Fast Response BTU Analyzer
COSA 9610™

COSA INSTRUMENT

APPLICATIONS

- Turbine Control
- Flare Stack Control
- Fuel Optimization
- Gas Blending
- Custody Transfer
- Hyco Plant Control
- Hydrogen Applications
- Air Blending Applications

FEATURES

- High Accuracy
- Fast Response
- Large Measurement Range
- Measures Low BTU Gases
- Low Maintenance
- Flameless / No Flameouts
- Measures Wobbe and CARI
- CSA Approval Optional
- Direct Measurement Method (ASTM D-4891 Compliant)
- Gross or Net Heating Values

The NEW Cosa9610™ Provides a Fast and Accurate Measurement of Wobbe Index, Heating Value and Combustion Air Requirement Index (CARI).

New updates to the Cosa9610™ have expanded capabilities that include total sulfur measurement, data storage of measured values and remote access, higher sample system temperatures, and more stream switching capabilities than other calorimeters.

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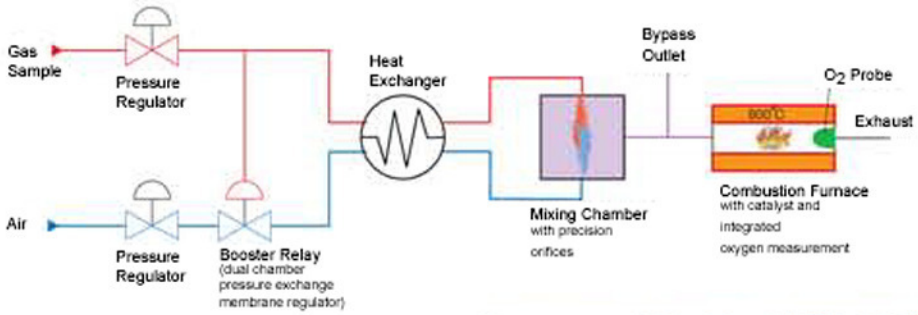
MEASUREMENT PRINCIPLE (RESIDUAL OXYGEN MEASUREMENT)

The COSA 9610™ BTU Analyzer's measuring principle is based on the analysis of the oxygen content in the flue gas after combustion of the sample. A continuous gas sample is mixed with dry air at a precisely maintained constant ratio, which depends on the BTU range of the gas to be measured. The fuel air mixture is oxidized in a combustion furnace in the presence of a catalyst at 800 °C, and the oxygen concentration of the combusted sample is measured by a zirconia oxide cell. The residual oxygen provides an accurate measurement for the Combustion Air Requirement of the sample gas, which can be correlated accurately to the Wobbe Index of the gas.



Measurement Principle of COSA 9610™

Pressure and temperature of gas sample and instrument air are equalized by means of pre-regulators, a dual chamber pressure exchange membrane regulator (booster relays) and a heat exchanger. The two streams then pass through precision orifices operating at super-critical stage into a mixing chamber. Orifice sizes in the mixing chamber, which are selected based on desired BTU range, precisely maintain a constant fuel-air ratio. The air-gas mixture then enters a combustion chamber where the fuel is oxidized at 800 °C in the presence of a catalyst. A zirconia oxide cell measures the residual oxygen concentration.

ADVANTAGES

Key advantages of this method are its insensitivity to changes in ambient temperature, a very fast response with the ability to measure gases with BTU values down to zero and the measurement of the Combustion Air Requirement Index besides Wobbe Index and Heating Value.

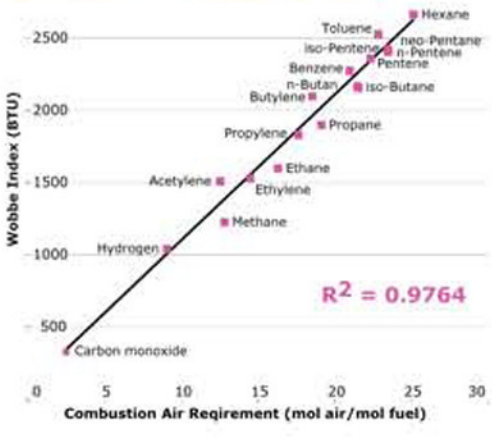
WOBBE INDEX VS. COMBUSTION AIR REQUIREMENT INDEX

The COSA 9610™ provides a direct measurement of the Combustion Air Requirement Index (CARI) of a fuel, which is ideally suited for the precise control of the fuel-air ratio of a combustion process.

