TRUSTED TOTAL SULFUR MEASUREMENT BY APPLIED ANALYTICS

TSA-100

Total Sulfur Analyzers

Three Distinct Solutions:

- **TSA-100G** for a gaseous stream with various, potentially unkown sulfur compounds
- **TSA-100L** for a liquid stream with various, potentially unkown sulfur compounds
- **TSA-100 Total Sulfur Direct** for a liquid or gaseous stream that contains only known sulfur compounds such as H_2S, SO_2, COS, and R-SH (mercaptans)

The TSA-100 series is designed to monitor total sulfur content in hydrocarbon fuels. This need for online measurement is motivated by anti-pollution regulations targeting SO_2 emissions as well as concerns about the destructive effect that hydrogen sulfide and other sulfur compounds have on equipment and distribution pipelines.

This system comes in three formats. The TSA-100G (for gaseous process streams) and the TSA-100L (for liquid process streams) both use controlled sample combustion in order to convert all sulfur compounds present in the sample to SO_2 and correlate resultant SO_2 concentration to real-time total sulfur. This failsafe method is aimed at streams with unknown composition; for simpler streams with known sulfur contaminants, AAI often recommends the multi-component TSA-100 Total Sulfur Direct.

Three Distinct Total Sulfur Solutions

SCENARIO ONE: Your process is gaseous, and contains various, potentially unknown sulfur compounds.

Meet the **TSA-100G Total Sulfur Analyzer** for gaseous streams.

TSA-100G Total Sulfur Analyzer (gaseous process)

Sulfur content in natural gas is an oft-cited parameter for improving product quality, distribution networks, and pollution control. These sulfur compounds carry with them a host of concerns energy producers, as they are known to cause gas pipeline corrosion, reduce the quality of sales gas, contribute directly to emissions of SO_2 (a widely regulated pollutant), and cause intolerable odor.

Avoiding these sulfur-related issues requires reliable online monitoring of total sulfur content in gaseous hydrocarbon streams. The common, antiquated method of measurement in industry today is lead acetate tape, on which H_2S forms color spots of precipitate. This technique requires continual tape replacement, hands-on sample dilution, leak maintenance, and proper disposal of the toxic consumables.

Blazing a path through an era of obselete sulfur detection methods, the solid state TSA-100G uses UV-VIS diode array detection for automated, real-time total sulfur analysis. This complete solution utilizes two mass flow controllers and an industrial pyrolyzer to combust all sulfur compounds (including exotic or unknown chemicals) in the stream sample into SO_2. The oxidized sample is then fed into the flow cell, where SO_2 concentration is continuously measured by detecting its UV absorbance. This value is correlated directly to the total concentration of sulfur compounds in the stream.

SCENARIO TWO: Your process is liquid, and contains various, potentially unknown sulfur compounds.

Meet the **TSA-100L Total Sulfur Analyzer** for liquid streams.

TSA-100L Total Sulfur Analyzer (liquid process)

The allowable sulfur content in diesel and other liquid fuels is dropping steadily with pressure from myriad governments and interest groups. In the USA, for example, the EPA mandated a complete crossover to ULSD (ultra-low sulfur diesel) which is legally defined as containing under 15 ppm sulfur. The environmental premise for such regulations is that the combustion of incident sulfur emits significant SO_2, a dangerous pollutant. Furthermore, automakers lobby for lower limits because sulfur-rich fuels inhibit catalytic converters, forcing target emissions like NO_x and CO to compete with sulfur for catalyst exposure.

Diesel producers are thus faced with verifying total sulfur contenet in liquid hydrocarbon streams; as limits grow more stringent, the need for accurate analysis down to parts per billion becomes more pronounced.

The solid state TSA-100L takes the pain out of compliance, smoothly monitoring total sulfur compounds in diesel down to trace levels. This system prepares a sample with precise fuel:air ratio and gasifies the resulting mixture by heating the mixing chamber. This gaseous sample is then fed into a pyrolyzer which combusts all present sulfur compounds to SO_2. Due to the oxygen demand of diesel combustion, the resultant sample is highly diluted and requires lower detection limits; the TSA-100L measures the UV fluorescence of SO_2 and correlates the concentration to real-time total sulfur content.

