Precisive 5

Hydrocarbon Composition Analyzer

(Natural Gas, LNG, LPG, BOG, BioGas)

FEATURES

- Fast response (1second) control & optimization
- C1 – C5 alkane speciation, CO2, Wobbe & calorific value
- Flow-through analysis without the need for carrier-gas
- Remote, unattended, continuous on-line operation
- Eliminates carrier gases and other consumables
- Eliminates calibration gases and fuel gases
- Virtually zero cross-sensitivity, high sensitivity & linearity
- Upto 25 real-time MODBUS RTU output channels
- Wide linear range for calorific value (BTU) and Wobbe Index unlike inferential type analyzers

APPLICATIONS

- Natural gas analysis for extraction, distribution, storage, process & power
- BTU/CV & Wobbe Index measurement
- Power (GT/CCPP, fuel cell, IC engine)
- Process control (HPI & Petrochem)
- Sulphur Recovery (C1-C5, CO2, H2S)
- Flare stack & combustion control
- LNG/LPG/BOG and BioGas analysis
- Alternative to Gas Chromatography

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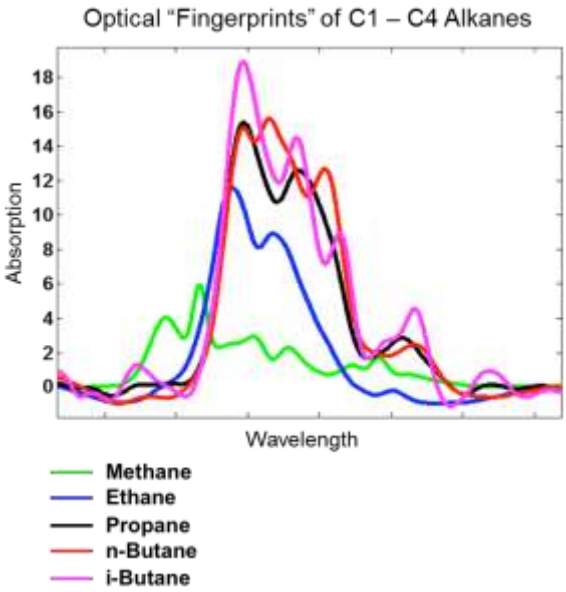

Description

The Precisive 5 Hydrocarbon Composition Analyzer is an infrared absorption based on-line monitoring system configured for measurement of alkanes: methane, ethane, propane, butanes and pentanes. A real-time optical analyzer capable of accurately separating the hydrocarbon components; which previously could only be performed by gas chromatograph (GC) analyzers.

Using a unique wavelength-sweeping tunable filter spectrometer, fast update rates down to sub-second intervals are performed for the full C1 through C5 analysis. Sampling is a flow-through type, suitable for a continuous, on-line, unattended operation. The analyzer does not require carrier gas, fuel gases, or on-site calibration gases. Contact Precisive for specific requirements, compounds and ranges.

Precisive 5 Hydrocarbon Composition Analyzer Specifications

Permanent Span Stability of the Precisive Gas Analyzer

Precisive's Tunable Filter Spectroscopy (TFS) based hydrocarbon analyzer is specified to have a "permanent" lifetime span calibration under normal or specified operating conditions.. However, the customer may periodically validate the span accuracy as well as modify the span factors as desired or required.

The analyzer is specified to have less than 0.2% of full scale of baseline drift per month. The customer can easily perform re-zeroing of the analyzer by purging it with clean air or nitrogen and sending a "zero" command through the software interface. Re-zeroing can be done automatically by using solenoids for stream switching.

Factors Resulting in Permanent Span Stability (ie no requirement for recalibration)

1. Precisive's TFS is non-contact in nature, therefore there is no sensor "poisoning" that could affect span stability or sensor responsivity.
2. Unlike "relative" sensing technologies such as gas chromatography, Precisive's TFS is based on direct, "first-principle" measurement. It is based on light absorption spectroscopy where signal corresponds directly to the amount of gas molecules in the sample cell. Refer to *Note A* below.
3. Precisive's TFS analyzers compensate for gas pressure variations in real-time and controls the gas temperature, the only two parameters that could affect span stability (see *Note B*)
4. Precisive's spectroscopic engine captures the true sample spectrum containing the "peaks and valleys" every scan, enabling measurement accuracy that is insensitive to light source drift, detector drift and other electronic drift.

Note A

The Precisive TFS measurement platform is based on light absorption spectroscopy, where the absorption magnitude is proportional to the amount of the sample gas molecules, path length and the absorption coefficient, as described by the equation below:

$a=\varepsilon n l$, where

a is the absorption magnitude
ε is the absorption coefficient of the sample gas
n is the number of moles of the sample gas contained in the sample cell
l is the path length

ε is a constant for a given sample compound for a certain wavelength, and *l* is a constant for a given instrument. The only variable is *n*, the number of moles of the sample gas, which is what is being measured.

Note B

Considering ideal gas law, the following show the parameters that could affect the *n*, the number of molecules of the sample gas.

