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## Applications

An ex situ zirconium oxide analyzer for excess oxygen measurement in dirty, rugged combustion applications such as:

- Boilers: all fuels and all types, including marine, recover, and utility
- Furnaces: all fuels and all types, including heat treating, glass and process
- Rotary kilns: ore reduction, cement, alumina processing and others
- Incinerators: industrial, municipal and hazardous waste

## Features

- Ex situ design for easy sensor replacement
- Sensor housing maintains steady temperature for greater accuracy and longer sensor life
- Optional sensor to measure $H_2$, CO, and other combustibles
- Corrosion-resistant design
- Plug-resistant sample path
- Easy installation
- Horizontal or vertical installation in flue
- Explosion-proof/flameproof models
- Suitable for temperatures up to 3452°F (1900°C)

# FGA 300

## Panametrics Flue Gas Oxygen Analyzer

FGA 300 is a Parametrics product. Parametrics has joined other GE high-technology sensing businesses under a new name—
GE Industrial, Sensing.

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## Flue Gas Oxygen Analyzer

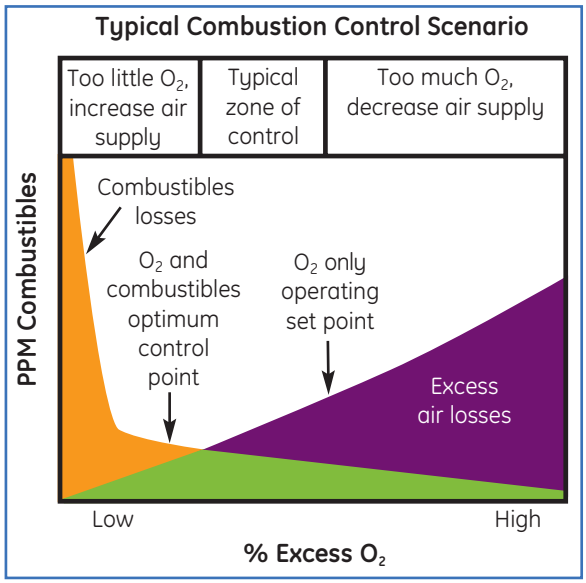
The FGA 300 flue gas analyzer can pay for itself through fuel savings, reduced air pollution and improved product quality. Using the information the analyzer provides, you can adjust your burner air supply for maximum combustion efficiency. The optional combustibles detector can be used to monitor burner operation for further improvements in efficiency and safety.

## Why Monitor Flue Gas?

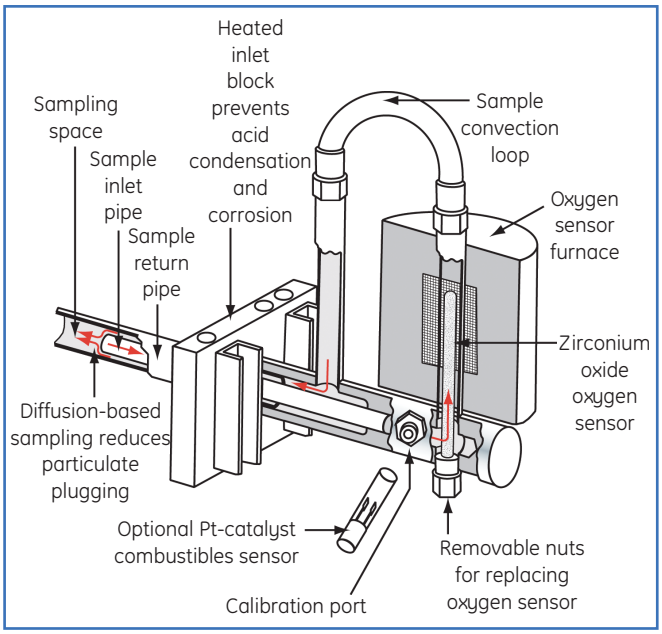
Ideally, every burner should mix a precise ratio of air and fuel, and the fuel should burn stoichiometrically to yield only heat, water vapor and carbon dioxide. In reality, this rarely happens. Burners age, mixing is imperfect, calorific value of fuel varies, firing rates change, and the weather changes from day to day. Any of these factors can change the amount of air required for safe and efficient combustion of fuel.

How much air is needed? Too little air sends unburned fuel to the stack—a costly and potentially explosive condition. Too much air wastes the heat of combustion by allowing excess hot air to go up the stack.