SCENARIO THREE: Your process is either liquid or gaseous, and contains only known sulfur compounds such as hydrogen sulfide (H_2S), sulfur dioxide (SO_2), carbonyl sulfide (COS), and mercaptans (R-SH group).

Meet the **TSA-100 Total Sulfur Direct** for gaseous/liquid streams.

TSA-100 Total Sulfur Direct

In a process stream with unknown and possibly exotic sulfur-based compounds, the only reliable analysis method is to convert all of these chemicals to SO_2 and measure the resultant concentration. This solution is highly effective but requires controlled sample combustion (as in the TSA-100's); for streams with relatively simple composition, it may be overkill.

That's when the TSA-100 Total Sulfur Direct comes in to play. Using powerful nova-II UV-VIS diode array detection, this system monitors up to five distinct stream chemicals simultaneously. With the unique ability to measure the concentrations of multiple compounds in the same UV wavelength range without any cross-interference whatsoever, the TSA-100-TSD excels in the scenario where a process stream contains only known sulfur compounds (such as H_2S, SO_2, COS, and R-SH). If your process stream fits these criteria, the TSA-100 might be an overly robust solution. The TSA-100-TSD provides elegant analysis with minimal sample conditioning in a highly cost-effective package.

NOTE: This system is a re-configuration of AAI's flagship OMA-300 Hydrogen Sulfide Analyzer. For specs, please refer to the brochure for the OMA-300-H2S, available at our website. To view an animated demo of how this system performs Multi-Component Analysis, please visit:
http://www.a-a-inc.com/multi-component/

SPECIFICATIONS

**NOTE: the specifications below pertain to the TSA-100G/L. For technical data about the TSA-100 Total Sulfur Direct, please consult the specifications on the last page of the OMA-300-H2S Hydrogen Sulfide Analyzer brochure.

Measurement Technology	TSA-100G: UV-VIS diode array spectrophotometer (nova-II) TSA-100L: UV fluorescence detector
Sample Introduction	TSA-100G: Sampling controlled by standard TSA-100G SCS TSA-100L: Sampling controlled by standard TSA-100L SCS
TSA-100G Accuracy	0-10 ppm: ±1 ppm 0-100 ppm: ±1% of measurement, full scale
TSA-100L Accuracy	0-10 ppm: ±1 ppm 0-100 ppm: ±1% of measurement, full scale
Calibration	Factory calibrated with certified calibration gases/liquids
Verification	Easy verification/validation with gas/liquid samples or neutral density filters
Ambient Temperature	Standard: 0 to 55 °C (32 to 131 °F) Optional: -20 to 55 °C (-4 to 131 °F)
Sample Temperature	In situ probe: -20 to 200 °C (-4 to 392 °F) Flow-through cell: -20 to 150 °C (-4 to 302 °F)
Sample Pressure	Flow-through cell: 206 bar (3000 psi)
Environment	Indoor/outdoor (no shelter required)
Size	Analyzer: 24" H x 20" W x 8" D (610mm H x 508mm W x 203mm D) Optional sampling system: 24" H x 30" W x 8" D (610mm H x 760mm W x 200mm D)
Weight	32 lbs. (15 kg)
Wetted Materials	Analyzer: Teflon, K7 glass, Kalrez, Hastelloy C-276 Optional sampling system: Teflon, quartz, Kalrez, Hastelloy C-276
Outputs	One galvanically isolated 4-20mA output per component; modbus TCP/IP (optional); RS232 (optional); Fieldbus, Profibus, and HART (all optional); two digital outputs for fault and sampling system control (user programmable)
Electrical Requirements	85 to 264 VAC 47 to 63 Hz
Power Consumption	45 watts
Area Classification	General Purpose (standard) / Class I, Div. 2 (optional) Class I, Div. 1 (optional) / ATEX Exp II 2(2) GD (optional)

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