Agilent

Trusted Answers

Analyzer Solutions Guide for the Energy and Chemical Industry

Generate Accurate, Reliable Data to Ensure Quality and Productivity

Your business helps fuel the global economy by meeting the demand for petroleum, natural gas, and biofuel. Success depends upon safe, reliable, and efficient processes to ensure that consumers receive a consistent flow of these products. For decades, Agilent has provided reliable analytical solutions to help researchers, process managers, and line analysts meet their measurement challenges. From characterizing raw crude and natural gas… to monitoring the production of refined chemicals… to determining the quality of alternative fuels… Agilent and our Channel Partners supply the most complete portfolio of analyzers to the energy and chemical industry.

Agilent energy and chemical analyzers reflect industry standards and a stringent quality control process

Before installation:

- Factory configuration and chemical check-out to “pre-test” analytical performance
- Field installation and performance verification by factory-trained Agilent or Channel Partner engineers

Following installation:

- Continued support by our application development and design teams as you work through your analytical challenges

Agilent’s energy and chemical analyzers build on our reputation for hardware excellence and technical expertise

Our solutions range from basic system modifications—such as using chemically inert materials and specialty columns in systems that quantitate trace contaminants in petrochemical streams—to complex, multi-valve analyzers that let you characterize a sample’s diverse components.

On the following pages, you will find Agilent’s complete energy and chemical analyzer portfolio, including:

- Factory-tested, ready-to-use GC analytical solutions developed to meet industry standards, such as ASTM, UOP, EN, and GPA*
- Custom analyzer systems configured and tested to your application’s predetermined specifications
- Specific instruments and tools designed, delivered, and supported by Agilent Channel Partners

Whether you need a ready-to-go configuration or a custom analyzer, Agilent can help you and your team spend less time on analytical setup and more time producing outstanding results.

**This guide reports typical quantitation limits for each system configuration. These values may differ from the absolute reporting limit required by the method.*

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Analyzer by Reference

Refinery gas

Analyzer Model	Description	Configured per Published Method(s)
8890 GC Option #600	Three-channel fast refinery gas analyzer	ASTM D1945, ASTM D1946, UOP 539
8890 GC Option #601	Fast refinery gas analyzer with H_2S	ASTM D1945, ASTM D1946, UOP 539
8890 GC Option #603	High-capacity refinery gas analyzer with large valve oven	ASTM D1945, ASTM D1946, UOP 539
8890 GC Option #604	Fast refinery gas analyzer with large valve oven	UOP 539
8890 GC Option #605	Extended refinery gas analyzer with large valve oven and micropacked columns (H_2S & O_2)	UOP 539

Natural gas

Analyzer Model	Description	Configured per Published Method(s)
8890 GC Option #610	Extended natural gas analyzer	GPA 2286
8890 GC Option #611	Single-channel natural gas analyzer	ASTM D1945, GPA 2261 (H_2/He not included)
8890 GC Option #612	Dual-channel natural gas analyzer	ASTM D1945, GPA 2261 (H_2/He on 2nd channel)
8890 GC Option #613	Sour natural gas analyzer	ASTM D1945, GPA 2261
8890 GC Option #615	Sour natural gas analyzer	GPA 2286

Fuel

Analyzer Model	Description	Configured per Published Method(s)
8890 GC Option #620	Oxygenates and aromatics in gasoline analyzer	ASTM D4815, D5580
8890 GC Option #621	Analyzer for D4815 oxygenates in gasoline	ASTM D4815
8890 GC Option #622	Analyzer for EN 13132 oxygenates in gasoline	EN 13132, EN 12177
8890 GC Option #623	Low oxygenates in hydrocarbons analyzer	ASTM D7423
8890 GC Option #624	Biodiesel analyzer	ASTM D6584
8890 GC Option #625	Biodiesel analyzer for methanol content by HSS-GC	EN 14110
8890 GC Option #630	Analyzer for sulfur in natural or fuel gas by SCD	ASTM D5504
8890 GC Option #631	Analyzer for sulfur in light petroleum by SCD	ASTM D5623, UOP 791
8890 GC Option #632	LPG composition analyzer	ASTM D2163, D2593, D2712, D5524

Analyzer by Reference

Process gas

Analyzer Model	Description	Configured per Published Method(s)
8890 GC Option #640	Low-level CO and CO_2 in-process gas analyzer with vent valve	N/A
8890 GC Option #641	Low-level CO and CO_2 in-process gas analyzer	N/A

Transformer oil gas

Analyzer Model	Description	Configured per Published Method(s)
8890 GC Option #650	Enhanced transformer oil gas (TOGA) analyzer	ASTM D3612 C

Greenhouse gas

Analyzer Model	Description	Configured per Published Method(s)
8890 GC Option #660	Greenhouse gas analyzer 0.4 ppm to 0.2% carbon dioxide, 0.2 ppm to 20% methane, 30 PPB nitrous oxide	N/A
8890 GC Option #661	Greenhouse gas analyzer with 0.4 ppm to 20% CO_2 detection	N/A

Analyzer by Compliance Method

Method	Analyzer Model
ASTM D1945	
Three-channel fast refinery gas analyzer	8890 GC Option #600
Fast refinery gas analyzer with H_2S	8890 GC Option #601
High-capacity refinery gas analyzer with large valve oven	8890 GC Option #603
Single-channel natural gas analyzer	8890 GC Option #611
Dual-channel natural gas analyzer	8890 GC Option #612
ASTM D1946	
Three-channel fast refinery gas analyzer	8890 GC Option #600
Fast refinery gas analyzer with H_2S	8890 GC Option #601
High-capacity refinery gas analyzer with large valve oven	8890 GC Option #603
ASTM D2163	
LPG composition analyzer	8890 GC Option #632
ASTM D2593	
LPG composition analyzer	8890 GC Option #632
ASTM D2712	
LPG composition analyzer	8890 GC Option #632
ASTM D3612 C	
Enhanced transformer oil gas (TOGA) analyzer	8890 GC Option #650
ASTM D4815	
Oxygenates and aromatics in gasoline analyzer	8890 GC Option #620
Analyzer for D4815 oxygenates in gasoline	8890 GC Option #621
ASTM D5504	
Analyzer for sulfur in natural or fuel gas by SCD	8890 GC Option #630
ASTM D5524	
LPG composition analyzer	8890 GC Option #632
ASTM D5580	
Oxygenates and aromatics in gasoline analyzer	8890 GC Option #620

Analyzer by Compliance Method

Method	Analyzer Model
ASTM D5623	
Analyzer for sulfur in light petroleum by SCD	8890 GC Option #631
ASTM D6584	
Biodiesel analyzer	8890 GC Option #624
ASTM D7423	
Low oxygenates in hydrocarbons analyzer	8890 GC Option #623
EN 12177	
Analyzer for EN 12177 oxygenates in gasoline	8890 GC Option #622
EN 13132	
Analyzer for EN 13132 oxygenates in gasoline	8890 GC Option #622
EN 14110	
Biodiesel analyzer for methanol content by HSS-GC	8890 GC Option #625
GPA 2261	
Single-channel natural gas analyzer	8890 GC Option #611
Dual-channel natural gas analyzer	8890 GC Option #612
Sour natural gas analyzer	8890 GC Option #613
GPA 2286	
Extended natural gas analyzer	8890 GC Option #610
GPA 2286 sour natural gas analyzer	8890 GC Option #615
UOP 539	
Three-channel fast refinery gas analyzer	8890 GC Option #600
Fast refinery gas analyzer with H_2S	8890 GC Option #601
High-capacity refinery gas analyzer with large valve oven	8890 GC Option #603
Fast refinery gas analyzer with large valve oven	8890 GC Option #604
Extended refinery gas analyzer with large valve oven and micropacked columns (H_2S & O_2)	8890 GC Option #605
UOP 791	
Analyzer for sulfur in light petroleum by SCD	8890 GC Option #631

Apply the Latest GC Technologies Without Disrupting Your Application Workflow

Refineries use distillation and chemical reactions to convert crude oil into fuel, lubricants, and feedstock for downstream processes. In recent years, supply-related performance requirements—together with environmental regulations for emissions and fuel composition—have rapidly driven new plant designs as well as upgrades to existing refineries.

The composition of refinery gases, which arises from cracking and subsequent distillation, depends on its generating source. Typically, refinery gases contain saturated and unsaturated hydrocarbons (C1-C5), H_2, O_2, N_2, CO, and CO_2. In some instances, C_6 or higher hydrocarbons and sulfur contaminants like H_2S may also be present. Confidently and precisely analyzing refinery gases is challenging, because the source and composition of each gas varies considerably. To succeed, refinery gas analyzers must be able to quickly separate complex mixtures from a broad range of samples found in refinery and petrochemical streams.

Agilent Refinery Gas Analyzers are **complete workflow solutions** that put the latest advances in reproducibility, speed, resolution, and retention into your hands without the hassles of setup, method development, and validation. Each arrives fully preconfigured and tested for applications, such as fast and extended refinery gas analysis (RGA) of permanent gases, hydrocarbon content determination (C_1-C_5 with C_{6+} as backflush), and the extended analysis of hydrocarbons in natural gas to C_{14}.

