

Gas Density

EXA GD402

Measure specific gravity and gas density reliably and accurately for control of refining and natural gas processes



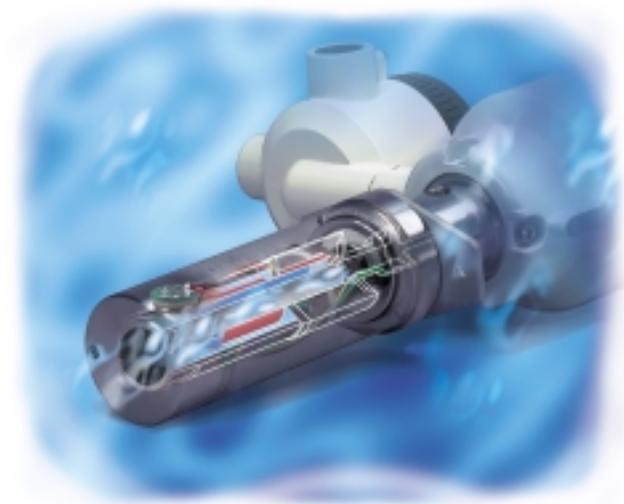
EXA GD402

Gas Density Analyzer

Yokogawa - the global leader in analytical technology has reached a new level of excellence with the **EXA-based GD402/GD40 Gas Density Analyzer**. It is a fast and accurate process gas measurement and control device that is unaffected by ambient temperature, vibration, or dust. It does not require reference gases or a constant temperature environment.

Simple operation, rock-solid performance and low maintenance are the standard for the GD402.

The heart of the GD402 is a unique sensor technology that directly measures the density of a gas flowing over an oscillating cylinder. Multi-frequency cylinder oscillation makes the GD402's measurement resistant to errors that can be caused by dust, oil, vibration and temperature changes. The **GD402** analyzer maintains $\pm 1\%$ FS accuracy and a response time (T90) of less than 5 seconds.

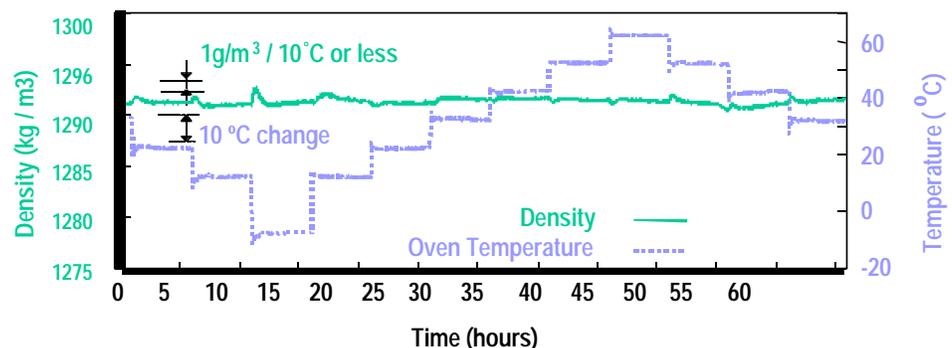


It is an ideal instrument for process control and consists of a detector (GD40) and converter (GD402) that continuously measures gas density. The instrument calculates specific gravity, molecular weight, percent concentration, and BTU content.

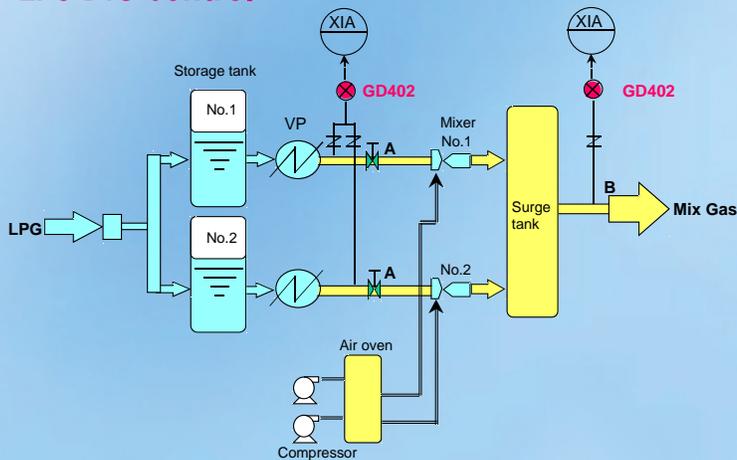
The GD40's immunity to water and oil misting and its measurement stability during extreme temperature swings ensure accurate performance. This has been proven under the most rigorous process conditions from South Texas, measuring the molecular weight of refinery off-gases, to measuring specific gravity of propane-air blending operations in Northern Nebraska.