In applications where the amount of energy introduced to the burner is to be controlled, the Wobbe Index can be closely correlated to the CARI Index and differences between the two measurements can be cancelled out by

Correlation Between Wobbe Index and Combustion Air Requirement

	Combustion Air Requirement (mol/mol)	Wobbe Index (BTU)
CARBON MONOXIDE (CO)	2.427	326.9
HYDROGEN (H_2)	9.048	1041
ACETYLENE (C_2H_2)	12.52	1509.1
METHANE (CH_4)	12.787	1226.1
ETHYLENE (C_2H_4)	14.475	1532
ETHANE (C_2H_6)	16.292	1599.1
PROPYLENE (C_3H_6)	17.638	1830.7
BUTYLENE (C_4H_8)	18.541	2098.8
PROPANE (C_3H_8)	19.126	1899.5
BENZENE (C_6H_6)	20.966	2275.2
N-BUTANE (n-C_4H_{10})	21.487	2167.7
ISO-BUTANE (i-C_4H_{10})	21.527	2156.9
PENTENE (C_5H_{10})	22.34	2360
TOLUENE (C_7H_8)	22.839	2528.6
N-PENTANE (n-C_5H_{12})	23.45	2425.2
NEO-PENTANE (neo-C_5H_{12})	23.48	2406.4
ISO-PENTANE (i-C_5H_{12})	23.509	2413.2
HEXANE (C_6H_{14})	25.161	2663.6



The table and graph above show the relationship of Wobbe Index and the Stochiometric Dry Air Requirement for some typical gas constituents. The correlation is close to linear (R^2=0.9767) with an intercept close to zero. The residual oxygen method takes advantage of this correlation by linear extrapolation between measurements of known calibration gases. R^2 for typical natural gas constituents plus hydrogen and CO is 0.9888.

the use of suitable calibration gases. In natural gas applications the instrument accuracy of the COSA 9610™ in terms of Wobbe Index is better than +/- 0.4% of reading. In flare gas applications, accuracy can be maintained within +/- 3%, even when hydrogen concentrations in the sample vary between 0% and 100%.

The stability, accuracy, speed of response, and reliability of the residual oxygen measurement represent significant advantages over traditional flame calorimeters and more than compensate for the small theoretical error in calculating Wobbe. It should be noted, that other calorimeters including flame type are not primary standards either, and they also depend on the use of suitable calibration gases.

HEATING VALUE

For applications requiring the measurement of the Heating Value, a precision specific gravity cell with an accuracy of +/- 1% of reading is integrated into the COSA 9610™, and the processor computes the heating value. In applications, where the fuel-air ratio is to be optimized based on the CARI, the measurement of specific gravity is not required.

ANALYZER CONSTRUCTION

The COSA 9610™ is housed in a painted stainless steel NEMA4X (IP65) cabinet with the dimensions 41" x 41" x 16" suitable for outdoor installations without additional temperature controlled shelter. For extreme climate conditions, the standard operating temperature range of the COSA 9610™ can be extended with the addition of a cabinet heater and/or vortex cooler. The cabinet is suitable for wall mounting or rack mounting.

The analyzer cabinet has three compartments: the gas mixing compartment, the combustion furnace compartment and the electronics compartments.

The gas mixing compartment contains sample condition and the gas mixing system. Components in this compartment are intrinsically safe. The gas mixing compartment can optionally be heated to avoid condensation of heavier gas constituents.

The electronics compartment contains the industrial PC based controller, which performs all instrument control functions and calculations. Results are available through isolated analog outputs and an LCD, which is visible through a cabinet window and displays residual O_2 in %, Cell volatage in mV, Wobbe-Index and Calorific Heating Value (optionally) in BTU/SCF or MJ/Nm3, relative density (optional), and CARI (Combustion Air Requirement Index).

