



Robust
Highest uptime: > 99%
10 ppb N₂O
Air, water and soil samples
No radioactive source

APPLICATION NOTE 219WA0614B

Greenhouse gas analysers

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, ISO, etc.) in the Oil and Gas industry. The efficient configurations are based on proven GC technology, resulting in robust instruments with an optimal return on investment.

Human activities - particularly burning fossil fuels (like coal, oil and natural gas), agriculture and land clearing - are increasing the concentrations of greenhouse gases, which are contributing to warming of the earth. G·A·S offers two greenhouse gas analysers for the analysis of CO₂, CH₄, N₂O and SF₆. Type A is based on ECD and methaniser-FID, while type B uses Plasma Emission Detection.

Greenhouse gas analyser A - ECD / FID

Analyser type A is configured with 2 analytical channels (see figure 1). The first channel separates CH₄ and CO₂ from air, while water is backflushed to vent. CO₂ is converted to methane by a methaniser, for sub ppm detection by FID (see figure 2). An optional TCD is available, placed in series with methaniser-FID, in case of high level of CO₂.

N₂O is measured by ECD (Electron Capture Detector) on the second channel, after separation from Air and CO₂ (figure 3). Water is backflushed to vent. SF₆ can be measured as well on this channel, with sub-ppb level detection limit.

Results

All component are analysed with repeatability < 1 % RSD. Figure 4 shows statistical result for N₂O at 330 ppb concentration level in air. The minimum detectability is < 50 ppb for CH₄, < 100 ppb for CO₂ and < 10 ppb for N₂O. SF₆ is analysed in the sub-ppb range.

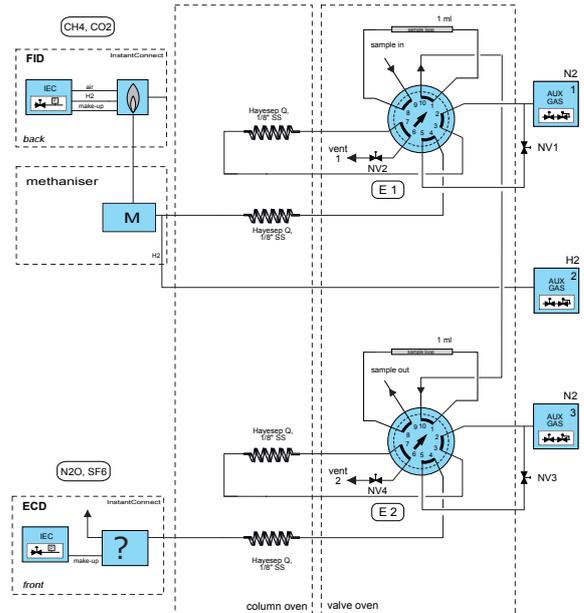


Figure 1. Diagram greenhouse gas analyser using ECD/methaniser-FID

TRACE 1300 GC-C...	N2O
Sample ID	Area
niowag_N2O_067	4713403.00
niowag_N2O_068	4695494.00
niowag_N2O_069	4689598.00
niowag_N2O_070	4779851.00
niowag_N2O_071	4731030.00
niowag_N2O_072	4706694.00
niowag_N2O_073	4780556.00
niowag_N2O_074	4778467.00
niowag_N2O_075	4748329.00
niowag_N2O_076	4784289.00

Min:	4689598.00
Max:	4784289.00
Mean:	4740771.10
Std Dev:	38232.97
%RSD:	0.81

Figure 4. Repeatability for N₂O in air at 330 ppb

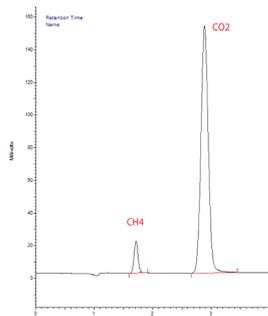


Figure 2. Channel 1 with methaniser-FID

LOD 10 ppb for N₂O

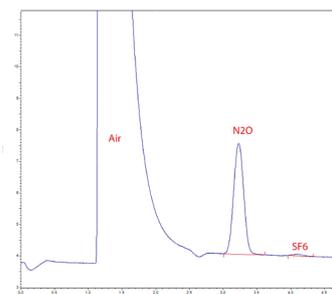


Figure 3. Channel 2 using ECD (330 ppb N₂O)

Greenhouse gas analyser B - PED

Analyser type B uses Plasma Emission Detector (PED) for the analysis of greenhouse gases. This detector only requires Argon or Helium (no FID detector gases needed), and avoids the uses of a radioactive source (like ECD). See our application note for HPA (High Purity Analyser) for further explanation. Two analysis channels are combined on a single PED using selection valve E2 (see figure 5), with figure 6 and 7 as a result. Levels of detection are <math><100\text{ ppb CO}_2</math>, <math><10\text{ ppb CH}_4</math>, and <math><10\text{ ppb N}_2\text{O}</math>.