Always a leader in primary measurement advancements, Yokogawa responds to the industry's need for cost-effective precision instrumentation. The **GD402's** fast, accurate, low-maintenance design, remote communications, self-diagnostic capabilities, and easy-to-use YES/NO programming provide a broad range of control options.

Control Output vs. Sudden Temperature Change



LPG BTU Control



LPG heating value control involves vaporizing LPG and mixing it with air to obtain a gas having the heat value of natural gas. The GD402 can be used to measure the heating value indirectly through a correlation between specific gravity and heating value. The relationship between SG and the heat value of air-PG mixture is well documented and can be used for process control.

Refinery Processes

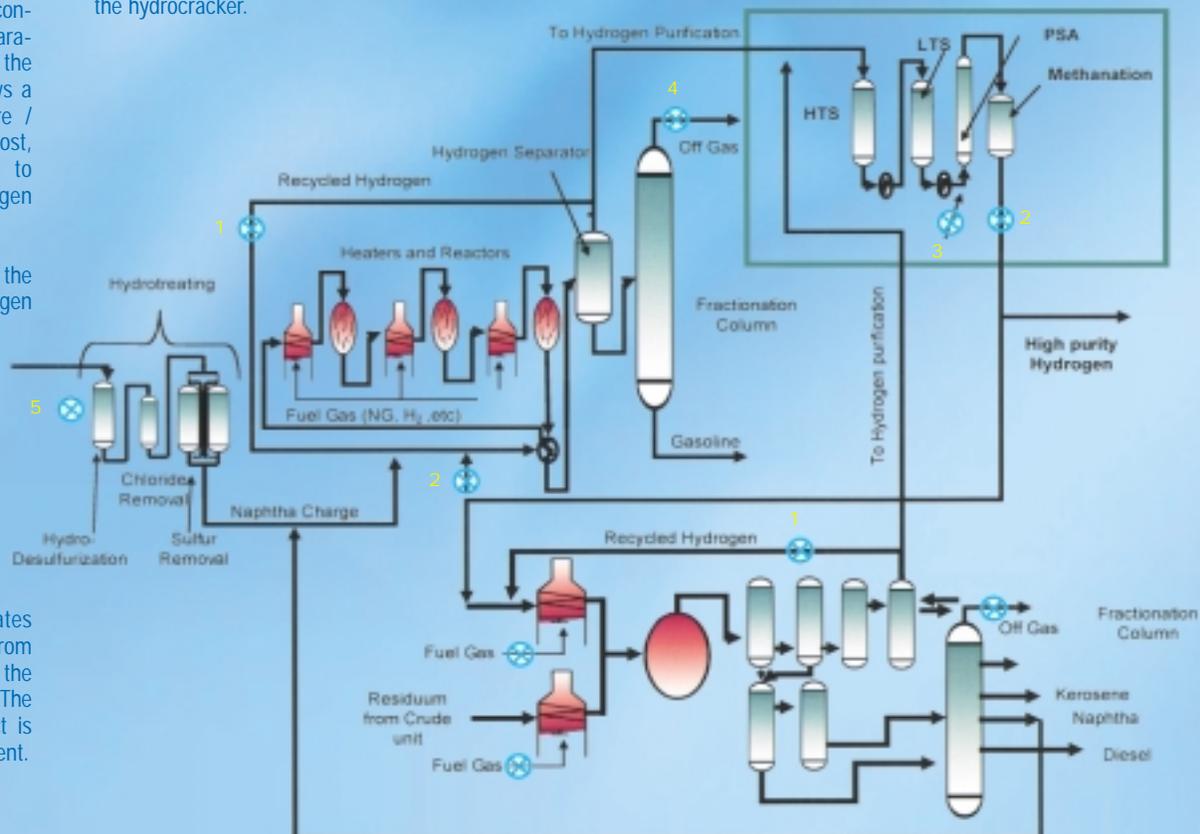
1 Recycled Hydrogen purity - The exit gas produced by a reformer or left after hydrocracking contains condensable hydrocarbons and ~75-90% H₂. Some of this mixture is recycled back to the process to minimize the use of virgin, pure hydrogen and to reduce cost. The purity of the exit hydrogen also represents conditions during production as the hydrogen purity will change as process conditions change, reaction catalysts are contaminated or gas / liquid separators are filled. Measurement of the recycled hydrogen purity allows a more efficient control of pure / recycled hydrogen and a low cost, LOW MAINTENANCE means to monitor real-time the hydrogen performance in the process.