Accurate flue gas analysis minimizes fuel costs and reduces pollution in all combustion processes. Incomplete combustion can lead to increased air pollution. The amount of excess air influences $SO_3$ and $NO_x$ formation. The correct air/fuel ratio minimizes the emission of pollutants.




*Combustion applications typically trim burner air supply to run excess oxygen at an optimal level to ensure complete combustion.*




*Unique FGA 300 ex situ diffusion convection loop design is better than traditional flue gas analyzers because it provides a clean gas to the sensor and resists plugging.*

## Why the FGA 300 Is Better Than Traditional Flue Gas Analyzers

The designs of many flue gas analyzers have proven to be inadequate and unreliable under the harsh conditions in which they must operate. Particulate contamination often leads to premature sensor failure. The routine maintenance required can be difficult and time-consuming.

The FGA 300 overcomes these limitations by combining state-of-the-art measurement technology with a unique sampling design. The result is an accurate, low-cost analyzer that stays on the job for extended periods without requiring continual maintenance. It responds in seconds to changes in flue gas concentrations of oxygen and/or combustibles, constantly providing the information you need to keep your boiler or furnace operating at maximum efficiency.

Some analyzers measure flue gas temperature, which is used to perform efficiency calculations. The trouble with this is that to calculate efficiency accurately, the temperature measurement should be taken after the last heat exchanger. Oxygen content, however, is best measured as close as possible to the combustion zone and before the heat exchanger in order to minimize the effects of air leaks, which may bias the excess oxygen reading. This means that the efficiency calculated by these analyzers may be quite inaccurate. Because the

FGA 300 is suitable up to 3452°F (1900°C), it can control excess $O_2$ in the stack location that is immediately adjacent to the furnace. Contact GE for our free combustion-efficiency slide chart.

Some of the FGA 300's special design features are detailed below:

**Stable, Accurate, Wide-Range Oxygen Sensor**
The oxygen sensor, a zirconium oxide cell, is housed in a special furnace that operates at a steady 1292°F (700°C). The temperature stability improves accuracy and extends the sensor's life.

**Optional Platinum-Catalyst Combustibles Sensor**
A unique platinum-catalyst sensor is available to measure levels of combustibles (CO plus $H_2$). This is useful for detecting incomplete combustion or defective burner equipment.

**Corrosion-Resistant Design**
The entire analyzer is kept heated to a temperature above the acid dew point of the flue gas. This prevents acid condensation and corrosion, ensuring maximum analyzer life with minimum maintenance.

**Plug-Resistant Sample Path**
A diffusion-based sampling technique eliminates or greatly reduces the entry of particulates into the analyzer. Should it ever become necessary, quick and easy cleaning is possible without disassembling the unit.

**Fast, Easy Routine Maintenance**
Calibration is easily achieved by using a calibration gas and making a single adjustment at the main analyzer. For sensor replacement, there is no need to remove the entire analyzer from the flue. Since the sensor is ex situ, it can be quickly removed with basic tools.

**Simple Installation**
The FGA 300 is easy to install. The FGA 300 can be installed on a flue or furnace using a standard or customer-supplied flange. Because it utilizes the ex situ connection loop design, reference air is not needed.

## Models for Every Application

The most basic version of the FGA 300 consists of a zirconium oxide oxygen sensor and diffusion convection sampling loop, combined with a logarithmic millivolt output inversely proportional to the oxygen concentration. The basic model can be customized with the following options to create a configuration optimized for the particular application:

- Linearized current output for oxygen concentration
- Microprocessor-based electronics console housed in an IP65 weatherproof enclosure
- Platinum-catalyst combustibles sensor housed in the main analyzer unit

**Standard Horizontal and Vertical Mounting Configurations**
The installation requirements of the application will generally determine whether the horizontal or vertical configuration is the best fit. In extreme cases of high dust loading, such as in cement kilns, an optional blow-back system can be added for manually or automatically blowing dust or dirt accumulation out of the sample probe.

**Explosion-proof Configurations**
The horizontal and vertical explosion-proof/flameproof configurations of the FGA 300 are ATEX-certified to EEx d IIC T4/T6. These units are typically used in furnace or process heater applications.