Instruments

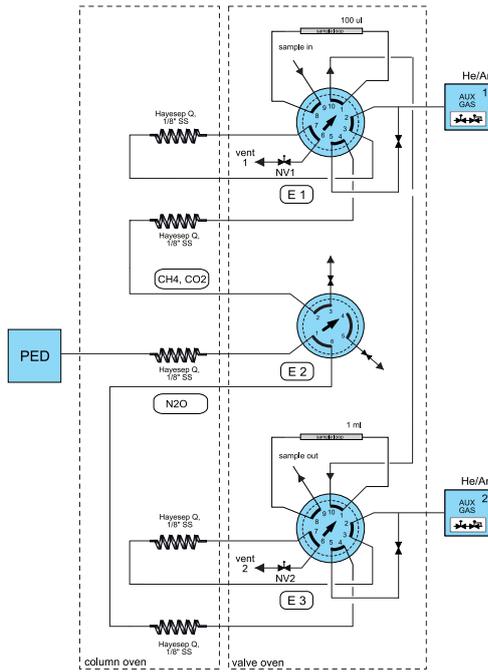


Figure 5. Greenhouse gas analyser with Plasma Emission Detector



Figure 8. Greenhouse gas analyser based on Trace 1310GC with ECD/methaniser-FID or PED

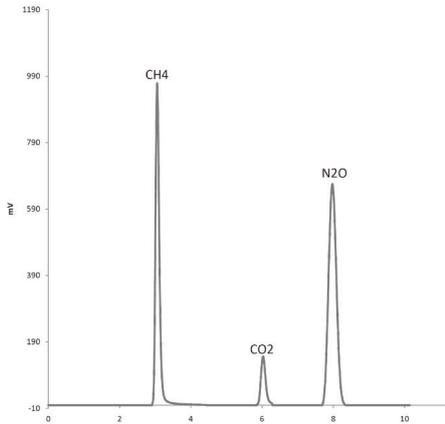


Figure 6. 8 ppm CH_4 , 50 ppm CO_2 , 10 ppm N_2O in He (PED)

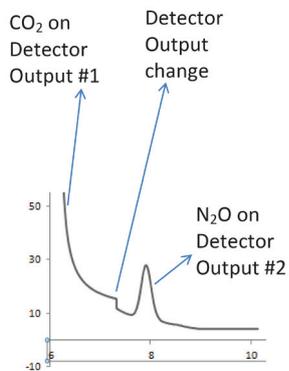


Figure 7. 30 ppb N_2O in air (PED)



Figure 9. CompactGC^{4.0} with PED for greenhouse gas analysis



Figure 10. Greenhouse gas analyser with Head Space sampler for water, soil or organic material samples. Sample trays for up to 1 liter vials are optional available.

Specifications

Application:	Analysis of greenhouse gases in air, water, soil or organic material samples
Configuration:	Dual channel instrument based on Thermo Trace 1300 GC or CompactGC ^{4.0} with (A) Methaniser-FID and ECD detection (TCD optional for high CO ₂ levels) (Trace 1300GC) (B) Plasma Emission Detector (Trace 1300GC or CompactCC ^{4.0})
Injection:	GSV (Gas Sampling Valve) or Head Space (Autosampler using syringe and SSL injector)
Optional:	Head Space sampling using GSV (closed loop sampling)
Analytes:	CH ₄ , CO ₂ , N ₂ O, SF ₆ ; chlorofluorohydrocarbons on request
Analysis Time:	Type A (methaniser-FID): 5 minutes Type B (PED): 10 minutes
Minimum Detectability:	Type A: CH ₄ < 50 ppb, CO ₂ < 100 ppb; N ₂ O < 10 ppb (Ar/CH ₄ as ECD make-up gas); SF ₆ : sub-ppt range Type B: CH ₄ < 10 ppb; CO ₂ < 100 ppb, N ₂ O < 10 ppb; SF ₆ < 10 ppb
Repeatability:	1% RSD (n=10) or better (N ₂ O @ 330 ppb; CH ₄ @ 2 ppm; CO ₂ @ 10 ppm; Gas Sampling Valve)
Data systems	Chromeleon, OpenLab, EZChrom



Figure 11. InstantConnect detector technology for high uptime and high flexibility



Figure 12. Diaphragm valve with internal purge for extreme low leak rate (mandatory for ECD and PED)



Figure 13. Plasma Emission Detector