane	30 1-Pentene
15 Cyclopropane	31 c-2-Pentene
16 Propene	

CGC4:FID	Methane	Ethane	Ethylene	Propane	Cyclopropane	Propylene
SampleID	Area	Area	Area	Area	Area	Area
780978	1241903	1241903	618062	2736559	14523	1365818
783446	1245766	1245766	620362	2745081	14564	1370162
782881	1245041	1245041	619624	2743410	14563	1369575
782363	1244084	1244084	619224	2741178	14571	1368002
781984	1243741	1243741	619147	2740279	14580	1367982
782674	1244982	1244982	619354	2742619	14574	1368922
781976	1243748	1243748	618844	2740141	14557	1367724
781786	1243263	1243263	618800	2738666	14554	1367319
776453	1235051	1235051	614093	2719683	14452	1358075
784457	1247394	1247394	620708	2749547	14606	1371998
Min:	776453	1235051	614093	2719683	14452	1358075
Max:	784457	1247394	620708	2749547	14606	1371998
Mean:	781900	1243497	618844	2739716	14556	1367558
Std Dev:	2141	3322	1841	7906	43	3739
%RSD:	0.27	0.27	0.30	0.29	0.29	0.27

CGC4:TCD CH 2/3	CO2	CO	Ethane-TCD	H2	O2	CH4-TCD
SampleID	Area	Area	Area	Area	Area	Area
9867879	2676988	2676988	16055955	8705969	2460836	11301961
9865582	2667500	2667500	16059980	8688911	2459909	11293394
9832687	2666236	2666236	16050034	8693997	2458372	11284272
9871328	2639155	2639155	16075659	8657410	2427309	11151795
9851870	2672312	2672312	16066498	8694393	2462544	11275184
9858837	2680423	2680423	16032345	8686151	2461801	11295337
9831261	2679669	2679669	16045805	8676985	2458632	11292557
9829077	2673583	2673583	15989060	8682432	2455520	11274628
9783803	2656435	2656435	15955874	8696667	2441349	11208062
9847112	2679352	2679352	16012540	8709029	2464301	11286237
Min:	9783803	2639155	15955874	8657410	2427309	11151795
Max:	9871328	2680423	16075659	8709029	2464301	11301961
Mean:	9843964	2689165	16034375	8689194	2455057	11267563
Std Dev:	26261	12933	37904	14889	11670	48909
%RSD:	0.27	0.48	0.24	0.17	0.48	0.43

Figure 6. Repeatability

Chromleon or EZChrom/OpenLab data systems with integrated instrument control are used for data handling and method programming, providing all needed processing, reporting and quality control features.

Additional reports are available as well, for instance reporting of Calorific value and Carbon content according to DIN 51666.

Figure 6 shows excellent repeatability. The minimum detectability is 0.01 % for all components (0.05 for H<sub>2</sub>S). Percentage levels of hydrogen sulfide are handled without any problem because robust parts and inert Sulfinert® treated materials are used.

Refinery gas calculation pack for Chromleon V2.0

Refinery gas calculations			
Instrument	MODOMA003	Sequence name	Data G.A.S. RGA pack
Instrument Method	Refinery Gas	Data Vault	ChromleonLocal
Processing Method	RGA	Report Template	G.A.S. RGA Report Template
Data File	RGA 001	Seq. Line	9
Injection Date	08/Jul/2014	Vial no.	10
Injection Time	13:03	Inj Vol (uL)	1.0
Calculation Type	Total	Peaks	9

---

Physical property report according to DIN 51666

	Molar basis	Mass basis	Volumetric basis
Sup. Calorific Value	896.77 kJ/mol	49.60 MJ/kg	40.12 MJ/m <sup>3</sup>
Inf. Calorific Value	809.15 kJ/mol	44.75 MJ/kg	36.20 MJ/m <sup>3</sup>
Mean mol weight	18.082 g/mol		
Carbon Content	55.260 g/100g		
Relative Density	0.6257		
Density	0.8089 kg/m <sup>3</sup>		

---

Composition report (mol %)

Name	Retention min	Area pA*min	Amount mol%
Propane	1.536	48.037	1.000
isoButane	1.917	12.712	0.200
n-Butane	2.240	12.796	0.200
neoPentane	2.398	3.990	0.050
isoPentane	3.380	3.881	0.050
n-Pentane	3.863	3.913	0.050

Figure 7. Post-run calculation of Calorific value and density by Chromleon datasystem

# Specifications



Figure 9. CompactGC<sup>4.0</sup> with Vaporiser for injection of LPG samples

<b>Standard methods:</b>	UOP 539, DIN 51666, ASTM D2163
<b>Configuration:</b>	Four channel instrument using 3 TCDs and FID, based on CompactGC <sup>4.0</sup> . Independent heated valve oven, 3 independent heated isothermal column ovens with capillary columns. Injection: gas sampling valves with fixed sample loops.
<b>Optional:</b>	Additional valve for gas injection at ambient pressure (stop flow), or back-pressure regulator for injection at constant pressure.
<b>Sample tubing:</b>	Sulfinert <sup>®</sup> tubing for inert sample path (H <sub>2</sub> S analysis).
<b>Application:</b>	Custom configured analyser for the analysis of gaseous samples, containing hydrocarbons, permanent gases and sulfur (H <sub>2</sub> S). All saturated and unsaturated hydrocarbons from C <sub>1</sub> -C <sub>6</sub> including C <sub>6</sub> + composite are separated (see component table). Separate analysis channels for hydrogen, permanent gases, and hydrocarbon analysis. The instrument can be applied for all types of refinery gases, including stack gases, flare gases and reformer gases.
<b>Sample requirements:</b>	The sample must be offered to the analyser as a gas at room temperature. See our pre-installation guide for additional requirements. Optional vaporiser available for LPG samples.
<b>Analysis Time:</b>	Less than 200 seconds.
<b>Minimum Detectability:</b>	Better than 0.01% for all individual components. H <sub>2</sub> S: 0.05%.
<b>Dynamic Range:</b>	Four decades for all components.
<b>Accuracy:</b>	Dependant on external calibration and repeatability.
<b>Repeatability:</b>	Better than 1% RSD at 1% concentration level for all analytes specified, measured over at least 10 consecutive runs.
<b>Custom reporting:</b>	Calorific value and carbon content calculation according to DIN 51666. Other calculations on request
<b>Optional:</b>	Vaporiser for injection for LPG samples