Analyzer Model	Description	Extended Hydrocarbon Analysis	Full-range Capacity for H_2	Separates Air (O_2 and N_2)
8890 GC Option #600	Three-channel fast refinery gas analyzer	Yes	No	Yes
8890 GC Option #601	Fast refinery gas analyzer with H_2S	Yes	No	Yes
8890 GC Option #603	High-capacity refinery gas analyzer with large valve oven	No	Yes	Yes
8890 GC Option #604	Fast refinery gas analyzer with large valve oven	No	Yes	Yes
8890 GC Option #605	Extended refinery gas analyzer with large valve oven and micropacked columns (H_2S & O_2)	Yes	Yes	Yes

Three-Channel Fast Refinery Gas Analyzer

8890 GC Option #600

Analyzer description

Configuration:

– 5-valve/7-column (capillary and packed), 2-TCD/FID

Sample type:

– Refinery gas, such as atmospheric overhead, FCC overhead, fuel gas, recycle gas

Compounds analyzed:

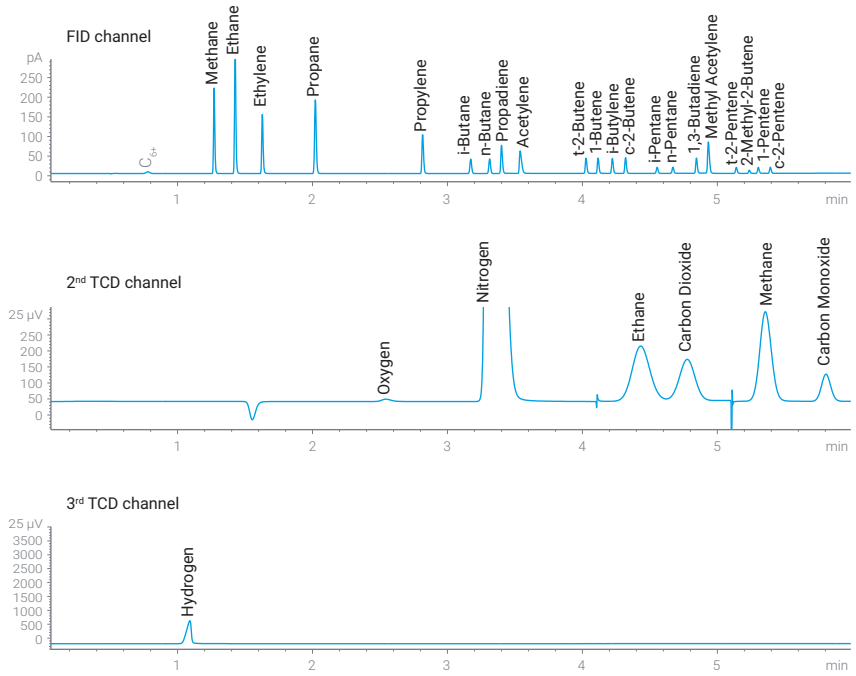
– C_1-C_5, and C_{6+} as backflush, H_2, He, O_2, N_2, CO_2, CO

Typical quantification range:

– 0.01 mol% for all above-mentioned components

Configured per method:

– ASTM D1945, ASTM D1946, UOP 539



Key benefits and features

– Three parallel channels with simultaneous detection for complete refinery gas analysis within 6 minutes

– Optimized columns to allow for faster hydrocarbon and permanent gas analysis using the same oven temperature program

– Full-range capability for H_2 by third TCD using N_2 or Argon carrier gas

Fast Refinery Gas Analyzer with H_2S

8890 GC Option #601

Analyzer description

Configuration:

- 5-valve/7-column (capillary and packed), 2-TCD/FID/nickel tubing, Hastelloy valve

Sample type:

- Refinery gas, such as atmospheric overhead, desulfurizer off gas, FCC overhead, fuel gas, recycle gas

Compounds analyzed:

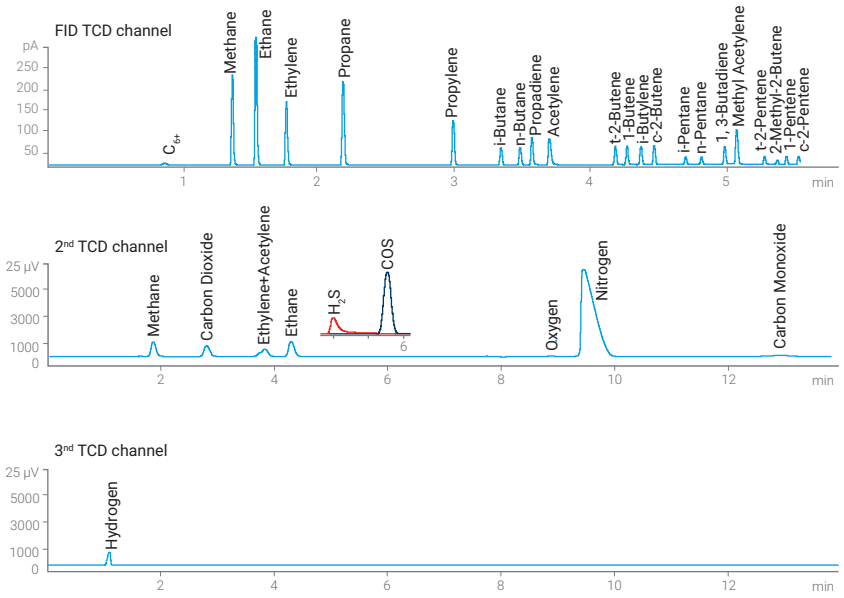
- C_1-C_5, and C_{6+} as backflush, H_2, He, O_2, N_2, CO_2, CO, H_2S, COS

Typical quantification range:

- 0.01 mol% for all above-mentioned components except H_2S and COS
- 500 ppm for H_2S
- 300 ppm for COS

Configured per method:

- ASTM D1945, ASTM D1946, UOP 539



Key benefits and features

- Three parallel channels with simultaneous detection for complete refinery gas analysis within 10 minutes
- Optimized columns to allow faster hydrocarbon and permanent gas analysis using the same oven temperature program
- Full-range capability for H_2 by third TCD using N_2 or Argon carrier gas
- Nickel tubing and Hastelloy valve for high H_2S and COS analysis
- O_2 may be present but not for quantitation

High-Capacity Refinery Gas Analyzer with Large Valve Oven

8890 GC Option #603

Analyzer description

Configuration:

- 3-valve/large valve oven/5-column (PLOT, packed), 2-TCD/FID, nickel tubing, Hastelloy valve

Sample type:

- Refinery gas, such as atmospheric overhead, desulfurizer off gas, FCC overhead, fuel gas, recycle gas

Compounds analyzed:

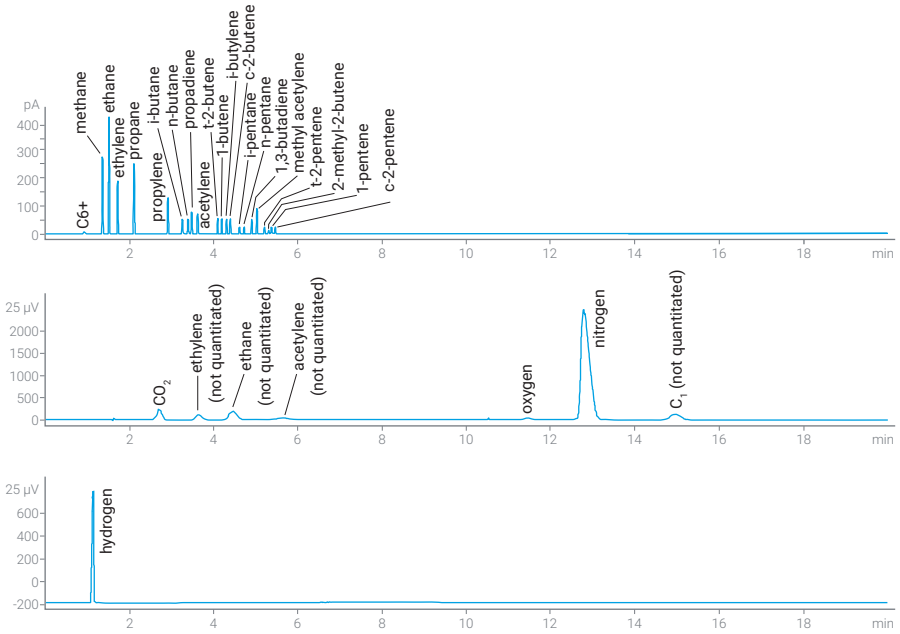
- C_1-C_5, and C_{6+} as backflush, H_2, He, O_2, N_2, CO_2, CO, H_2S, COS

Typical quantification range:

- 0.01 mol% for all above-mentioned components except H_2S and COS
- 500 ppm for H_2S
- 300 ppm for COS

Configured per method:

- ASTM D1945, ASTM D1946, UOP 539



Key benefits and features

- Three parallel channels with simultaneous detection for complete refinery gas analysis within 17 minutes
- Large valve oven (LVO) for packed columns to allow independent hydrogen, hydrocarbon, and permanent gas analysis
- Full-range capability for H_2 by third TCD using N_2 carrier gas
- Nickel tubing and Hastelloy valve for resistance to sulfur corrosion

Fast Refinery Gas Analyzer with Large Valve Oven

8890 GC Option #604

Analyzer description

Configuration:

- 3-valve/large valve oven/4-column (PLOT, micropacked), 2-TCD/FID, nickel tubing, Hastelloy valve

Sample type:

- Refinery gas, such as atmospheric overhead, desulfurizer off gas, FCC overhead, fuel gas, recycle gas

Compounds analyzed:

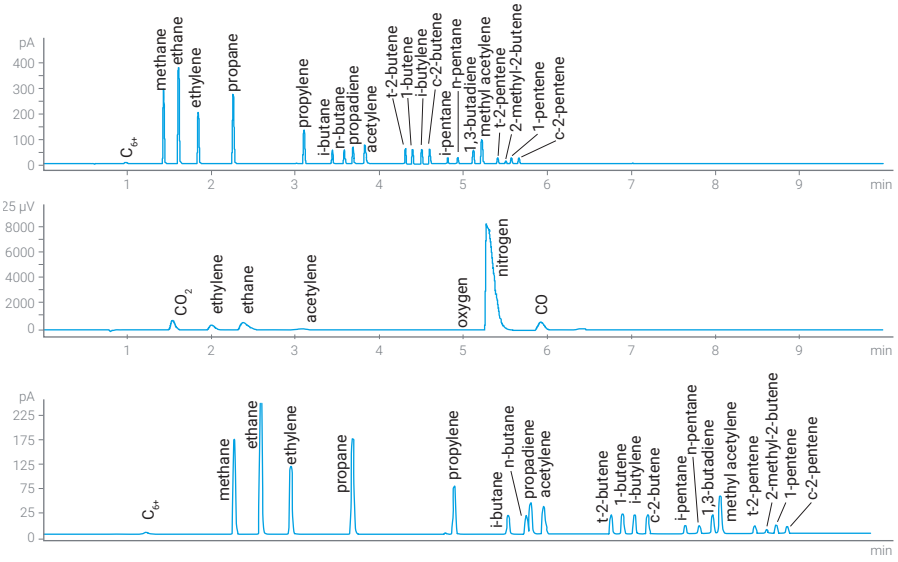
- C_1-C_5, and C_{6+} as backflush, H_2, He, O_2, N_2, CO_2, CO, H_2S, COS

