

# 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.*



### Contents

Analyzer by Reference.....	4
Analyzer by Compliance Method.....	6
Solutions for Refinery Gas.....	8
Solutions for Natural Gas.....	14
Solutions for Fuel.....	20
Solutions for Process Gas.....	30
Solutions for Transformer Oil Gas.....	33
Solutions for Greenhouse Gas.....	35
Solutions from our Channel Partners.....	38



## Analyzer by Reference

### Refinery gas

Analyzer Model	Description	Configured per Published Method(s)
<a href="#">8890 GC Option #600</a>	Three-channel fast refinery gas analyzer	ASTM D1945, ASTM D1946, ASTM D7833, UOP 539
<a href="#">8890 GC Option #601</a>	Fast refinery gas analyzer with H <sub>2</sub> S	ASTM D1945, ASTM D1946, UOP 539
<a href="#">8890 GC Option #603</a>	High-capacity refinery gas analyzer with large valve oven	ASTM D1945, ASTM D1946, UOP 539
<a href="#">8890 GC Option #604</a>	Fast refinery gas analyzer with large valve oven	ASTM D7833, UOP 539
<a href="#">8890 GC Option #605</a>	Extended refinery gas analyzer with large valve oven and micropacked columns (H <sub>2</sub> S & O <sub>2</sub> )	UOP 539

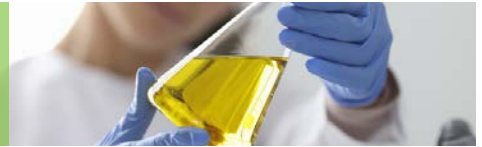
### Natural gas

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

### Fuel

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

# Analyzer by Reference



## Process gas

Analyzer Model	Description	Configured per Published Method(s)
<a href="#">8890 GC Option #640</a>	Low-level CO and CO <sub>2</sub> in-process gas analyzer with vent valve	N/A
<a href="#">8890 GC Option #641</a>	Low-level CO and CO <sub>2</sub> in-process gas analyzer	N/A

## Transformer oil gas

Analyzer Model	Description	Configured per Published Method(s)
<a href="#">8890 GC Option #650</a>	Enhanced transformer oil gas (TOGA) analyzer	ASTM D3612 C

## Greenhouse gas

Analyzer Model	Description	Configured per Published Method(s)
<a href="#">8890 GC Option #660</a>	Greenhouse gas analyzer 0.4 ppm to 0.2% carbon dioxide, 0.2 ppm to 20% methane, 30 PPB nitrous oxide	N/A
<a href="#">8890 GC Option #661</a>	Greenhouse gas analyzer with 0.4 ppm to 20% CO <sub>2</sub> detection	N/A



## Analyzer by Compliance Method

Method	Analyzer Model
<b>ASTM D1945</b>	
Three-channel fast refinery gas analyzer	<a href="#">8890 GC Option #600</a>
Fast refinery gas analyzer with H <sub>2</sub> S	<a href="#">8890 GC Option #601</a>
High-capacity refinery gas analyzer with large valve oven	<a href="#">8890 GC Option #603</a>
Single-channel natural gas analyzer	<a href="#">8890 GC Option #611</a>
Dual-channel natural gas analyzer	<a href="#">8890 GC Option #612</a>
<b>ASTM D1946</b>	
Three-channel fast refinery gas analyzer	<a href="#">8890 GC Option #600</a>
Fast refinery gas analyzer with H <sub>2</sub> S	<a href="#">8890 GC Option #601</a>
High-capacity refinery gas analyzer with large valve oven	<a href="#">8890 GC Option #603</a>
<b>ASTM D2163</b>	
LPG composition analyzer	<a href="#">8890 GC Option #632</a>
<b>ASTM D2593</b>	
LPG composition analyzer	<a href="#">8890 GC Option #632</a>
<b>ASTM D2712</b>	
LPG composition analyzer	<a href="#">8890 GC Option #632</a>
<b>ASTM D3612 C</b>	
Enhanced transformer oil gas (TOGA) analyzer	<a href="#">8890 GC Option #650</a>
<b>ASTM D4815</b>	
Oxygenates and aromatics in gasoline analyzer	<a href="#">8890 GC Option #620</a>
Analyzer for D4815 oxygenates in gasoline	<a href="#">8890 GC Option #621</a>
<b>ASTM D5504</b>	
Analyzer for sulfur in natural or fuel gas by SCD	<a href="#">8890 GC Option #630</a>
<b>ASTM D5524</b>	
LPG composition analyzer	<a href="#">8890 GC Option #632</a>
<b>ASTM D5580</b>	
Oxygenates and aromatics in gasoline analyzer	<a href="#">8890 GC Option #620</a>

# Analyzer by Compliance Method



Method	Analyzer Model
<b>ASTM D5623</b>	
Analyzer for sulfur in light petroleum by SCD	8890 GC Option #631
<b>ASTM D6584</b>	
Biodiesel analyzer	8890 GC Option #624
<b>ASTM D7423</b>	
Low oxygenates in hydrocarbons analyzer	8890 GC Option #623
<b>EN 12177</b>	
Analyzer for EN 12177 oxygenates in gasoline	8890 GC Option #622
<b>EN 13132</b>	
Analyzer for EN 13132 oxygenates in gasoline	8890 GC Option #622
<b>EN 14110</b>	
Biodiesel analyzer for methanol content by HSS-GC	8890 GC Option #625
<b>GPA 2261</b>	
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
<b>GPA 2286</b>	
Extended natural gas analyzer	8890 GC Option #610
GPA 2286 sour natural gas analyzer	8890 GC Option #615
<b>UOP 539</b>	
Three-channel fast refinery gas analyzer	8890 GC Option #600
Fast refinery gas analyzer with H <sub>2</sub> S	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 <sub>2</sub> S & O <sub>2</sub> )	8890 GC Option #605
<b>UOP 791</b>	
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 (C<sub>1</sub>-C<sub>5</sub>), H<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, CO, and CO<sub>2</sub>. In some instances, C<sub>6</sub> or higher hydrocarbons and sulfur contaminants like H<sub>2</sub>S 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<sub>1</sub>-C<sub>5</sub> with C<sub>6+</sub> as backflush), and the extended analysis of hydrocarbons in natural gas to C<sub>14</sub>.

Analyzer Model	Description	Extended Hydrocarbon Analysis	Full-range Capacity for H <sub>2</sub>	Separates Air (O <sub>2</sub> and N <sub>2</sub> )
8890 GC Option #600	Three-channel fast refinery gas analyzer	Yes	Yes	Yes
8890 GC Option #601	Fast refinery gas analyzer with H <sub>2</sub> S	Yes	Yes	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 <sub>2</sub> S & O <sub>2</sub> )	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:

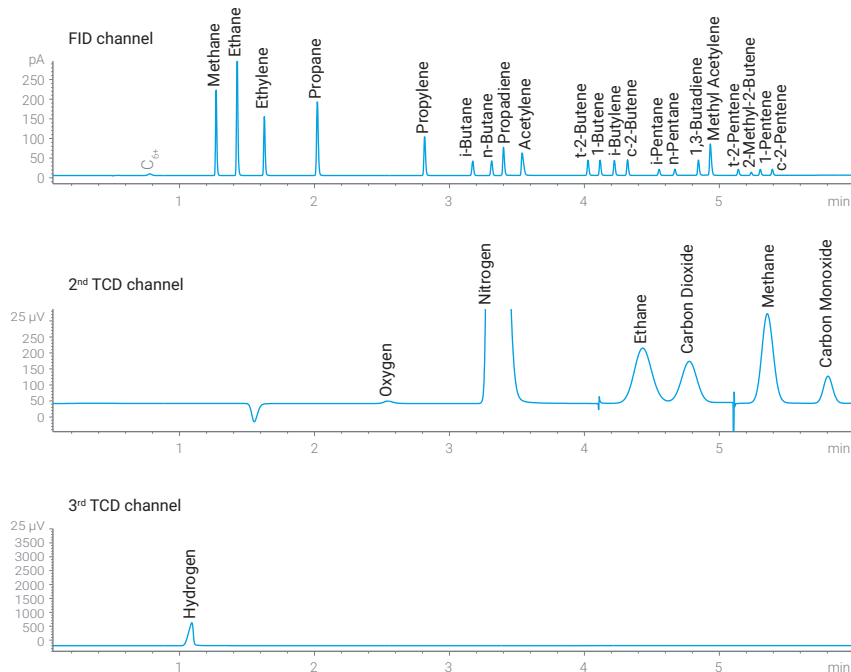
- C<sub>1</sub>-C<sub>5</sub>, and C<sub>6+</sub> as backflush, H<sub>2</sub>, He, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, CO

#### Typical quantification range:

- 0.01 mol% for all above-mentioned components

#### Configured per method:

- ASTM D1945, ASTM D1946, ASTM D7833, 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<sub>2</sub> by third TCD using N<sub>2</sub> or Argon carrier gas



## Fast Refinery Gas Analyzer with H<sub>2</sub>S

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:

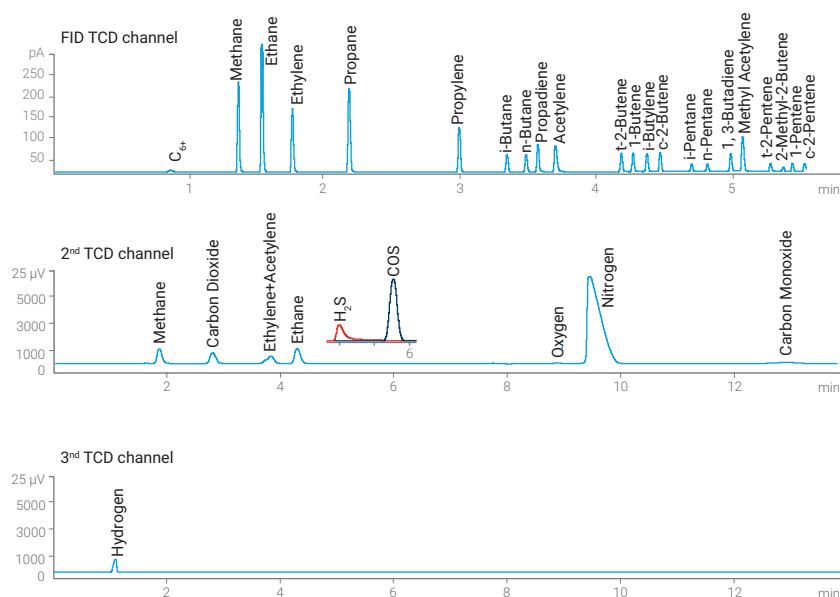
- C<sub>1</sub>-C<sub>5</sub>, and C<sub>6+</sub> as backflush, H<sub>2</sub>, He, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, CO, H<sub>2</sub>S, COS

#### Typical quantification range:

- 0.01 mol% for all above-mentioned components except H<sub>2</sub>S and COS
- 500 ppm for H<sub>2</sub>S
- 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<sub>2</sub> by third TCD using N<sub>2</sub> or Argon carrier gas
- Nickel tubing and Hastelloy valve for high H<sub>2</sub>S and COS analysis
- O<sub>2</sub> may be present but not for quantitation



# High-Capacity Refinery Gas Analyzer with Large Valve Oven

8890 GC Option #603

## Analyzer description

### Configuration:

- 4-valve/large valve oven/7-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:

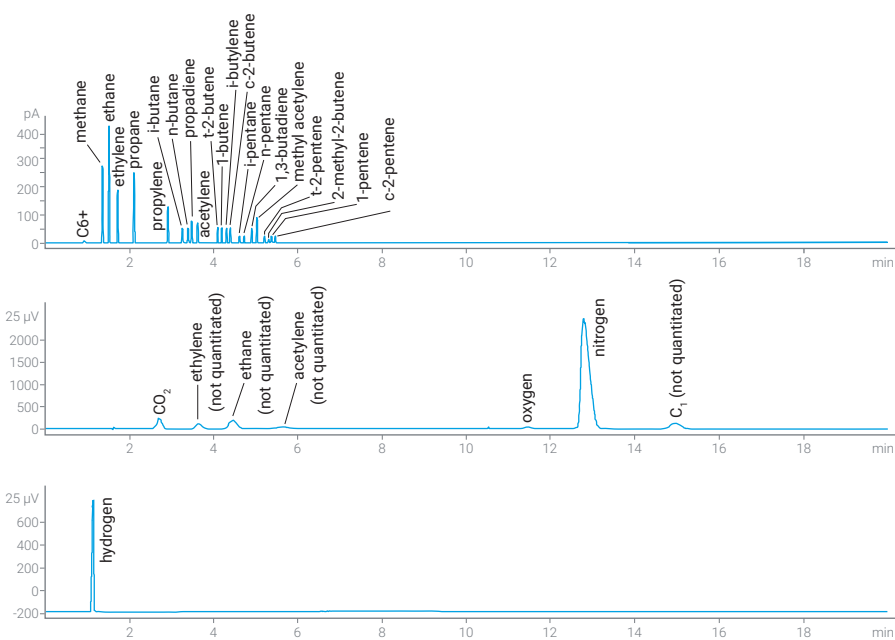
- C<sub>1</sub>-C<sub>5</sub>, and C<sub>6+</sub> as backflush, H<sub>2</sub>, He, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, CO, H<sub>2</sub>S, COS

### Typical quantification range:

- 0.01 mol% for all above-mentioned components except H<sub>2</sub>S and COS
- 500 ppm for H<sub>2</sub>S
- 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<sub>2</sub> by third TCD using N<sub>2</sub> 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:

- 4-valve/large valve oven/7-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:

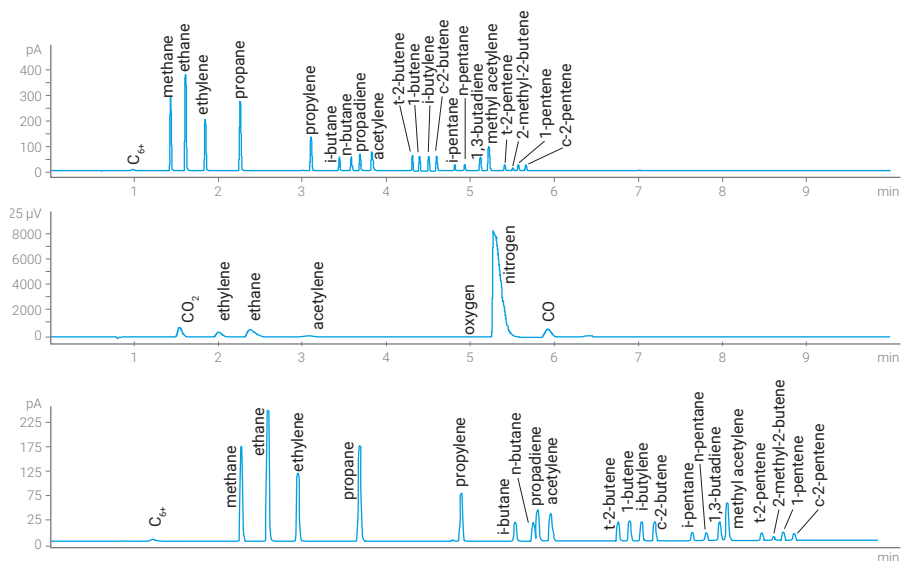
- C<sub>1</sub>-C<sub>5</sub>, and C<sub>6+</sub> as backflush, H<sub>2</sub>, He, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, CO, H<sub>2</sub>S, COS