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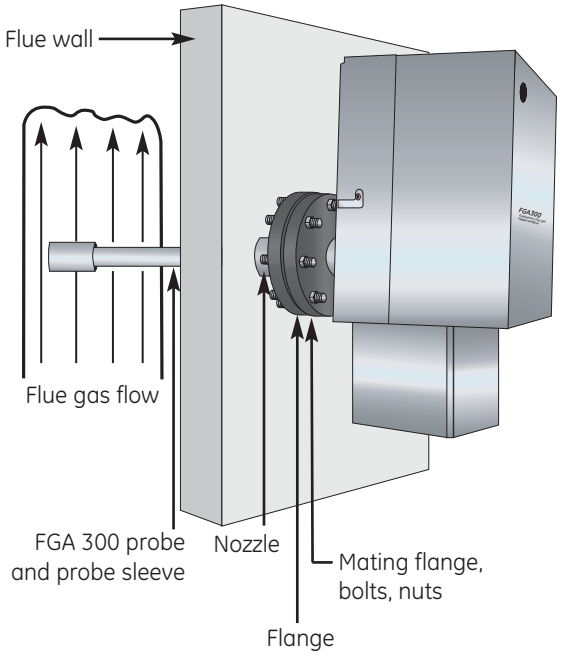
## Microprocessor-Based Electronics Provide Diagnostics and Other Useful Data

**The default setting for the FGA 300's microprocessor-based electronics displays oxygen concentration, optional combustibles concentration, alarm output, and either current or voltage output. At the push of a button on the front panel, the default display can be overridden to show fuel and other parameters that may be more relevant to the individual process application. In addition, at the flip of a switch, you can select a particular fuel as the default fuel upon which all other calculations will be based. The buttons on the front panel display the following functions:**

| | |
|---|---|
| **ΔΩ** | Equivalent Combustibles. This supplements the combustibles measurement in excess fuel situations. |
| **ΔC** | Excess Fuel. This is useful for monitoring conditions when fuel is either deliberately in excess (e.g., in reducing atmospheres) or unintentionally in excess. |
| **$O_2$** | Percent Oxygen. This displays the amount of oxygen in excess of the stoichiometric quantity. This is the only accurate method for setting the proper air/fuel ratio. |
| **mV** | Oxygen Sensor Millivolts. This displays the raw oxygen-sensor millivolt output, which indicates the oxygen sensor's operating condition. |
| **C.I.** | Combustivity Index. The combustion air requirement index is needed when there are rapid, large changes in the fuel gas composition. (Optional hardware is required.) |
| **A.F.** | Air Factor. Air Factor (ratio of air supplied to air needed for stoichiometric combustion) is often the preferred parameter to control furnaces that are operated from reducing through oxidizing conditions. |
| **Ω** | Oxygen Sensor Test. This button tests the operating condition of the oxygen sensor and warns in advance that replacement is necessary. This is used instead of automatic recalibration. |




*Typical horizontal flue gas analyzer installation*

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# FGA 300 Specifications

## Oxygen Analyzer

**Sensor**
Stabilized zirconium oxide

**Accuracy**
- Logarithmic output: ±1% of reading
- Linear output: ±0.5% of full scale (FS)

**Repeatability**
- Logarithmic output: ±0.2% of reading
- Linear output: ±0.5% of FS

**Drift**
Less than 0.1% of sensor output per month

**Response Time**
Standard: 90% of a step change within 20 seconds

*Faster speed of response available with optional air ejector/aspirator*

**Sample Probe Length**
- 0.6 m (2 ft)
- 0.9 m (3 ft)
- 1.2 m (4 ft)
- Other lengths available on request

**Sample Temperature**
- Up to 1200°F (650°C)
- 1200°F to 1750°F (650°C to 950°C)
- 1750°F to 2900°F (950°C to 1600°C )
- 2900°F to 3450°F (1600°C to 1900°C)

**Sample Dew Point**
- Standard: 356°F (180°C) maximum
- Optional: Higher dew point version available

**Ambient Analyzer Temperature**
- Standard: –13°F to 158°F (–25°C to 70°C)
- Optional: Higher temperature version available

**Power Requirements**
100/110/220/240 VAC ±10%, 50/60 Hz, 480 W start-up maximum/250 to 300 W in operation

**Calibration**
Through online calibration port using certified mixture of $O_2$ in $N_2$

**Warm-Up Time**
Meets specified accuracy within one hour

**Environmental**
- Weatherproof (IP65)
- Flameproof
  Display electronics with or without FGA 300 furnace temperature controller
  Ⓔx II 2 G EEx d IIC T6 -4°F to 131°F (-20°C to 55°C)
  ISSeP04ATEX071