$PV=nRT$, where

P is the pressure of the gas in the sample cell	*[measured and compensated for]*
V is the volume of the sample gas	*[constant by design]*
n is the number of moles of the sample gas	*[measurement variable]*
R is the ideal gas constant	*[constant]*
T is the temperature of the sample gas	*[controlled by design]*

The only two variables that could cause span drifts are the sample pressure and temperature variations. In Precisive analyzers, the sample pressure is continuously measured in real time and compensated for in the concentration calculation. Similarly, sample temperature is maintained at a set temperature (nominally 60^0C) through the use of a heated gas cell and an integrated pre-heat line. Provided that the sample flow rate and temperature are within specification, the sample is maintained at the set temperature during measurement.

Precisive 5 Hydrocarbon Composition Analyzer Specifications

Example Calibrations and Matrices for the Precisive Gas Analyzer

The following table summarizes some of the permanent calibrations available on the Precisive Gas Analyzer. Please contact Precisive for specific compositions, ranges, and sample conditions.

Compound	Formula	Recipe 142	Recipe 143	Recipe 153	Recipe 154
Methane	CH_4	✔	✔	✔	✔
Ethane	C_2H_6	✔	✔	✔	✔
Propane	C_3H_8	✔	✔	✔	✔
iso-Butane	iC_4H_{10}	✔	✔	✔	✔
normal-Butane	nC_4H_{10}	✔	✔	✔	✔
Pentanes (normal, neo, iso)	C_5H_{12} lumped	✔		✔	
Propylene	C_3H_6		✔		✔
Ethylene	C_2H_4		✔		✔
Carbon Dioxide	CO_2	✔	✔	✔	✔
Acetylene	C_2H_2				✔
iso-Pentane	Iso-C_5H_{12}				✔
Hydrogen Sulfide	H_2S			✔	
1-Butene	1-C_4H_8				✔
cis-2-Butene	Cis-2-C_4H_8				✔
trans-2-Butene	Trans-2-C_4H_8				✔
isobutylene	2-methylpropene				✔
1,3 Butadiene	C_4H_6				tbd
BTU calorific value	ISO 6976	✔		✔	
Wobbe Index		✔		✔	
* request others					

Precisive's TFS gas analyzers are designed to be robust and accurate, requiring low maintenance. Span recalibration is a time-consuming and expensive procedure requiring high-quality certified calibration cylinders and their required infrastructure and maintenance. Precisive TFS analyzers eliminate the need for span recalibration through its inherent first-principle methodology and its instrumentation design that systematically manages sample uncertainties and variations.

The Precisive analyzers are calibrated at the factory using NIST traceable gas mixtures with gravimetric validation. The Precisive-factory calibration maintains its accuracy throughout the life of the analyzer.

The customer is free to perform re-spanning or "recalibration" as they see fit as per their process. They may use their own trusted certified mixture(s) and perform the re-spanning as often as their process calls.

Many of our customers do not like to validate our first-principles direct-measurement technology by comparing with a GC. The GC itself may be inaccurate or inconsistent given it is a relative method to the calibration itself. The most common approach is to use high-quality certified mixtures, much like what Precisive uses at the factory to calibrate the analyzer in the first place.

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Precisive 5 Hydrocarbon Composition Analyzer Specifications (-142 Configuration)

Measurement

Standard Natural Gas Analyzer with recipe 142 *	Methane, Ethane, Propane, n-Butane, iso-Butane, C5 (lumped), CO2 (0-100%)
Precision / Repeatability *	< +/- 0.05% (repeatability based upon 5-second averaging)
Accuracy *	Methane (80-100%): +/- 0.2%, Methane (0 – 80%): +/- 0.5% Ethane & Propane: +/- 0.2% iso & n-Butane: +/- 0.1% Pentanes: +/- 0.2% CO2: +/- 0.2%
Zero drift	Less than ±0.2% (absolute) per month (zero on air or N_2)
Span calibration	Factory calibrated (permanent calibration)
Update rate	5 seconds (default) or 1sec-300sec software configurable (averaging time improves precision)
Additional channel(s)	Contact Precisive for additional target gases

Sampling

Technique	Flow through
Flow rate	0.1 – 1 SLPM (up to 15 SLPM available upon request)
Pressure*	0 – 5 psig (up top 100 psia available upon request)
Sample temperature	0 – 50^{o} C
IMACbvba	¼" Swagelok^{TM} fittings

Compliance & Certifications

North America Div System	Class 1, Division 2, Groups A/B/C/D, T4, Type NEMA 4X
North America Zone System	Class 1, Zone 2, Aen nA IIC T4, IP66. Ex nA IIC T4, IP66
European Zone System	CE EX II 3G n IIC T4 Gc (ATEX Zone 2)

Installation

Mechanical dimensions	17" wall-mountable enclosure, 11" high, 6" deep
Weight	25.8 lbs (11.7 kg)
Power requirements	24VDC or 110-250VAC
Operating temperature	-20 ^{o}C – 50^{o}C
Output interface*	Modbus RTU over TCP/IP or RS-422

* Typical values. Contact IMAC for other specifications, recipes, or values

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