#### Typical quantification range:

- 0.01 mol% for all above-mentioned components except H<sub>2</sub>S
- 500 ppm for H<sub>2</sub>S
- 300 ppm for COS

#### Configured per method:

- ASTM D7833, 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<sub>2</sub> by third TCD using N<sub>2</sub> carrier gas
- Nickel tubing and Hastelloy valve for resistance to sulfur corrosion



## Extended Refinery Gas Analyzer with Large Valve Oven and H<sub>2</sub>S and O<sub>2</sub>

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:

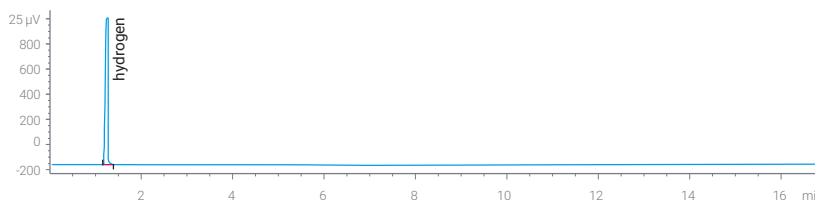
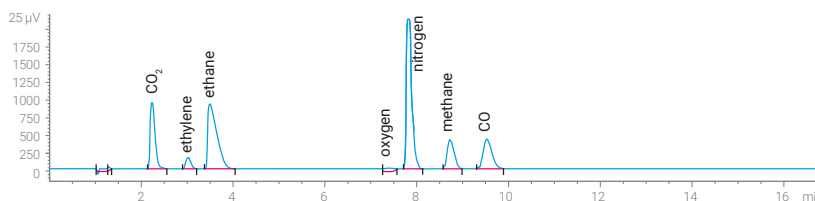
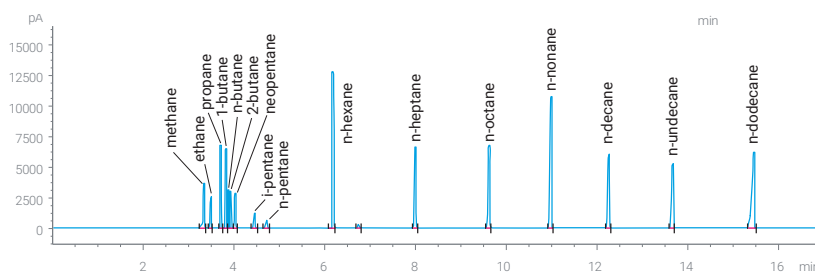
- Hydrocarbons up to C<sub>12</sub>, H<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, CO, H<sub>2</sub>S

#### Typical quantification range:

- 0.01 mol% for all above-mentioned components except H<sub>2</sub>S
- 500 ppm for H<sub>2</sub>S

#### Configured per method:

- UOP 539



### Key benefits and features

- Three parallel channels with simultaneous detection for complete refinery gas analysis within 16 minutes
- Large valve oven (LVO) to allow independent hydrogen, hydrocarbon, and permanent gas analysis
- Full-range capability for H<sub>2</sub> by third TCD using N<sub>2</sub> 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<sub>1</sub>-C<sub>4</sub> chain length) as well as small amounts of impurities, such as O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>, 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<sub>1</sub>-C<sub>5</sub> with C<sub>6+</sub> as backflush), and perform extended analysis of hydrocarbons in natural gas to C<sub>14</sub>. 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 <sub>2</sub>	Separates Air (O <sub>2</sub> and N <sub>2</sub> )
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	Yes	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:

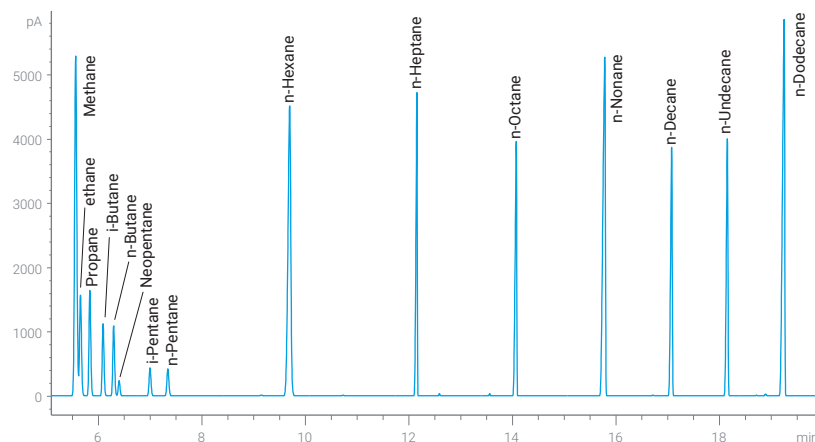
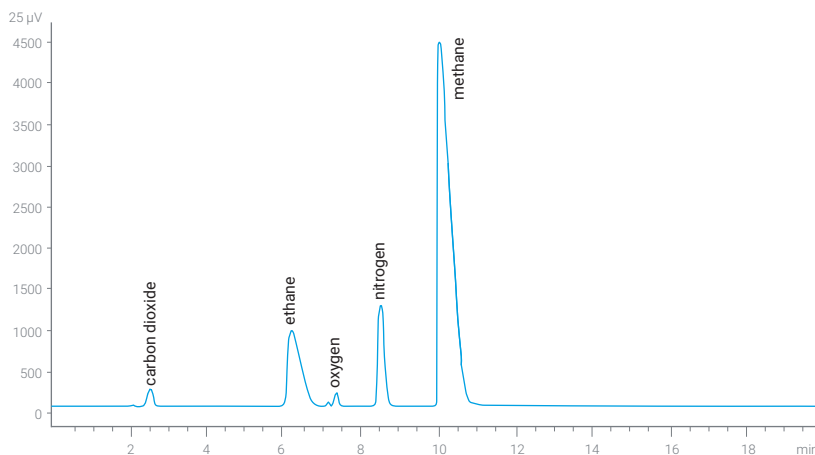
- C<sub>1</sub>-C<sub>12</sub>, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, CO

#### Typical quantification range:

- 50 ppm for permanent gases and C<sub>1</sub>-C<sub>2</sub> hydrocarbons on TCD
- 10 ppm for C<sub>3</sub>-C<sub>12</sub> on FID

#### Configured per method:

- Results per GPA 2286, but calculation without bridge components iC<sub>5</sub> and nC<sub>5</sub>



### Key benefits and features

- Dual channels with TCD and FID detectors
- TCD channel with packed column for C<sub>1</sub>-C<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub> analysis
- C<sub>3</sub>-C<sub>12</sub> 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\*:

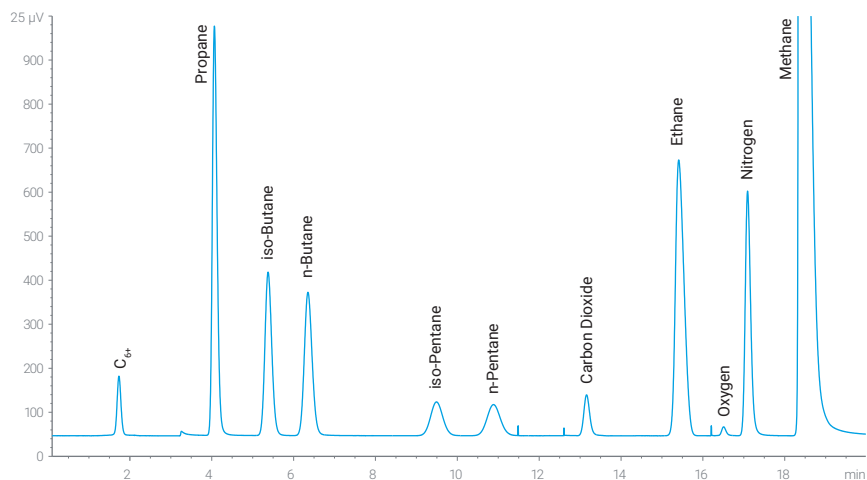
- C<sub>1</sub>-C<sub>5</sub>, C<sub>6+</sub> as backflush
- O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, CO

#### Typical quantification range:

- 0.01 mol% for all components

#### Configured per method:

- ASTM D1945, GPA 2261 (H<sub>2</sub> 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:

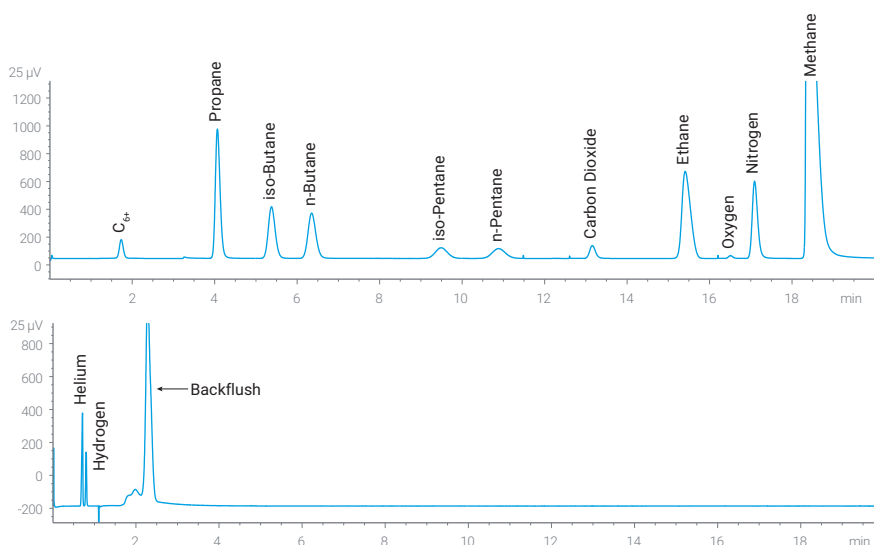
- C<sub>1</sub>-C<sub>5</sub>, C<sub>6+</sub> as backflush
- H<sub>2</sub>, He, O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, CO

#### 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<sub>2</sub> and He analysis



## GPA 2261 Sour Natural Gas Analyzer

8890 GC Option #613

### Analyzer description

#### Configuration:

- 3-valves/4-column, corrosion-resistant plumbing, TCD

#### Sample type:

- Natural gas and similar gaseous mixtures

#### Compounds analyzed:

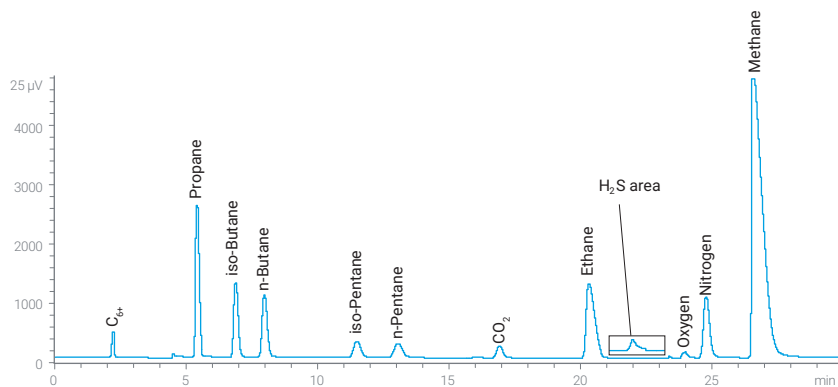
- C<sub>1</sub>-C<sub>5</sub>, C<sub>6+</sub> as backflush
- O<sub>2</sub>, N<sub>2</sub>, CO<sub>2</sub>, CO

#### Typical quantification range:

- 0.01 mol% for all components
- 500 ppm for H<sub>2</sub>S

#### 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<sub>2</sub>S analysis



## GPA 2286 Sour Natural Gas Analyzer

8890 GC Option #615

### Analyzer description

#### Configuration:

- 3-valve, 6-column, TCF/TCF/FID

#### Sample type:

- Natural gas and similar gaseous mixtures

#### Compounds analyzed:

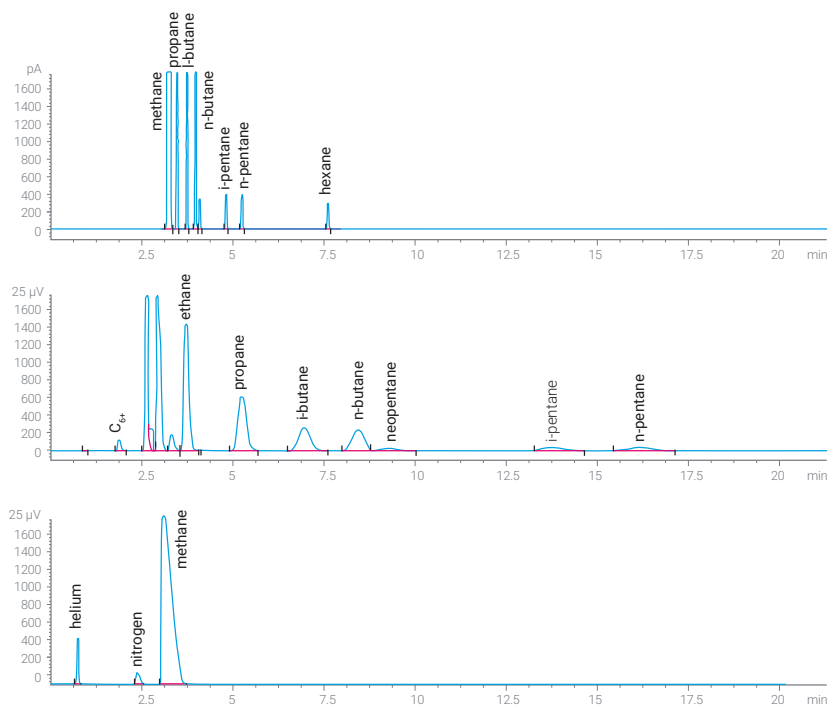
- C<sub>1</sub>-C<sub>14</sub>
- He, H<sub>2</sub>, N<sub>2</sub>, CO

#### Typical quantification range:

- 50 ppm for permanent gases and C<sub>1</sub>-C<sub>5</sub> (TCD)
- 10 ppm for C<sub>5</sub>-C<sub>6</sub> (FID)

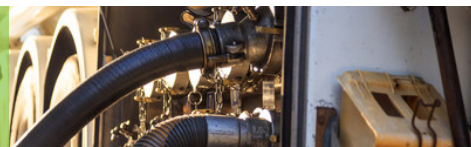
#### Configured per method:

- GPA 2286



### Key benefits and features

- 3-channel with TCD and FID detectors
- Fixed gases and hydrocarbons up to C<sub>5</sub> on packed columns and thermal conductivity detector
- Hydrocarbons from C<sub>5</sub> to C<sub>14</sub> 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

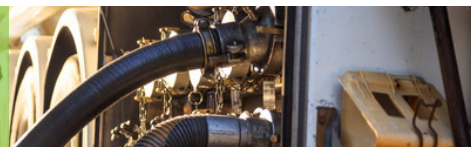


## Conform to Strict Octane and Emissions Regulations

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:

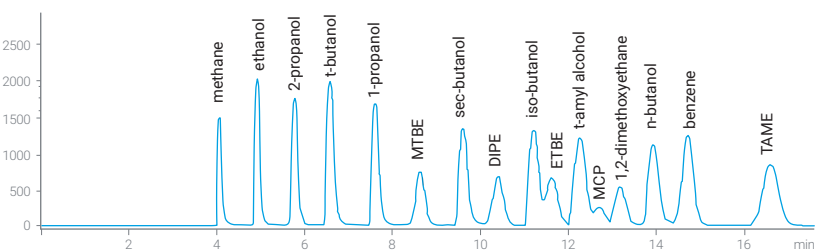
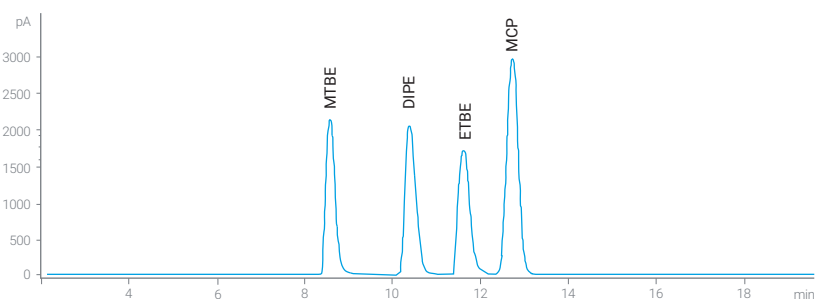
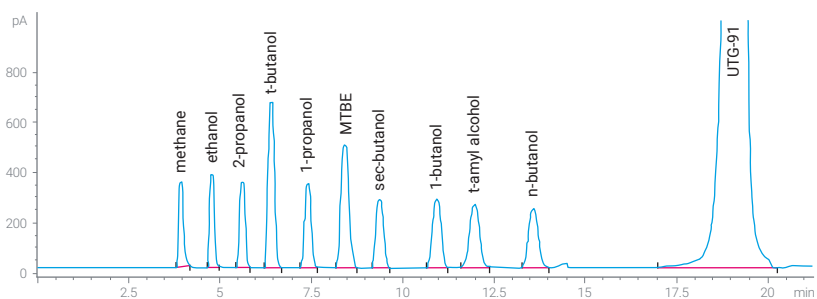
- ASTM D4815: MTBE, ETBE, TAME, DIPE, methanol, ethanol, isopropanol, *n*-propanol, isobutanol, *tert*-butanol, *sec*-butanol, *n*-butanol, *tert*-pentanol
- ASTM D5580: benzene, toluene, ethylbenzene, xylene, C<sub>9</sub> and heavier aromatics, total aromatics

#### Typical quantification range:

- 0.2 to 20 Wt% for individual ethers, 0.2 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<sub>8</sub> aromatics, 5 to 30 Vol% for total C<sub>9</sub> and heavier aromatics, 10 to 80 Vol% for total aromatics

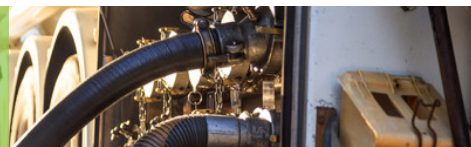
#### Configured per method:

- 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:

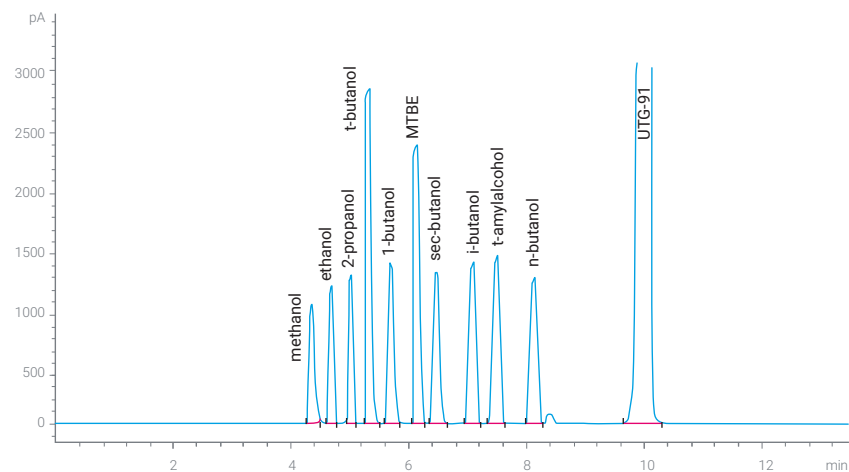
- MTBE, DME, TAME, DIPE, methanol, ethanol, isopropanol, *n*-propanol, isobutanol, *tert*-butanol, *sec*-butanol, *n*-butanol, *tert*-pentanol

#### 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:

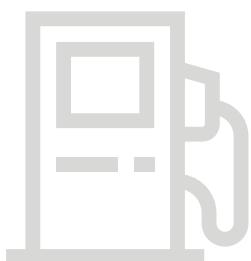
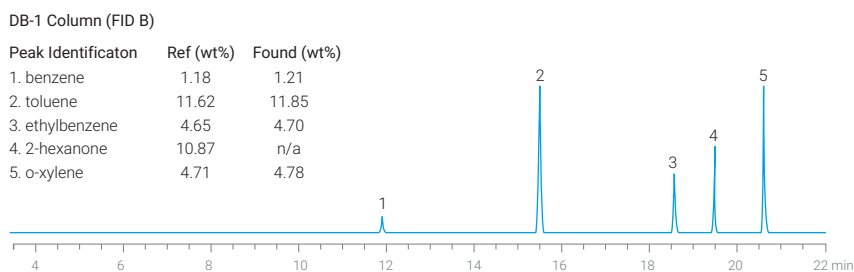
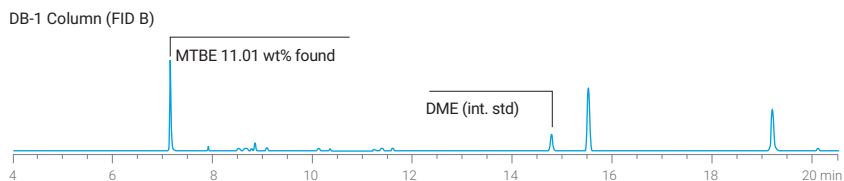
- Benzene, toluene, ethylbenzene, and oxygenates: MTBE, ETBE, TAME, DIPE, ethanol, isopropanol, *n*-propanol, isobutanol, *tert*-butanol, *sec*-butanol, *n*-butanol, and *tert*-pentanol

#### Typical quantification range:

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

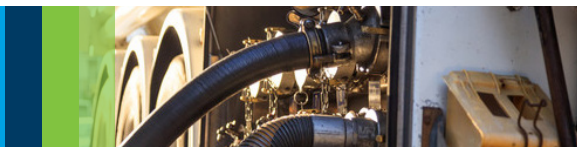
#### Configured per method:

- EN 13132, EN 12177



### 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:

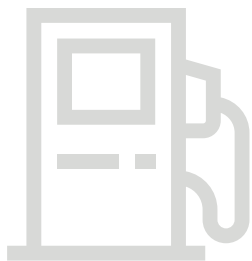
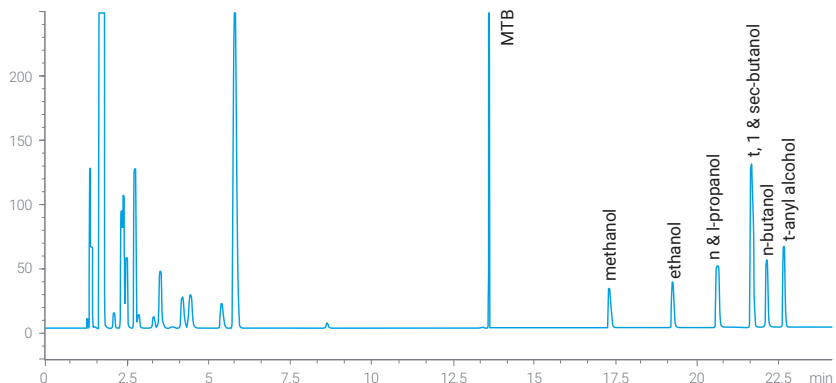
- MTBE, ETBE, DIPE, TAME, methanol, *n*-propanol and *i*-propanol, *n*-butanol, *i*-butanol, *tert*-butyl alcohol, *sec*-butyl alcohol, and *tert*-pentanol

#### Typical quantification range:

- 0.5 ppm for MTBE

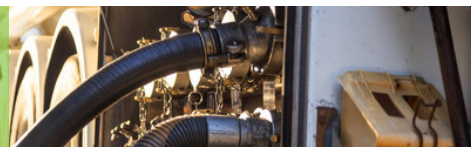
#### Configured per method:

- 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:

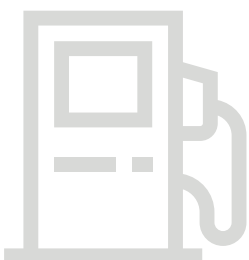
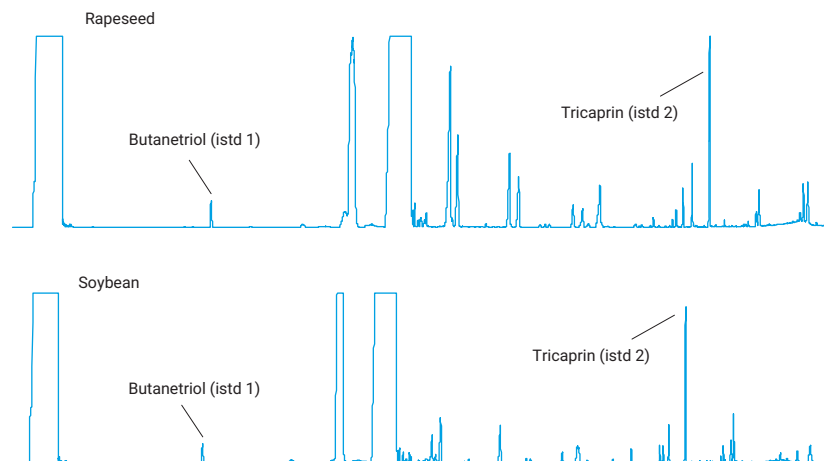
- Free glycerin, monoglycerides, diglycerides, triglycerides, bound glycerin, total glycerin

#### Typical quantification range:

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

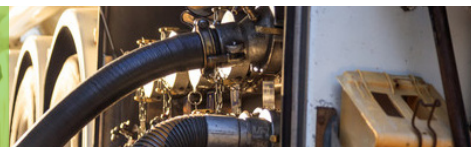
#### Configured per method:

- 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:

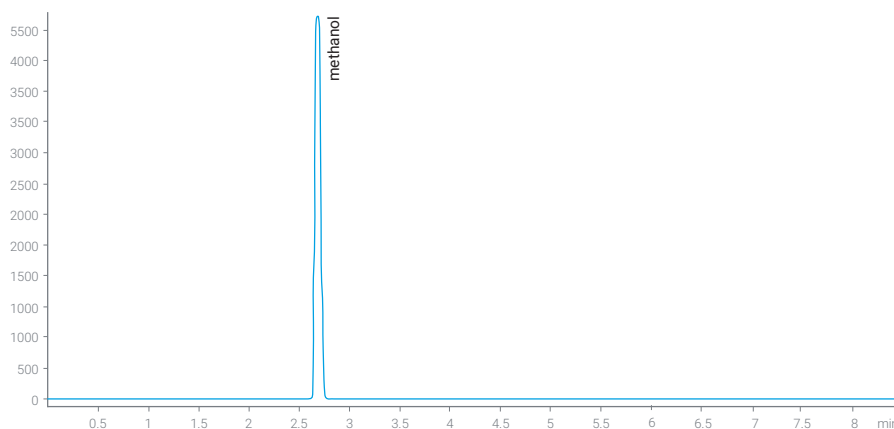
- Methanol

#### 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

#### Sample type:

- Natural gas and other gaseous fuels

#### Compounds analyzed:

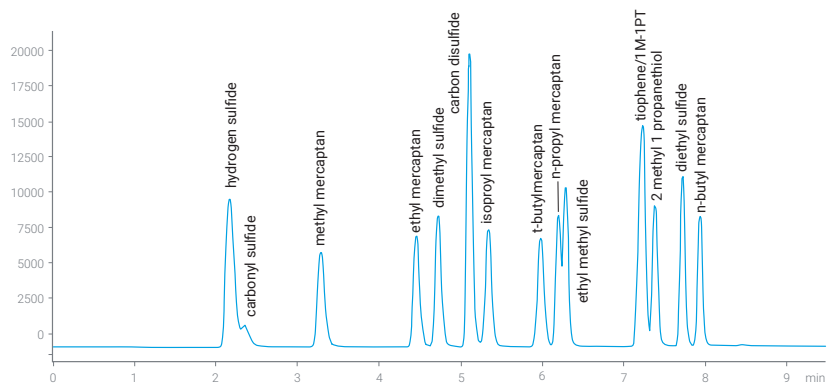
- Sulfur compounds in natural gas or gaseous fuels
- H<sub>2</sub>S, CS<sub>2</sub>, COS, mercaptans, aromatic sulfur compounds, sulfides

#### Typical quantification range:

- 100 ppb H<sub>2</sub>S
- 20-40 ppb for other S components

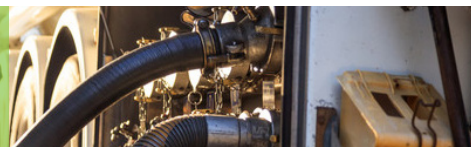
#### Configured per method:

- 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



## Analyzer for Sulfur in Light Petroleum by SCD

8890 GC Option #631

### Analyzer description

#### Configuration:

- 1-valve/capillary column/SCD

#### Sample type:

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

#### Compounds analyzed:

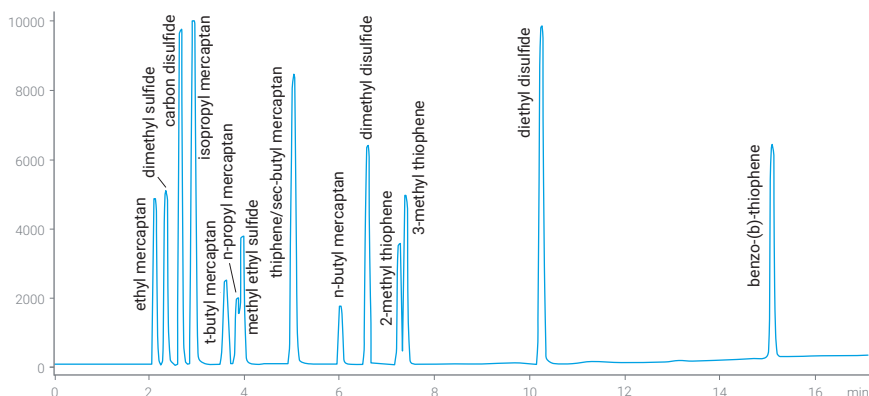
- Volatile sulfur-containing compounds in light petroleum liquids