## Combustibles Analyzer

**Sensor**
Catalytic-combustion, platinum resistance thermometer

**Accuracy**
±5% of FS

**Repeatability**
±1% of FS

**Drift**
Less than 2% of FS per month

**Response Time**
Standard: 90% of a step change within 20 seconds

**Calibration**
Through online calibration port using certified mixture of CO and $H_2$ in $N_2$ with $O_2$

**Warm-Up Time**
Meets specified accuracy within one hour

## Microprocessor-Based Electronics

**AC Power Supply**
100/110/220/240 VAC ±10%, 50/60 Hz

**Power Consumption**
15 W

**Operating Temperature**
14°F to 122°F (–10°C to 50°C )

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# FGA 300 Specifications

**Storage Temperature**
–67°F to 158°F (–55°C to 70°C)

**Warm-Up Time**
Meets specified accuracy in five minutes

*Analyzer requires one hour*

**Output**
- 0 to 20 mA/4 to 20 mA, isolated output, loop resistance
- < 600 Ω or 0 to 10 VDC

**Displays**
- Oxygen: four-digit LED
- Combustibles: 4.5-digit LED

**Units**
- Oxygen sensor, switch selectable: % oxygen, mV, air factor, excess fuel, equivalent combustibles, combustion air requirement index
- Combustibles sensor: 0 to 19,999 $ppm_V$ combustibles

**Environmental**
- Weatherproof (IP65)
- Flameproof: Display electronics with or without FGA300 furnace temperature controller
  ⟨Ex⟩ II 2 G EEx d IIC T6 -4°F to 131°F (-20°C to 55°C)
  ISSeP04ATEX076

**Alarms**
Two Form C relays for both oxygen and combustibles; rated 4 A at 110/220 VAC, 28 VDC

*Alarms also activate for analyzer plugging and sensor failure*

## Dimensions and Weights

**Standard Horizontal Analyzer**
- Dimensions, (h x w x d): 22 in x 9 in x 14 in (555 mm x 235 mm x 350 mm)
- Weight: 37 lb (18 kg)

**Standard Vertical Analyzer**
- Dimensions, (h x w x d): 23 in x 10 in x 11 in (590 mm x 265 mm x 280 mm)
- Weight: 33 lb (15 kg)

**Explosion-proof Horizontal Analyzer**
- Dimensions, (h x w x d): 17in x 28 in x 14 in (440 mm x 700 mm x 355 mm)
- Weight: 88 lb (40 kg)

**Explosion-proof Vertical Analyzer**
- Dimensions, (h x w x d): 24 in x 27 in x 12 in (600 mm x 675 mm x 300 mm)
- Weight: 99 lb (45 kg)

**Remote Furnace-Temperature Control Box**
- Dimensions, (h x w x d): 12 in x 9 in x 4 in (293 mm x 221 mm x 105 mm)
- Weight: 17 lb (8 kg)

*Required for all configurations except standard horizontal*

**Rack-Mount Electronics**
- Dimensions, (h x w x d): 5.25 in x 19 in x 12 in (133 mm x 483 mm x 300 mm)
- Weight: 7 lb (3 kg)

**Bench-Mount Electronics**
- Dimensions, (h x w x d): 4.5 in x 9.5 in x 12 in (120 mm x 240 mm x 300 mm)
- Weight: 7 lb (3 kg)

**Panel-Mount Electronics**
- Dimensions, (h x w x d): 5.5 in x 10.5 in x 12 in (140 mm x 264 mm x 300 mm)
- Weight: 7 lb (3 kg)

**Weatherproof Electronics**
- Dimensions, (h x w x d): 13 in x 11 in x 7 in (330 mm x 280 mm x 170 mm)
- Weight: 15 lb (7 kg)

**Explosion-proof Electronics**
- Dimensions, (h x w x d): 18.3 in x 18.3 in x 10.4 in (465 mm x 465 mm x 255 mm)
- Weight: 103 lb (47 kg)

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# FGA 300 Specifications

## Other Options

- Remote logarithmic meter or linearized current output for basic model
- Aspirated sample extraction
- Automated or manual blow-back system for extreme conditions
- Customized systems for special applications including glass furnace and water washed system requirements. Please consult GE.

## European Compliance

Complies with EMC Directive 89/336/EEC, 73/23/EEC LVD (Installation Category II, Pollution Degree 2) and PED 97/23/EC for DN<25

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