Typical quantification range:

- 0.01 mol% for all above-mentioned components except H_2S
- 500 ppm for H_2S
- 300 ppm for COS

Configured per method:

- UOP 539



Key benefits and features

- Three parallel channels with simultaneous detection for complete refinery gas analysis within 9 minutes
- Large valve oven (LVO) for micropacked columns to allow independent hydrogen, hydrocarbon, and permanent gas analysis
- Full-range capability for H_2 by third TCD using N_2 carrier gas
- Nickel tubing and Hastelloy valve for resistance to sulfur corrosion

Extended Refinery Gas Analyzer with Large Valve Oven and H_2S and O_2

8890 GC Option #605

Analyzer description

Configuration:

- 3-valve/large valve oven/6-column, 2-TCD/FID, nickel tubing, Hastelloy valve

Sample type:

- Refinery gas, such as atmospheric overhead, desulfurizer off gas, FCC overhead, fuel gas, recycle gas

Compounds analyzed:

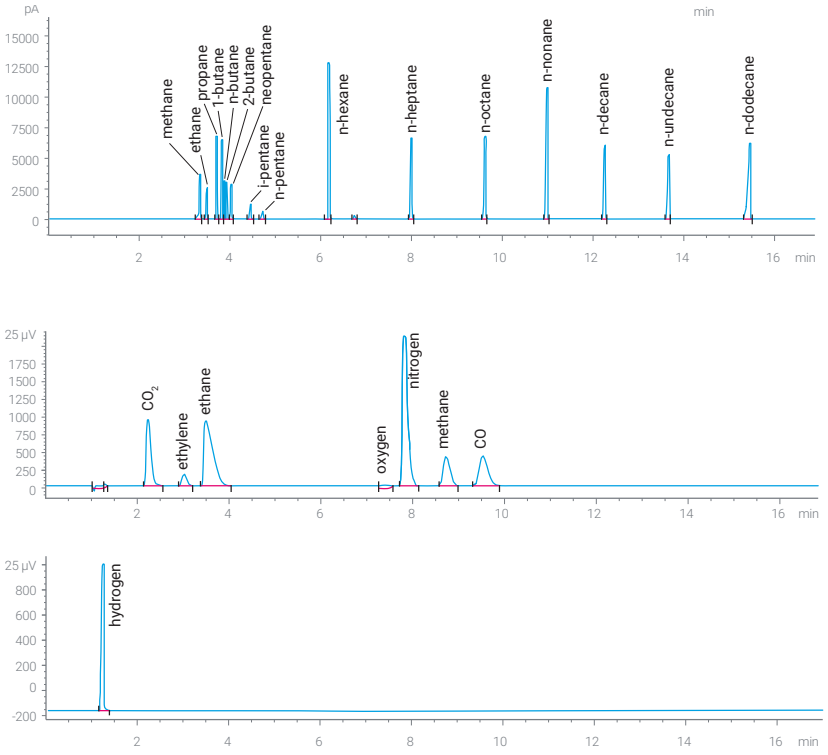
- Hydrocarbons up to C_{12}, H_2, O_2, N_2, CO_2, CO, H_2S

Typical quantification range:

- 0.01 mol% for all above-mentioned components except H_2S
- 500 ppm for H_2S

Configured per method:

- UOP 539



Key benefits and features

- Three parallel channels with simultaneous detection for complete refinery gas analysis within 12 minutes
- Large valve oven (LVO) to allow independent hydrogen, hydrocarbon, and permanent gas analysis
- Full-range capability for H_2 by third TCD using N_2 carrier gas
- Nickel tubing and Hastelloy valve for resistance to sulfur corrosion

Quickly and Reliably Determine Composition and Calorific Value

Natural gas is widely used for heating buildings, generating electricity, and providing needed power for industrial processes. This naturally occurring mixture of gaseous hydrocarbons consists primarily of methane, but can also include other hydrocarbons (C_1-C_4 chain length) as well as small amounts of impurities, such as O_2, N_2, CO_2, H_2, He, and sulfur-containing hydrocarbons.

Before it can be sold, natural gas must meet specifications for calorific value and purity; accordingly, collection, processing, transmitting, and distribution demands an array of analytical capabilities. Production byproducts—such as ethane, propane, butanes, pentanes, and hydrogen sulfide—must also be characterized prior to use in downstream processes.

Agilent Natural Gas Analyzers measure permanent gases and hydrocarbon content (C_1-C_5 with C_{6+} as backflush), and perform extended analysis of hydrocarbons in natural gas to C_{14}. These factory-configured, chemically tested GC analyzers help you evaluate the chemical composition of natural gas, natural gas liquids, and byproducts that result from processing.

Analyzer Model	Description	Extended Hydrocarbon Analysis	Full-range Capacity for H_2	Separates Air (O_2 and N_2)
8890 GC Option #610	Extended natural gas analyzer	Yes	No	Yes
8890 GC Option #611	Single-channel natural gas analyzer	No	No	Yes
8890 GC Option #612	Dual-channel natural gas analyzer	No	Yes	Yes
8890 GC Option #613	GPA 2261 Sour natural gas analyzer	No	No	Yes
8890 GC Option #615	GPA 2286 Sour natural gas analyzer	Yes	No	Yes

Extended Natural Gas Analyzer

8890 GC Option #610

Analyzer description

Configuration:

– 3-valve/4-column (capillary and packed), TCD/FID

Sample type:

– Natural gas and similar gaseous mixtures

Compounds analyzed:

– C_1-C_{12}, O_2, N_2, CO_2, CO

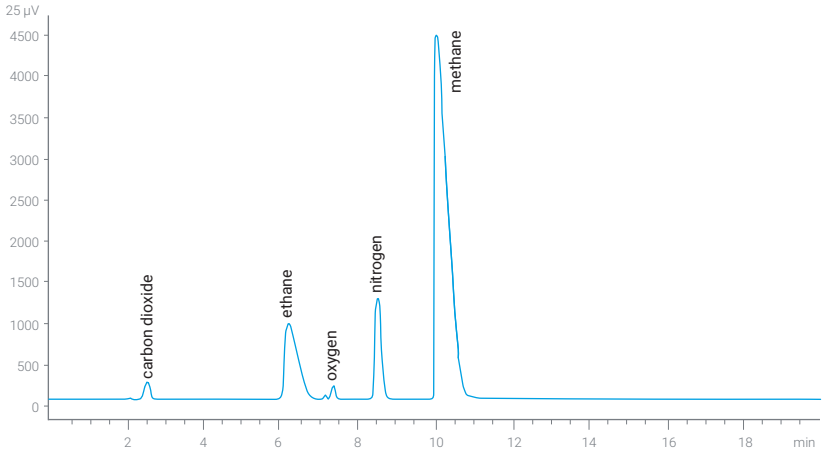
Typical quantification range:

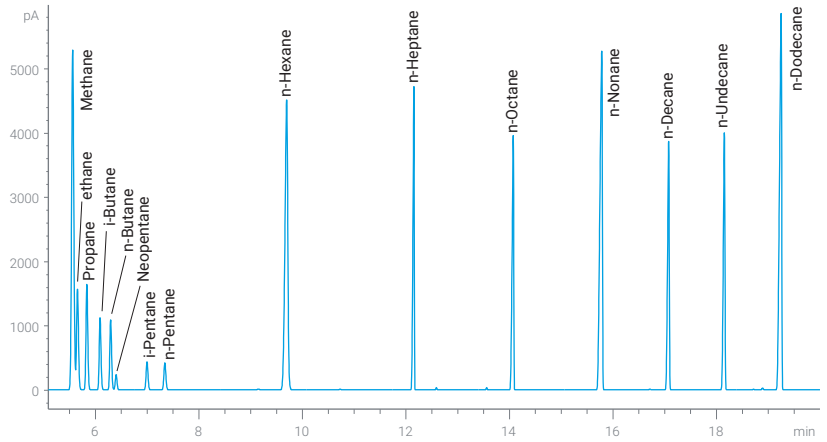
– 50 ppm for permanent gases and C_1-C_2 hydrocarbons on TCD

– 10 ppm for C_3-C_{12} on FID

Configured per method:

– Results per GPA 2286, but calculation without bridge components iC_5 and nC_5





Key benefits and features

– Dual channels with TCD and FID detectors

– TCD channel with packed column for C_1-C_2, O_2, N_2, CO_2 analysis

– C_3-C_{12} hydrocarbons separated on PONA column and measured on FID

– Adapt to liquefied natural gas by adding additional liquid sampling valve

Single-Channel Natural Gas Analyzer

8890 GC Option #611

Analyzer description

Configuration:

- 3-valve/4-column (packed), TCD

Sample type:

- Natural gas and similar gaseous mixtures

Compounds analyzed*:

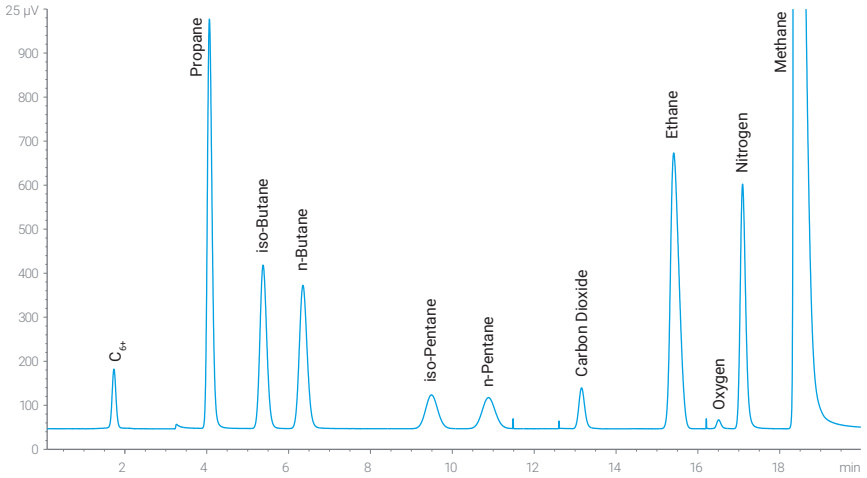
- C_1-C_5, C_{6+} as backflush
- O_2, N_2, CO_2, CO

Typical quantification range:

- 0.01 mol% for all components

Configured per method:

- ASTM D1945, GPA 2261 (H_2 and He are not included)



Key benefits and features

- Single TCD channel
- Rugged packed columns
- 20-minute analysis time
- Software provided for natural gas calculations per GPA 2261

Dual-Channel Natural Gas Analyzer

8890 GC Option #612

Analyzer description

Configuration:

– 4-valve/6-column (packed), 2-TCD

Sample type:

– Natural gas and similar gaseous mixtures

Compounds analyzed:

– C_1-C_5, C_{6+} as backflush

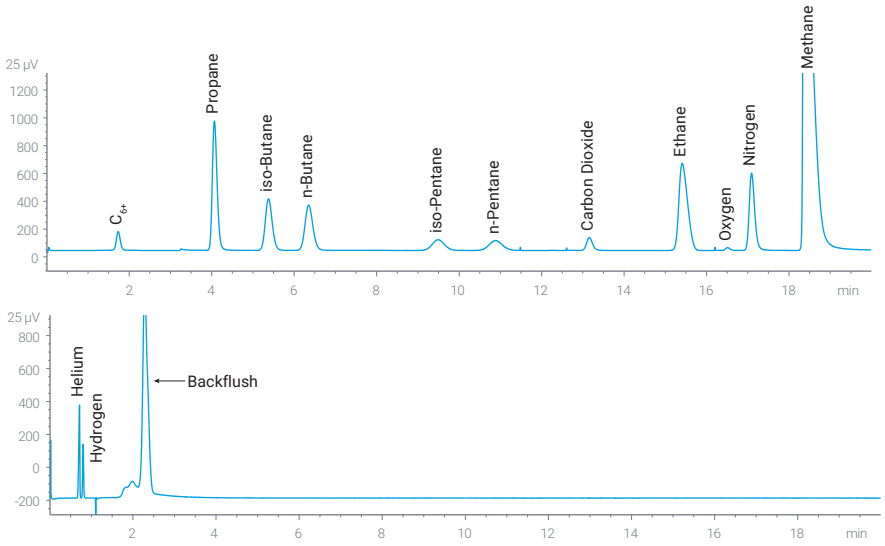
– H_2, He, O_2, N_2, CO_2, CO

Typical quantification range:

– 0.01 mol% for all components

Configured per method:

– ASTM D1945, GPA 2261



Key benefits and features

– Dual TCD channels

– Rugged packed columns

– 20-minute analysis time

– Dedicated channel for H_2 and He analysis

GPA 2261 Sour Natural Gas Analyzer

8890 GC Option #613

Analyzer description

Configuration:

– 3-valve/4-column (packed), TCD

Sample type:

– Natural gas and similar gaseous mixtures

Compounds analyzed:

– C_1-C_5, C_{6+} as backflush

– O_2, N_2, CO_2, CO

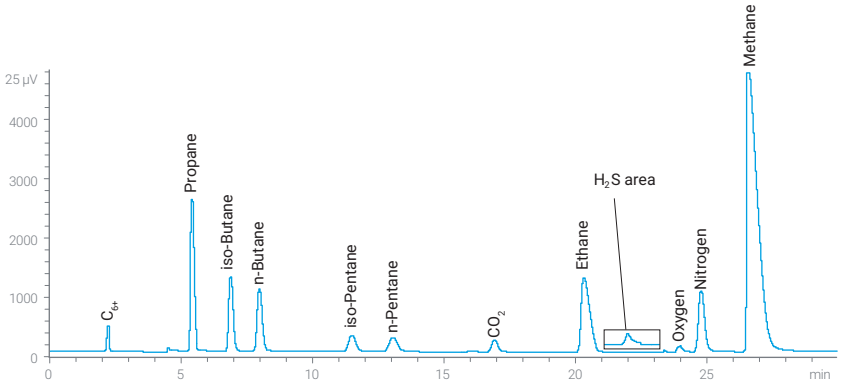
Typical quantification range:

– 0.01 mol% for all components

– 500 ppm for H_2S

Configured per method:

– ASTM D1945, GPA 2261



Key benefits and features

– Single TCD channel

– Rugged packed columns

– 30-minute analysis time

– Software provided for natural gas calculations per GPA 2261

– Similar to G3445 #611 but with hardware to allow H_2S analysis

– Dedicated channel for H_2 and He analysis

GPA 2286 Sour Natural Gas Analyzer

8890 GC Option #615

Analyzer description

Configuration:

– 2-valve/5-column, TCF/TCF/FID

Sample type:

– Natural gas and similar gaseous mixtures

Compounds analyzed:

– C_1-C_5

– N_2, CO_2, CO

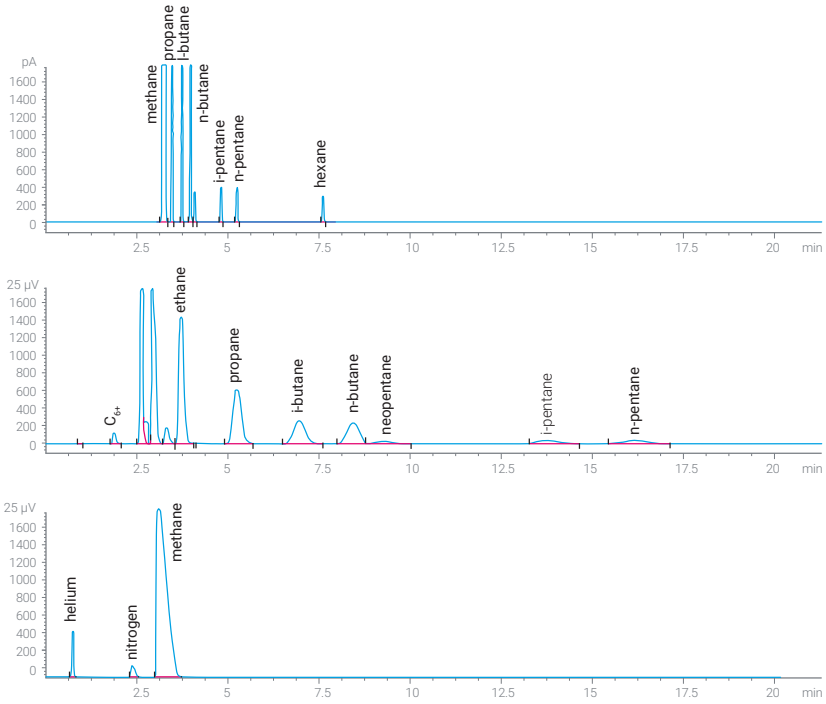
Typical quantification range:

– 50 ppm for permanent gases and C_1-C_5 (TCD)

– 10 ppm for C_5-C_6 (FID)

Configured per method:

– GPA 2286



Key benefits and features

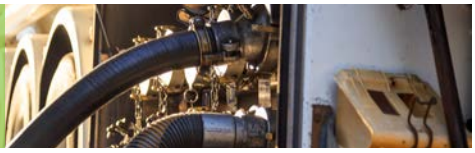
– 2-channel with TCD and FID detectors

– Fixed gases and hydrocarbons up to C_5 on packed columns and thermal conductivity detector

– Hydrocarbons from C_5 to C_{14} are analyzed on a capillary column and a flame ionization detector

– The pentanes are used as “bridging” compounds for calculations per GPA 2286

– Software supplied to generate a data report per GPA 2286

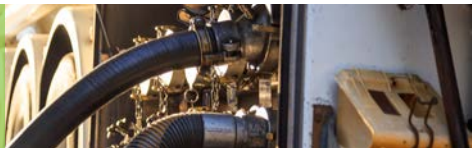


Conform to Strict Octane and Emissions Regulations

The 1990 U.S. EPA Clean Air Act sets strict limits on volatile organic compounds (VOCs) and other toxic chemicals that are emitted from gasoline engine exhaust. To reach these target levels, fuel producers must reformulate their gasoline to increase octane levels.

This is accomplished through catalytic restructuring of hydrocarbon molecules in naphtha feedstock to produce a more complex structure and increase oxygen content through oxygenate blending. The resulting fuels have higher octane ratings and combust more efficiently and thoroughly. Agilent, together with our Channel Partners, offers a portfolio of Reformulated Gasoline and other fuel analyzers that are factory configured to meet standards—such as ASTM and CEN—and are chemically tested for analyzing oxygenate concentrations, benzene, and heavier aromatic content in fuels.