2 Input Hydrogen Purity - In the case of (over the fence) hydrogen production. The supply of hydrogen is produced by alternate means, steam methane reforming, and partial oxidation of water (gasification) being the most common means. From a reformer or hydrocracker perspective there is value in knowing the hydrogen purity from the supplier. Checking for air in leakage or other contaminants could save money or lives. From the perspective of the over the fence hydrogen producer. The hydrogen purity of the product is clearly an important measurement.

3 Hydrogen purity before cleaning or separation- A gas purity measurement before and after the cleaning (absorption, membrane, cryogenics) or separation stage of hydrogen recycling can allow accurate determination of the efficacy of the cleaning stage. Contaminates in the post cleaning process stream indicate a change in the process (i.e. the separator is full, the membrane or catalyst is contaminated). This information is valuable in preventive maintenance schedules or in trouble shooting batch problems.

4 Off gas specific gravity measurements - The specific gravity of the off gas is monitored to determine hydrogen content. The s.g. value of the off gas shows hydrogen slip in the process.

5 Hydrotreating - Is the process of cleaning the process charge of sulfur and chlorine before the reforming or hydrocracking process. The hydrotreating process is carried out in the presence of hydrogen to saturate the cleaned hydrocarbons. Hydrogen is consumed during this process. Many of the same parameters exist for the hydrotreater as for the hydrocracker.



For more information, call 1-800-888-6400 and ask for Analytical Gas Products.

General Specifications

	Density kg/m ₃	Density lb/ft ₃	Specific Gravity	Molecular Weight MW	Concentration vol%
Range	0.6	0-0.4	0-5	0-140	0-100
Minimum Range	0.1	0.01	0.1	4	
Response Time 90%	approximately 5 seconds				
Linearity	± (0.001 + 1% of set range)	± (1x10 ⁻⁴ + 1% of set range)	± (0.001 + 1% of set range)	±1% of set range	±1
Repeatability	±0.001	±1x10 ⁻⁴	±0.001	±0.02	±0.5
Long Term Stability	±0.003/month	±2x10 ⁻⁴ /month	±0.003/month	±0.07/month	±0.5/month

Hydrogen Purging Standard Ranges

	H ₂ in Air vol%	H ₂ in CO ₂ vol%	Air in CO ₂ vol%
Range	85-100	0-100	0-100
Minimum Range			
Response Time 90%	approximately 5 seconds		
Linearity	±1	±1	±1
Repeatability	±0.5	±0.5	±0.5
Long Term Stability	±0.5/month	±0.5/month	±0.5/month

Calorie Specifications

Caloric Value MJ/m ₃	British Thermal Unit kBTU/ft ₃
0-130	0-3.5
8	0.25
approximately 5 seconds	
±1% of set range	±1% of set range
±0.040	±0.001
±0.1/month	±0.0025/month

Density is the basic measurement, all other representations are derived from the basic density data.

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