#### Typical quantification range:

- 20 ppb of sulfur in gasoline

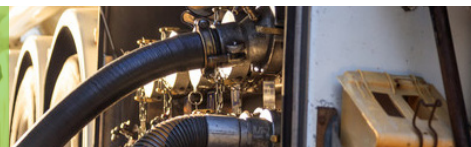
#### Configured per method:

- 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



## LPG Composition Analyzer

8890 GC Option #632

### Analyzer description

#### Configuration:

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

#### Sample type:

- LPG

#### Compounds analyzed:

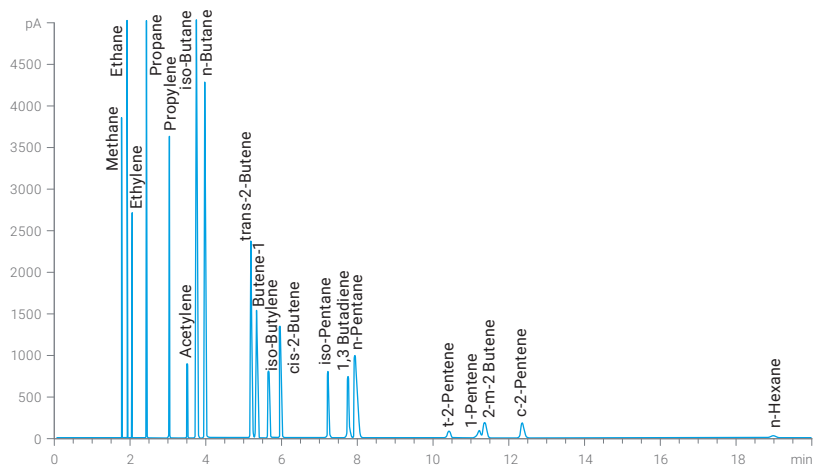
- C<sub>1</sub>-C<sub>6</sub>

#### 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<sub>1</sub> to C<sub>8</sub> 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<sub>2</sub>, and CO<sub>2</sub> 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 <sub>2</sub> in-process gas analyzer with vent valve
8890 GC Option #641	Low-level CO and CO <sub>2</sub> in-process gas analyzer



## Low-Level CO and CO<sub>2</sub> In-Process Gas Analyzer with Vent Valve

8890 GC Option #640

### Analyzer description

#### Configuration:

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

#### Sample type:

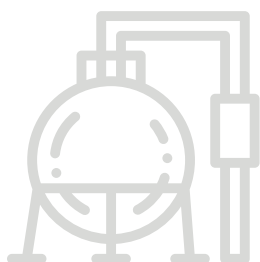
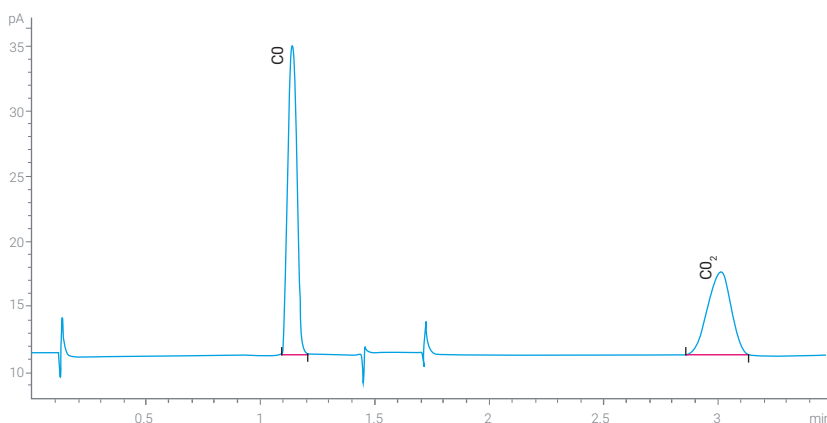
- Process gas containing high levels of methane, natural gas

#### Compounds analyzed:

- CO<sub>2</sub> and CO

#### Typical quantification range:

- 0.2 ppm for CO
- 0.4 ppm for CO<sub>2</sub>



### Key benefits and features

- Single channel with packed columns
- High concentration hydrocarbons cut on the pre-column; CH<sub>4</sub> vented during the analysis through use of a 4-port valve
- Trace levels of CO and CO<sub>2</sub> analyzed by conversion to CH<sub>4</sub> and detection with FID
- 3-minute analysis time



## Low-Level CO and CO<sub>2</sub> In-Process Gas Analyzer

8890 GC Option #641

### Analyzer description

#### Configuration:

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

#### Sample type:

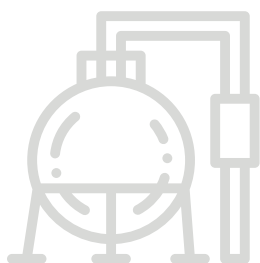
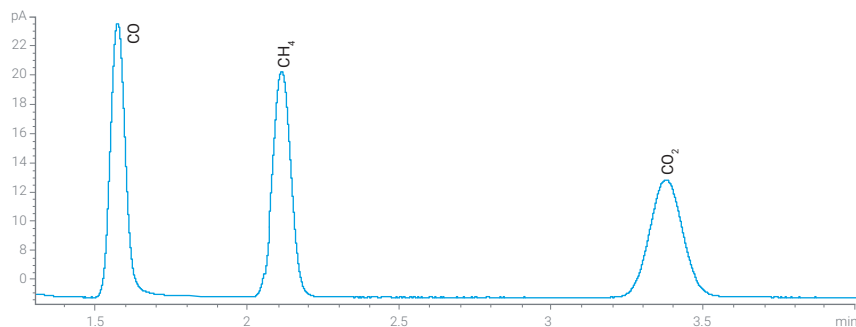
- Ethylene, propylene, or process gas streams containing low concentrations of methane

#### Compounds analyzed:

- CO<sub>2</sub> and CO

#### Typical quantification range:

- 0.2 ppm for CO
- 0.4 ppm for CO<sub>2</sub>



### Key benefits and features

- Single channel with packed columns
- Hydrocarbons cut on the pre-column while trace levels of CO and CO<sub>2</sub> pass through methanizer for conversion to CH<sub>4</sub> 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:

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

### Sample type:

- Gas

### Compounds analyzed:

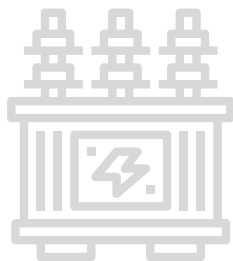
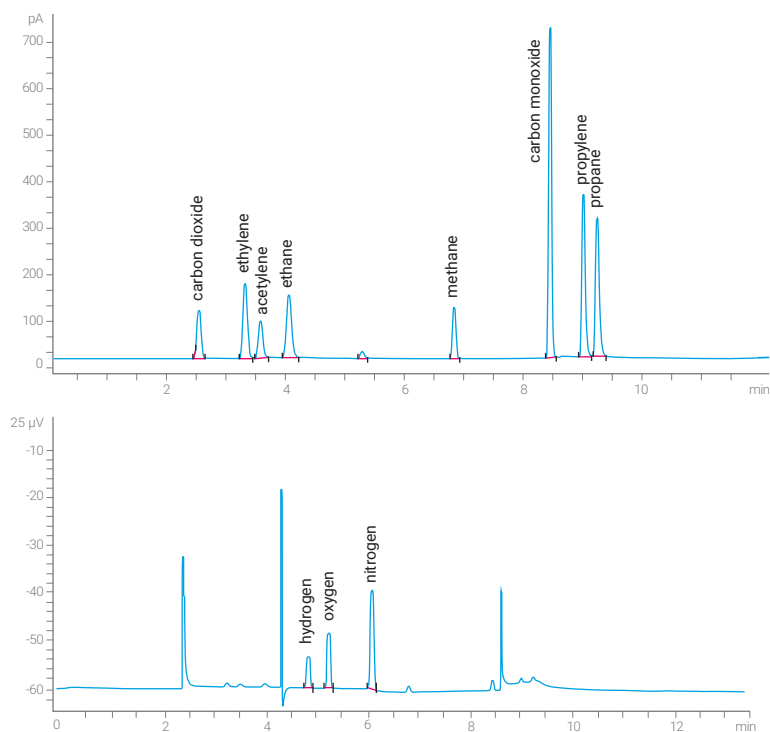
- $H_2$ ,  $O_2$ ,  $N_2$ ,  $CH_4$ , CO, and  $CO_2$
- $C_2$  (ethane, ethylene, acetylene),  $C_3$  (propane, propylene),  $C_4$  (1-butene)

### 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<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O)—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 <sub>2</sub> O LDL	CH <sub>4</sub>	CO <sub>2</sub>
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:

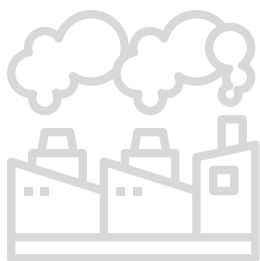
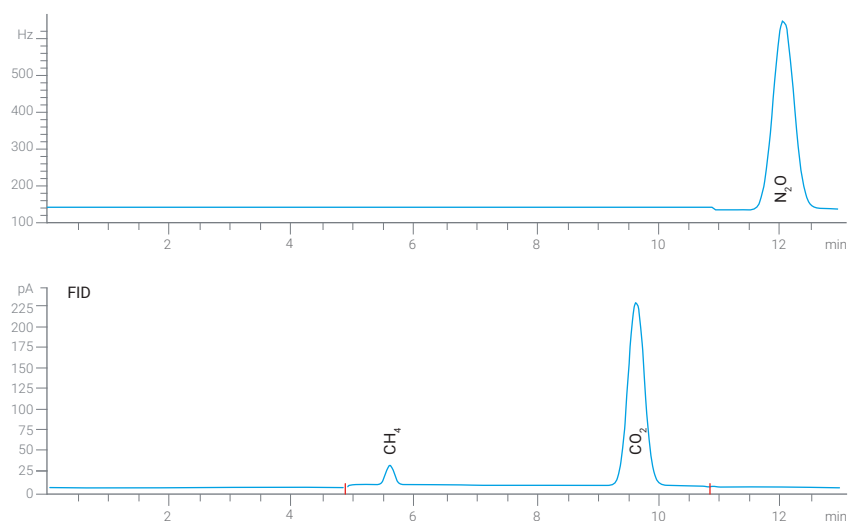
- Greenhouse gases and soil gases with compounds of interest contain gases such as  $\text{CH}_4$ ,  $\text{N}_2\text{O}$ , and  $\text{CO}_2$

#### Compounds analyzed:

- $\text{CH}_4$ ,  $\text{N}_2\text{O}$ ,  $\text{CO}_2$

#### Typical quantification range:

- 50 ppb for  $\text{N}_2\text{O}$
- 0.2 ppm to 20% for  $\text{CH}_4$
- 0.4 ppm to 0.2% for  $\text{CO}_2$



### Key benefits and features

- Configured for simultaneous analysis of greenhouse gas with one injection
- Sensitivity of micro-ECD ensures the detection of  $\text{N}_2\text{O}$  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  $\text{SF}_6$
- Single channel with a simple valve configuration



## Greenhouse Gas Analyzer with 0.4 ppm to 20% CO<sub>2</sub> Detection

8890 GC Option #661

### Analyzer description

#### Configuration:

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

#### Sample type:

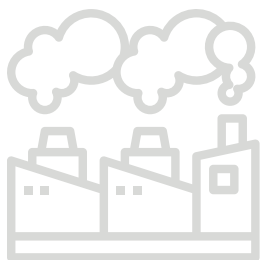
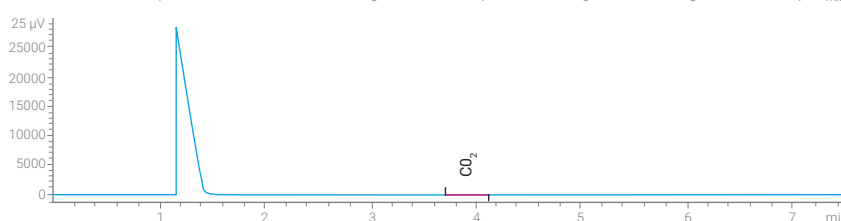
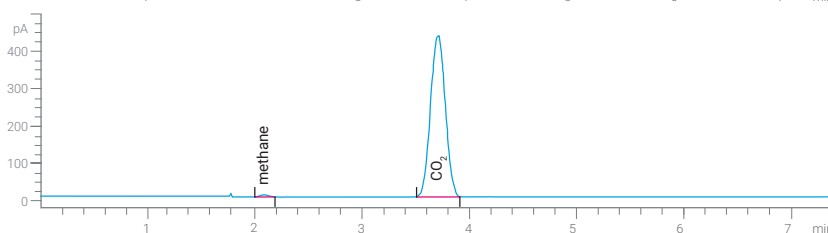
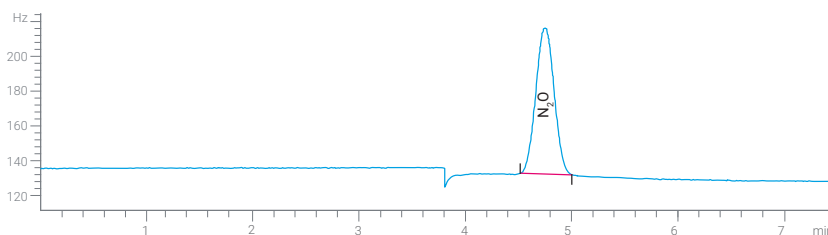
- Greenhouse gases and soil gases with compounds of interest contain gases such as CH<sub>4</sub>, N<sub>2</sub>O, and CO<sub>2</sub>

#### Compounds analyzed:

- CH<sub>4</sub>, N<sub>2</sub>O, CO<sub>2</sub>

#### Typical quantification range:

- 50 ppb for N<sub>2</sub>O
- 0.2 ppm to 20% for CH<sub>4</sub>
- 0.4 ppm to 20% for CO<sub>2</sub>



### Key benefits and features

- Configured for simultaneous analysis of greenhouse gas with one injection
- Sensitivity of micro-ECD ensures the detection of N<sub>2</sub>O 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<sub>6</sub>
- 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<sub>2</sub> 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<sub>3</sub>
- 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.

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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.

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