Analyzer Model	Description	Configured per Published Method(s)
8890 GC Option #620	ASTM D4815/D5580 oxygenates and aromatics in gasoline analyzer	ASTM D4815, D5580
8890 GC Option #621	Analyzer for D4815 oxygenates in gasoline	ASTM D4815
8890 GC Option #622	Analyzer for EN 13132 oxygenates in gasoline	EN 13132, EN 12177
8890 GC Option #623	Low oxygenates in hydrocarbons analyzer	ASTM D7423
8890 GC Option #624	Biodiesel analyzer	ASTM D6584
8890 GC Option #625	Biodiesel analyzer for methanol content by HSS-GC	EN 14110
8890 GC Option #630	Analyzer for sulfur in natural or fuel gas by SCD	ASTM D5504
8890 GC Option #631	Analyzer for sulfur in light petroleum by SCD	ASTM D5623, UOP 791
8890 GC Option #632	LPG composition analyzer	ASTM D2163, D2593, D2712, D5524



ASTM D4815/D5580 Oxygenates and Aromatics in Gasoline Analyzer

8890 GC Option #620

Analyzer description

Configuration:

– 1-valve, 2-column, TCD/FID

Sample type:

– Finished gasoline

Compounds analyzed:

– ASTM D4815: MTBE, ETBE, TAME, DIPE, methanol, ethanol, isopropanol, *n*-propanol, isobutanol, *tert*-butanol, *sec*-butanol, *n*-butanol, *tert*-pentanol

– ASTM D5580: benzene, toluene, ethylbenzene, xylene, C_9 and heavier aromatics, total aromatics

Typical quantification range:

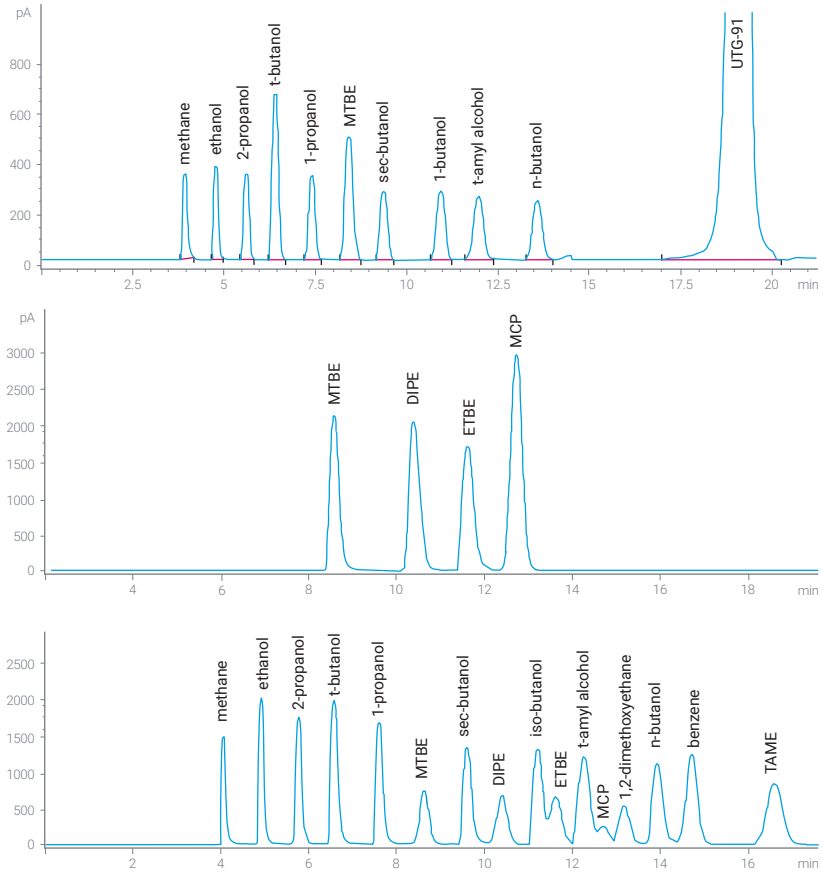
– 0.1 to 20 Wt% for individual ethers, 0.1 to 12 Wt% for individual alcohols

– 0.1 to 5 Vol% for benzene, 1 to 15 Vol% for toluene

– 0.5 to 10 Vol% for individual C_8 aromatics, 5 to 30 Vol% for total C_9 and heavier aromatics, 10 to 80 Vol% for total aromatics

Configured per method:

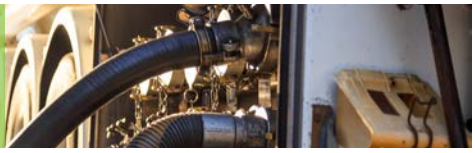
– ASTM D4815, ASTM D5580



Key benefits and features

– Designed for both ASTM D4815 and ASTM D5580 methods, uses same hardware configuration

– Configured to determine oxygenates (ASTM D4815) and aromatics (ASTM D5580) in gasoline by using either helium or nitrogen (which is lower cost) carrier gas



Analyzer for D4815 Oxygenates in Gasoline

8890 GC Option #621

Analyzer description

Configuration:

– 1-valve/2-column (micropacked and capillary)/FID

Sample type:

– Finished gasoline

Compounds analyzed:

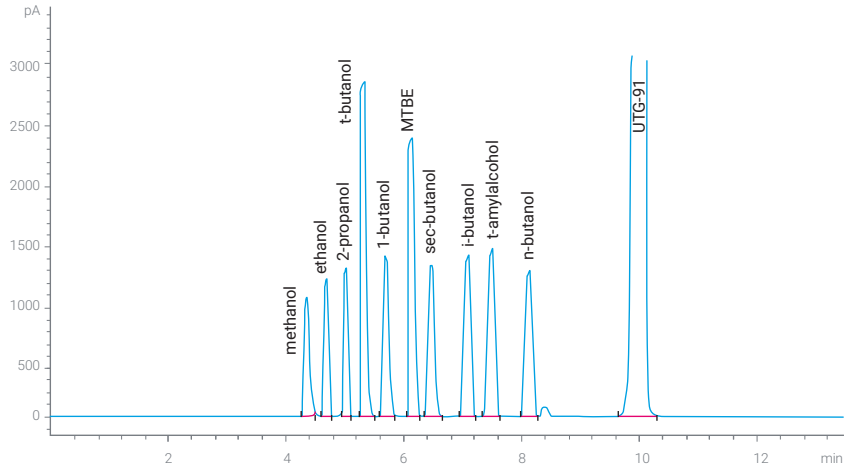
– MTBE, DME, TAME, DIPE, methanol, ethanol, isopropanol, *n*-propanol, isobutanol, *tert*-butanol, *sec*-butanol, *n*-butanol, *tert*-pentanol

Typical quantification range:

– 0.1 to 20 Wt% for individual ethers, 0.1 to 12 Wt% for individual alcohols

Configured per method:

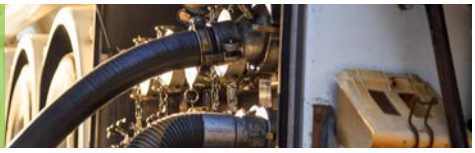
– ASTM D4815



Key benefits and features

– Designed for ASTM D4815

– Configured to determine oxygenates in gasoline



Analyzer for EN 13132 Oxygenates in Gasoline

8890 GC Option #622

Analyzer description

Configuration:

– Deans Switching/2-column/2-FID

Sample type:

– Commercial or raw gasoline

Compounds analyzed:

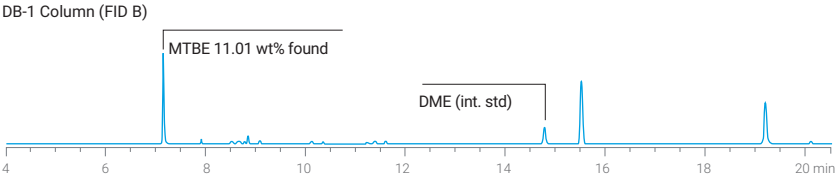
– Benzene, toluene, ethylbenzene, and oxygenates: MTBE, ETBE, TAME, DIPE, ethanol, isopropanol, *n*-propanol, isobutanol, *tert*-butanol, *sec*-butanol, *n*-butanol, and *tert*-pentanol

Typical quantification range:

– 0.05 to 6 Vol% for benzene, 0.17 to 15 Vol% for individual organic oxygenates

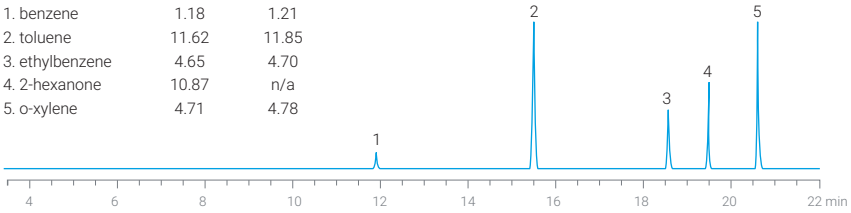
Configured per method:

– EN 13132, EN 12177



DB-1 Column (FID B)

Peak Identificaton	Ref (wt%)	Found (wt%)
1. benzene	1.18	1.21
2. toluene	11.62	11.85
3. ethylbenzene	4.65	4.70
4. 2-hexanone	10.87	n/a
5. o-xylene	4.71	4.78

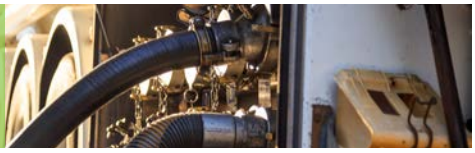


Key benefits and features

– Configured to determine the oxygenates (EN 13132) and benzene (EN 12177) in gasoline

– Capillary flow technology (CFT) Deans Switch provides easier method setup and reliable performance by eliminating carryover and minimizing peak tailing for very polar compounds

– Uses backflush to reduce analysis time



Low Oxygenates in Hydrocarbons Analyzer

8890 GC Option #623

Analyzer description

Configuration:

- Capillary flow technology micro-volume tee/2-column/FID/Autosampler (for liquid samples), gas sampling valve (for gas samples), LSV (for liquefied gases)

Sample type:

- Ethene, propene, hydrocarbon matrices that do not have a final boiling point greater than 200 °C

Compounds analyzed:

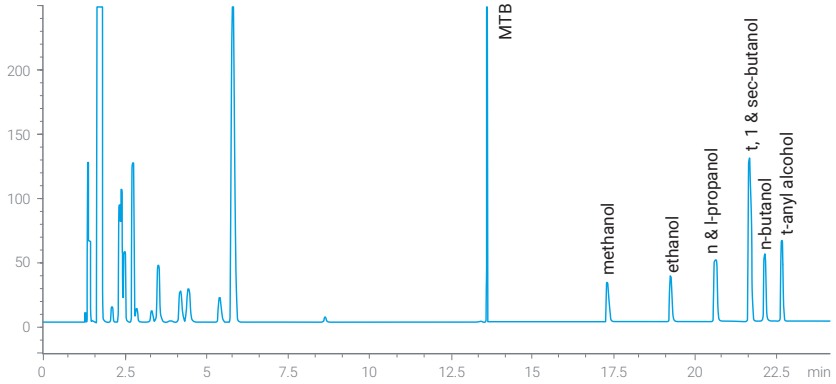
- MTBE, ETBE, DIPE, TAME, methanol, *n*-propanol and *i*-propanol, *n*-butanol, *i*-butanol, *tert*-butyl alcohol, *sec*-butyl alcohol, and *tert*-pentanol

Typical quantification range:

- 0.5 ppm for MTBE

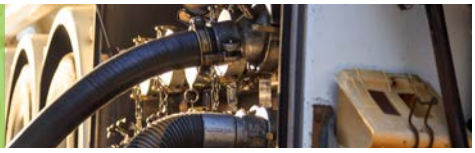
Configured per method:

- ASTM D7423



Key benefits and features

- Analyzer configured to determine low-level oxygenates in any hydrocarbon matrix with final boiling point <200 °C
- Capillary flow technology (CFT) fluidic switch with backflush used to remove hydrocarbons with higher boiling points
- Agilent GS-OxyPLOT column separates light hydrocarbons from oxygenates
- GS-OxyPLOT is surprisingly inert to polar compounds and is an excellent column for quantitative analysis of oxygenates at low concentrations



Biodiesel Analyzer

8890 GC Option #624

Analyzer description

Configuration:

- On-column capillary inlet/FID

Sample type:

- B100 biodiesel
- Not applicable to vegetable oil methyl esters obtained from lauric oils, such as coconut oil and palm kernel oil

Compounds analyzed:

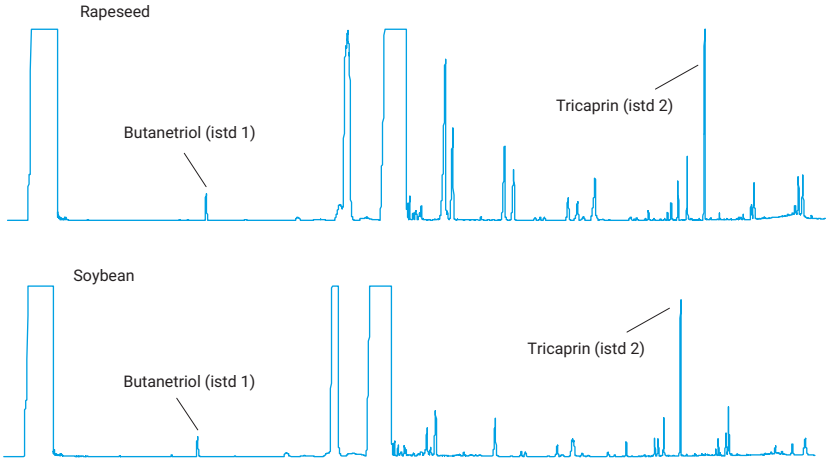
- Free glycerin, monoglycerides, diglycerides, triglycerides, bound glycerin, total glycerin

Typical quantification range:

- 0.005 to 0.05 Wt% for free glycerin, 0.05 to 0.5 Wt% for total glycerin

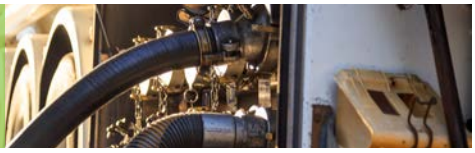
Configured per method:

- ASTM D6584



Key benefits and features

- Configured with COC inlet with a retention gap column in front of the analytical column
  - Significantly improves peak shape for better accuracy and reproducibility
  - Use of standard syringes instead of special narrow-bore syringes
- Uses Agilent Ultimate Union to connect retention gap to column
  - Reliable, leak-free, high-temperature connection
- Exceeds ASTM and CEN specifications for calibration and precision



Biodiesel Analyzer for Methanol Content by HSS-GC

8890 GC Option #625

Analyzer description

Configuration:

– Headspace/FID

Sample type:

– B100 biodiesel

Compounds analyzed:

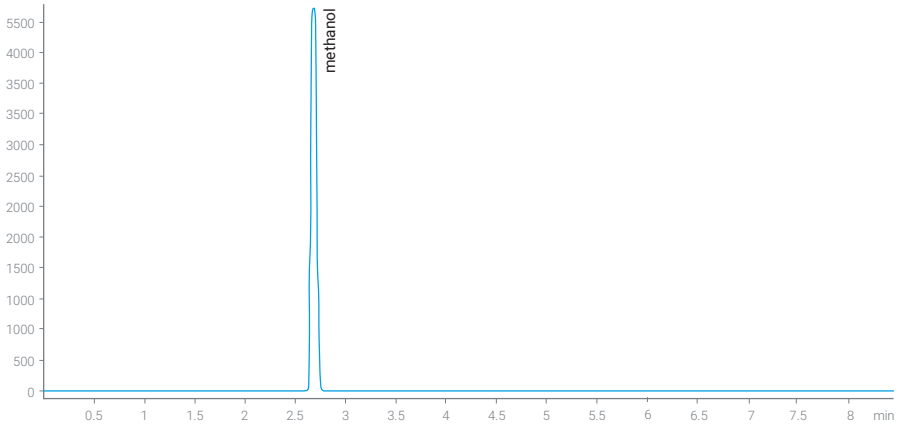
– Methanol

Typical quantification range:

– 0.01 to 0.5 Wt% for methanol

Configured per method:

– EN 14110:2003



Key benefits and features

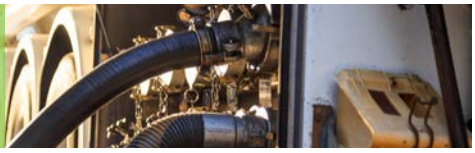
– Uses Agilent 7697A headspace sampler for automated sample preparation

– Enhanced precision through backpressure regulation of headspace gas sampling valve loop

– Increased sensitivity for low concentration methanol through pressurization of the headspace sample loop

– Quantitative analysis using external calibration; no internal standard required

– Improved peak shape for easy quantification



Analyzer for Sulfur in Natural or Fuel Gas by SCD

8890 GC Option #630

Analyzer description

Configuration:

- Capillary inlet/capillary column/SCD (requires additional automatic liquid sampler for liquid sample analysis)

Sample type:

- Gasoline motor fuels, petroleum liquids with a final boiling point of approximately 230 °C or lower at atmospheric pressure

Compounds analyzed:

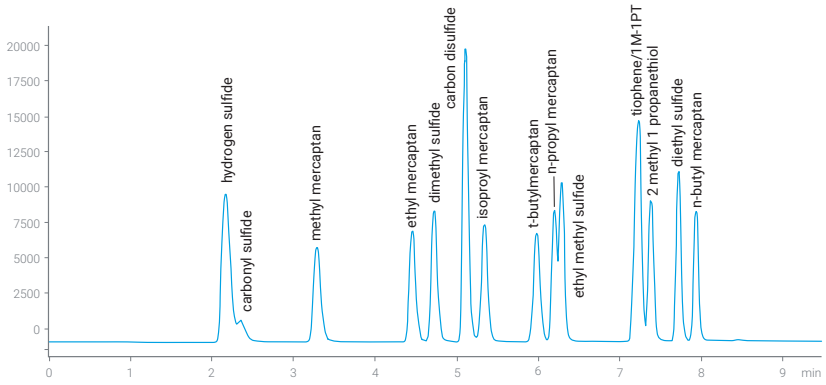
- Volatile sulfur-containing compounds in light petroleum liquids, such as CS_2, COS, mercaptans, aromatic sulfur compounds, sulfides

Typical quantification range:

- 20 ppb of sulfur in gasoline

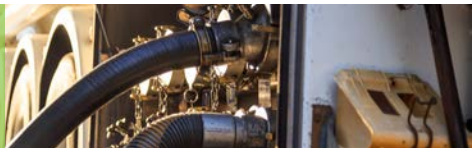
Configured per method:

- ASTM D5623, UOP 791



Key benefits and features

- 8890 GC with sulfur chemiluminescence detector (SCD) for sulfur analysis in natural gas and gaseous fuels
- High selectivity: higher selectivity for sulfur over carbon
- Equimolar: simplifies quantification of unknowns
- Linear: simplifies calibration
- UltiMetal hardware to enhance sulfur analysis without corrosion
- Dynamic detection range with GC-integrated 8355 SCD



Analyzer for Sulfur in Light Petroleum by SCD

8890 GC Option #631

Analyzer description

Configuration:

- 1-valve/capillary column/SCD

Sample type:

- Natural gas and other gaseous fuels

Compounds analyzed:

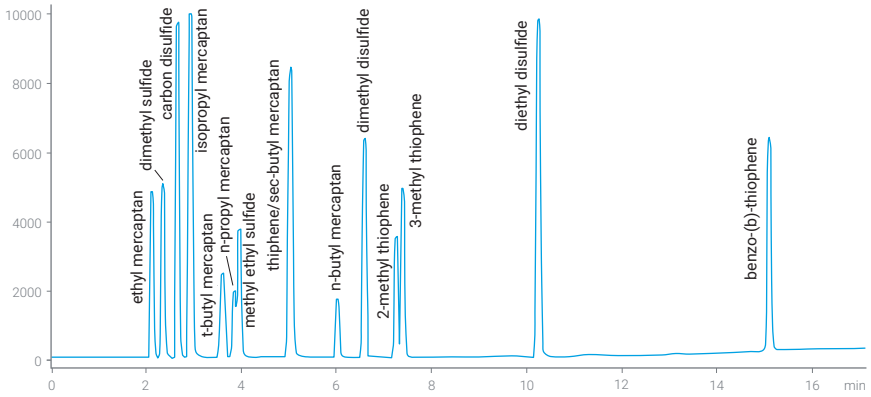
- Sulfur compounds in natural gas or gaseous fuels
- H_2S, CS_2, COS, mercaptans, aromatic sulfur compounds, sulfides