The combustion furnace compartment contains the combustion furnace with the zirconia oxide sensor. The exhaust gas is vented and drained. The electronics compartment and combustion furnace compartment can optionally be purged for Class 1 Div 2 or Class 1 Div 1 applications.

The purge panel is mounted at the underside of the enclosure.

MAINTENANCE

The COSA 9610™ has no moving parts and consequently, maintenance requirements are low. With the use of proper sample conditioning, the COSA 9610™ can operate unattended for several months. All compartments are easily accessible through seperate doors on the front side of the enclosure.

SPECIFICATIONS

Analyzer Performance

Model: ..... COSA 9610™

Sample gas:..... Natural gas, fuel gas, refinery gases, biogas etc.

Ranges ..... Wobbe Index: 0-3000 BTU/SCF, span 1150 BTU/SCF (selectable)
CARI Index: 0-20, span 0-10

Accuracy (Wobbe): ..... ±0.4% of reading for natural gas
±2.0% of reading for refinery gases with large variations of constituents and BTU values

Repeatability..... ±0.7 BTU/SCF

Drift..... 0.4 BTU/SCF/24 hours

Response time ..... T90 ≤ 5 seconds (Wobbe)

Ambient temperature..... :Standard: 10-40° C
50-104°F
Extended range: -40°C to +50°C
-40°F to +122°F

Outputs..... 2 x isolated 4-20mA, with programmable span
Backlit LCD screen
Malfunction relay
RS-485 MODBUS RTU (option)
Analog Outputs: 2 standard isolated 4-20mA with programmable span: Wobbe, Calorific Value CARI, plus 2 additional outputs available
Relay Contacts: up to 9 channels (digital)

Specific Gravity (optional) ... Range: ..... 0.07 - 3 rD
Accuracy: ..... ±0.1% of reading

Utilities:

Power supply..... 110 VAC, 50/60 Hz or 220 VAC/50 Hz

Amps..... 8-16 amps Option Dependent

Power consumption ..... 430 VA typical

Instrument air ..... 20 SCFH (analyzer) at 42 PSIG
40 SCFH (z-purge) at 80 PSIG

Sample ..... 2 SCFH at 28 PSIG

Installation:

Mounting ..... Wall mounting

Dimensions..... 40.82" x 40.82" x 16.33" (1000 x 1000 x 400 mm)

Measured Gas Streams:

1 stream standard
2 stream optional
4 stream optional

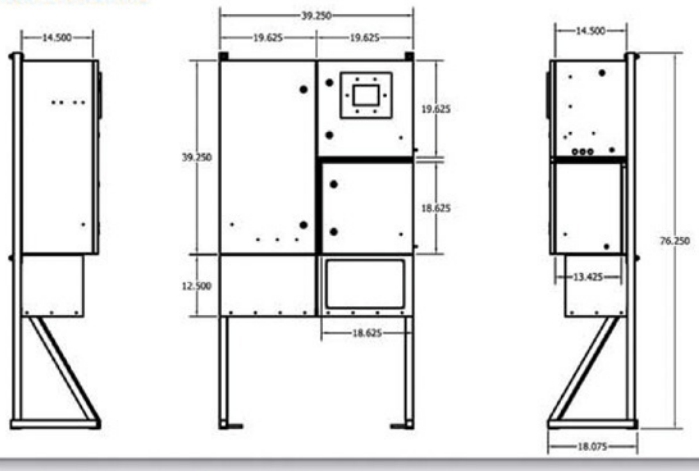
Sample System:

50°C (122°F) standard, for most applications.
100°C (239°F) optional, for hydrocarbons or components with a high dew point
Optional Hastelloy® and Kalrez® sample system component materials

Certifications:

CSA Approval Optional
ATEX - 2010

DIMENSIONS



NEW FOR 2009

- **Redesigned HMI software (human machine interface)**
- **Optional remote data storage retrieval**
- **Optional 4th Measured Gas Stream**
- **Optional Total Sulfur Measurement from ppm to 100%**

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