Typical quantification range:

- 100 ppb of H_2S
- 20-40 ppb for other S components (depends on different compounds)

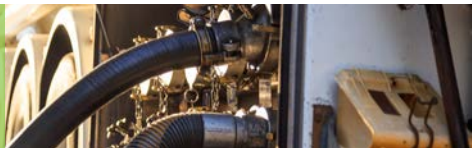
Configured per method:

- ASTM D5504



Key benefits and features

- 8890 GC with sulfur chemiluminescence detector (SCD) for sulfur analysis in natural gas and gaseous fuels
- High selectivity: higher selectivity for sulfur over carbon
- Equimolar: simplifies quantification of unknowns
- Linear: simplifies calibration
- UltiMetal hardware to enhance sulfur analysis without corrosion
- Dynamic detection range with GC-integrated 8355 SCD



LPG Composition Analyzer

8890 GC Option #632

Analyzer description

Configuration:

– Liquid valve/1-column (PLOT Alumina)/FID

Sample type:

– LPG

Compounds analyzed:

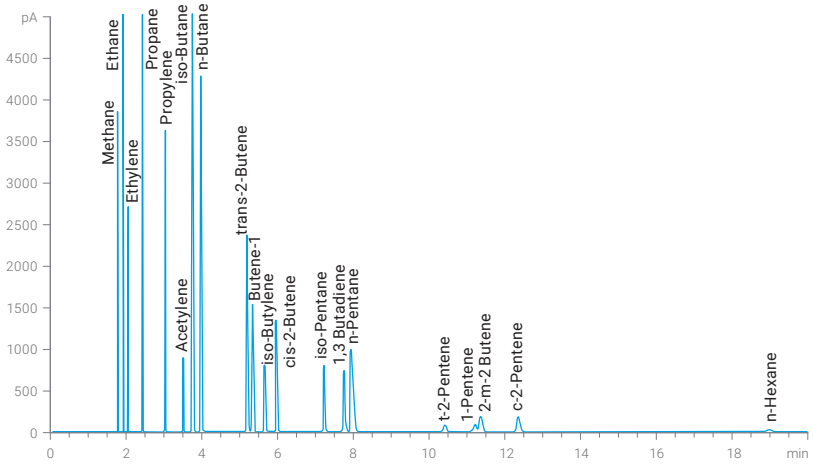
– C_1-C_6

Typical quantification range:

– 10 ppm for hydrocarbons

Configured per method:

– ASTM D2163, ASTM D2593, ASTM D2712, ASTM D4424



Key benefits and features

– Single channel with single LSV

– PLOT Alumina is ideal for separation of the C_1 to C_8 isomers; especially for separation of cyclopropane and propylene

Reliably Confirm the Purity of Raw Materials

Accurately measuring feedstock impurities at increasingly lower concentrations is critical to process efficiency and profitability. For example, producers of high-purity monomers (such as ethylene and propylene) face stiff competition and tight customer specifications.

Purity is also a must for researchers and production operations in the food, pharmaceutical, chemical, and semiconductor industries. Failure to fully characterize the impurity content of N, Ar, H_2, and CO_2 can render the gas unfit for a given application.

Trace contaminants also contribute to equipment corrosion and reduced polymer yields. Even worse, they can cause catalyst degradation, poisoning, and contamination, which can lead to costly, time-consuming catalyst bed replacement.

With their innovative hardware configurations, Agilent Trace Impurities Analyzers reliably confirm the purity of raw materials provided by your suppliers, so you can detect contaminants with confidence at trace levels.

Analyzer Model	Description
8890 GC Option #640	Low-level CO and CO_2 in-process gas analyzer with vent valve
8890 GC Option #641	Low-level CO and CO_2 in-process gas analyzer

Low-Level CO and CO_2 In-Process Gas Analyzer with Vent Valve

8890 GC Option #640

Analyzer description

Configuration:

- 2-valve/2-column (packed column)/ methanizer/FID

Sample type:

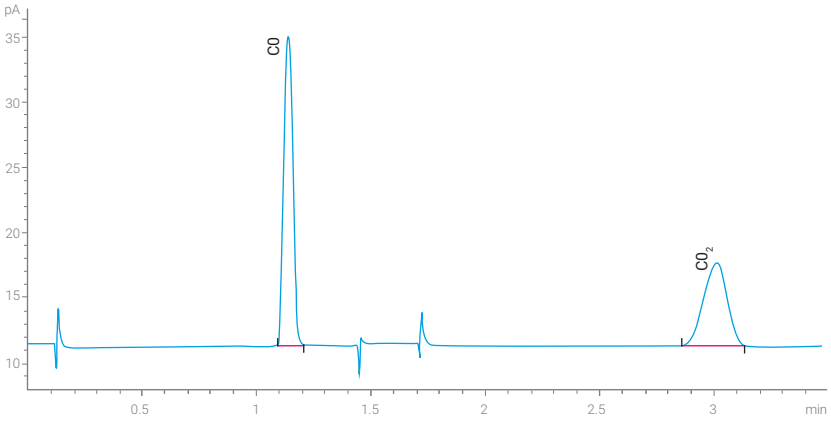
- Process gas containing high levels of methane, natural gas

Compounds analyzed:

- CO_2 and CO

Typical quantification range:

- 0.2 ppm for CO
- 0.4 ppm for CO_2



Key benefits and features

- Single channel with packed columns
- High concentration hydrocarbons cut on the pre-column; CH_4 vented during the analysis through use of a 4-port valve
- Trace levels of CO and CO_2 analyzed by conversion to CH_4 and detection with FID
- 3-minute analysis time

Low-Level CO and CO_2 In-Process Gas Analyzer

8890 GC Option #641

Analyzer description

Configuration:

- 1-valve/2-column (packed column)/ methanizer/FID

Sample type:

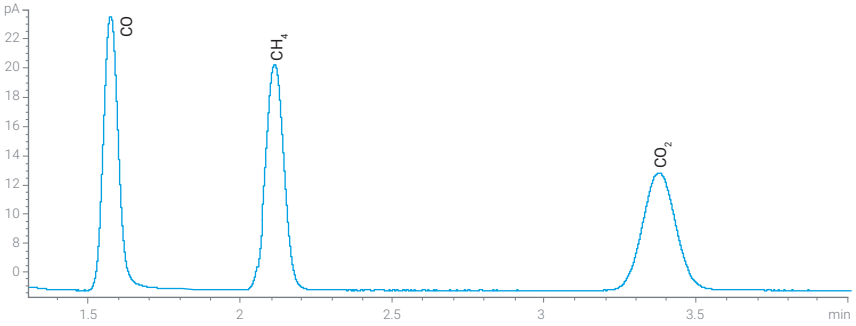
- Ethylene, propylene, or process gas streams containing low concentrations of methane

Compounds analyzed:

- CO_2 and CO

Typical quantification range:

- 0.2 ppm for CO
- 0.4 ppm for CO_2



Key benefits and features

- Single channel with packed columns
- Hydrocarbons cut on the pre-column while trace levels of CO and CO_2 pass through methanizer for conversion to CH_4 and detection with FID
- 4-minute analysis time

Confirm Oil Integrity and Prevent Catastrophic Failure

Electrical transformers, which literally **transform** voltage from one level to another, use oil as both an insulator and a coolant for internal components. Because the transformer operation subjects the oil to electrical and mechanical stresses, the oil must be able to maintain its stability at high temperatures for extended periods of time.

Factors such as aging, oxidation, vaporization, electrolytic action, and decomposition can change the oil's chemical properties, resulting in gas formation. Information derived by analyzing these dissolved gases provides considerable diagnostic information about the transformer's current and future stability—helping operators determine whether or not a transformer should be decommissioned.

Agilent Transformer Oil Gas (TOGA) Analyzers, configured per ASTM standards, harness advanced technologies, such as headspace sampling and TCD/FID detectors (following methanization), to deliver rugged, reliable TOGA analysis.

Analyzer Model	Description
8890 GC Option #650	Enhanced transformer oil gas (TOGA) analyzer (ASTM D3612-C)

Enhanced Transformer Oil Gas (TOGA) Analyzer (ASTM D3612-C)

8890 GC Option #650

Analyzer description

Configuration:

- 1-valve/2-column/TCD/FID/methanizer/ headspace

Sample type:

- Gas

Compounds analyzed:

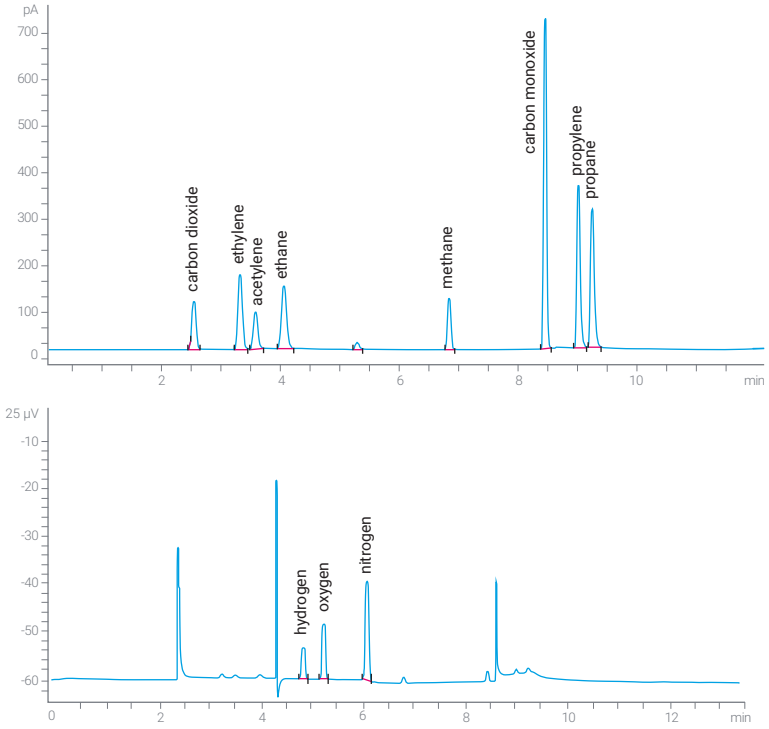
- H_2, O_2, N_2, CH_4, CO, and CO_2
- C_2 (ethane, ethylene, acetylene), C_3 (propane, propylene), C_4 (1-butene)

Typical quantification range:

- Meet the specifications listed in table 3 in ASTM D3612-C

Configured per method:

- ASTM D3612-C



Key benefits and features

- Single channel with PLOT columns
- Use direct transfer line to column connection
- Trace levels of CO and CO_2 analyzed by conversion to CH_4 and detection with FID
- 12-minute analysis time
- Improved precision through 8890 Pneumatic Control Module (PCM) backpressure regulation of headspace gas sampling valve loop

Monitor and Measure Gases That Contribute to Climate Change

Fossil fuel consumption increases the concentration of greenhouse gases (GHGs)—such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O)—in the Earth's atmosphere. These gases trap heat, thereby effecting our planet's temperature.

To help fight climate change caused by increased concentrations of atmospheric GHGs, regulatory institutions (such as the EPA and CEN) have initiated programs to inventory GHG emissions through continuous measurement.

Agilent can help you track GHG emissions with factory-configured and chemically tested Greenhouse Gas Analyzers.

Analyzer Model	Valve/Column	Detector	Headspace	N_2O LDL	CH_4	CO_2
8890 GC Option #660	3/2	FID/micro-ECD	Optional	50 ppb	0.2 ppm to 20%	0.4 ppm to 0.2%
8890 GC Option #661	4/4	FID/micro-ECD/TCD	No	50 ppb	0.2 ppm to 20%	0.4 ppm to 20%

Greenhouse Gas Analyzer 0.4 ppm to 0.2% Carbon Dioxide, 0.2 ppm to 20% Methane, 30 ppb Nitrous Oxide

8890 GC Option #660

Analyzer description

Configuration:

- 3-valve/2-packed column/micro-ECD/FID/methanizer

Sample type:

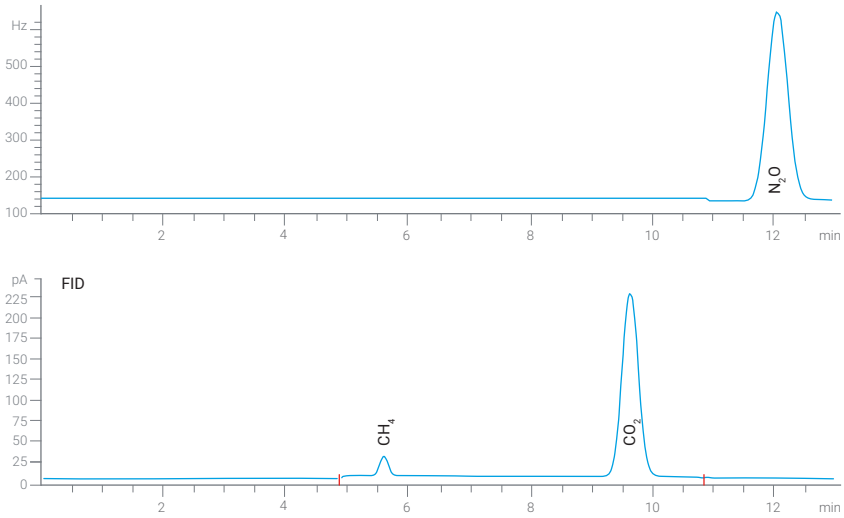
- Greenhouse gases and soil gases with compounds of interest contain gases such as CH_4, N_2O, and CO_2

Compounds analyzed:

- CH_4, N_2O, CO_2

Typical quantification range:

- 50 ppb for N_2O
- 0.2 ppm to 20% for CH_4
- 0.4 ppm to 0.2% for CO_2



Key benefits and features

- Configured for simultaneous analysis of greenhouse gas with one injection
- Sensitivity of micro-ECD ensures the detection of N_2O at ppb level
- An easy-to-use union based on capillary flow technology connects valves and micro-ECD to improve chromatographic performance, including the peak shape
- Easily expanded to include the determination of SF_6
- Single channel with a simple valve configuration

Greenhouse Gas Analyzer with 0.4 ppm to 20% CO_2 Detection

8890 GC Option #661

Analyzer description

Configuration:

- 4-valve/4-packed column/micro-ECD/ TCD/FID/methanizer

Sample type:

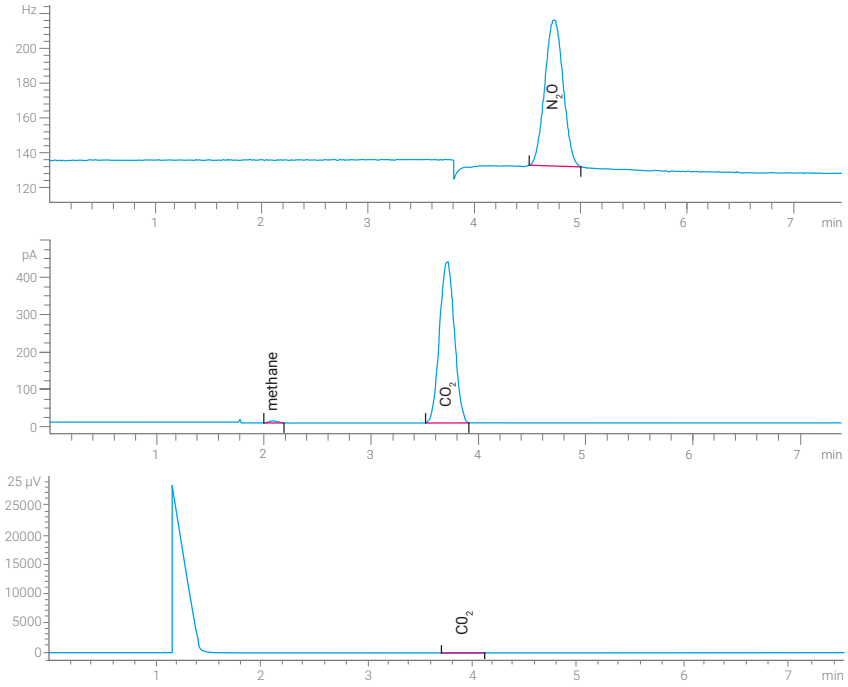
- Greenhouse gases and soil gases with compounds of interest contain gases such as CH_4, N_2O, and CO_2

Compounds analyzed:

- CH_4, N_2O, CO_2

Typical quantification range:

- 50 ppb for N_2O
- 0.2 ppm to 20% for CH_4
- 0.4 ppm to 0.2% for CO_2



Key benefits and features

- Configured for simultaneous analysis of greenhouse gas with one injection
- Sensitivity of micro-ECD ensures the detection of N_2O at ppb level
- An easy-to-use union based on capillary flow technology connects valves and micro-ECD to improve chromatographic performance, including the peak shape
- Easily expanded to include the determination of SF_6
- Uses 2 separate channels with three detectors
  - –Achieves faster results
  - –Increases flexibility-reducing critical nature timing for valve switching
  - –Facilitates method setup
  - –Uses third TCD to expand concentration range for CO_2 determinations

Enriching Our Expertise with Specialized Technologies and Experience

Helping you meet your analytical challenges does not end with our own technological developments. Agilent's industry leadership has enabled us to nurture valuable partnerships that complement our energy and chemical analysis capabilities with solutions, such as:

- Refinery gas analyzers/fast RGA (UOP 539)
  - High-speed RGA (ASTM D2163/ISO 7941/DIN 51666)
  - Micro GC
  - Sulfur in LPG
- Natural gas analyzers
- Petrochemical analyzers
  - Trace sulfur in ethylene and propylene
- PIONA/Reformulyzer M_3
- Olefins analyzer
- DHA analyzer
- Oxygenates analyzer
- Aromatics analyzer
- 8634 analyzer for ASTM D86 (equivalent for groups 3 and 4)
- Simulated distillation analyzer/HT simulated distillation analyzer
- DHA front end
- Apply lab GC online
- HPLC-based solutions

GC and GC/MS Analyzers Let You Focus on System Validation and Data Generation… Not Method Development

Agilent GC and GC/MS analyzers are factory configured and chemically tested to meet method requirements, and get you on the fast track to producing quality data and processing backlogs.

More than just instruments, Agilent analyzers are complete workflow solutions that incorporate advanced technologies, such as capillary flow technology and target compound databases, that allow us to optimize your system for your unique application.

Each analyzer arrives ready to perform with pre-set chromatography and checkout samples to verify separation capabilities. That means your team can work toward system validation as soon as installation is complete—and significantly reduce your method development costs. And as always, our support team is available, should any problems arise.

Agilent CrossLab services

CrossLab is an Agilent capability that integrates services and consumables to support workflow success and important outcomes like improved productivity and operational efficiency. Through CrossLab, Agilent strives to provide insight in every interaction to help you achieve your goals. CrossLab offers method optimization, flexible service plans, and training for all skill levels. We have many other products and services to help you manage your instruments and your lab for best performance.

Learn more about Agilent CrossLab, and see examples of insight that lead to great outcomes, at www.agilent.com/crosslab

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U.S. and Canada
1-800-227-9770
agilent_inquiries@agilent.com

Europe
info_agilent@agilent.com

Asia Pacific
inquiry_lsca@agilent.com

DE 44211.269849537

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