# Model 6400TSG Total Sulfur System





- > Meets technical requirements of ASTM D6667
- > Total sulfur detection in fuel gas and in hydrogen
  - > Minimum: 0-1 ppm TS in Hydrogen





### **Series Overview**

TAI Model 6400TSG utilizes a field-proven ultraviolet fluorescence (UVF) detector to continuously monitor the Total Sulfur content found in process gas. UVF method of total sulfur measurement is a non-reagent consuming analysis method of sulfur species, eliminating the hassles associated with replacing operational consumable cartridges, and enables stable, reproducible, ppb level of lower detection limit in process gas applications.

The undesirable sulfur compounds present (i.e.  $H_2S$ , DMS, COS,  $CH_3SH$ ,  $CS_2$ , etc.) are converted into sulfur dioxide ( $SO_2$ ) under precisely controlled temperature and flow conditions.

# $SO_2 + hv^1 - SO_2^* - SO_2 + hv^2$

When  $SO_2$  is exposed to UV light energy, hv1, it creates an "excited" form of sulfur dioxide ( $SO_2^*$ ). A molecule in a high, vibrational level of the excited state,  $SO_2^*$ , will quickly fall to its lowest vibrational level by losing energy to other molecules through collision. Fluorescence occurs when the molecule returns to its electronic ground state. The intensity of the emitted light, hv<sup>2</sup>, is directly proportional to the total sulfur content found in the sample.



## Model 6400TSG Converter

Model 6400TSG uses a direct flame combustion converter module (FCCM), that fully converts the sulfur compounds. The FCCM approach is best suited for gas phase application for fuel gas, natural gas, hydrogen gas, and  $CO_2$  with flammable gas mixture. The 6400TSG does not use any gas chromatograph columns, thus providing a true continuous, real time analysis of total sulfur regardless of sulfur speciation. Carrier gas or GSV (gas switching valves) are not required for operation of 6400TSG – total sulfur analyzer.

# **Communication & Diagnostic Links**

Unlike conventional  $H_2S$  fuel gas analyzer, the 6400TSG is a single stream, continuous, online process gas analyzer without the need to use carrier gas or switching out lead acetate tape. Equipped with the conventional 4-20mA output as well as various discrete alarms, the system allows user to maintain an real time measurement of sulfur concentration in process gas.

#### **Key Product Features and Advantages**

- Continuous and online Total Sulfur measurement for fuel gas and CCUS type applications.
- Real time sulfur conversion with flame combustion converter module.
- Can support up to 500 ppm of total sulfur in fuel gases for process safety monitoring
- Excellent linearity, high sensitivity for most gas phase application
- Built-in diagnostic capability for routine and advance troubleshooting
- · Easy-access front door, wall mount with NEMA rated enclosure
- Sulfur Inert and Teflon wetted parts for low range systems
- Optional heated sample conditioning systems for process stream with high dew points
- Versatile to tackle most challenging sulfur applications
- Design meets ASTM D-6667 test method for sulfur measurements with UV Fluorescence detector.

# **Total Sulfur Application**

#### Steam Methane Reformer (SMR)

Hydrocarbon feed-stocks are routinely passed over expensive catalysts for conversion purposes. Undesirable sulfur compounds present in the feed stream can serve to poison the catalyst and reduce its conversion potential. By continuously detecting the total sulfur content present on the inlet and outlet of a sulfur scrubber, the operator can gain an early warning of an upset or break-through condition and take preventative steps that will serve to persevere the catalyst life and increase product yields.



#### **Refinery Fuel and Flare Gases**

Stricter environmental regulations have led to an increased demand to continuously monitor total sulfur content found in refinery fuel gases, hydrogen recycled gas streams, reusable natural gas, flare vent gases (Rule 1118)

#### Hydrogen Fuel Analysis:

Hydrogen is becoming a valuable green energy source due to its high calorific value and net zero emission capability. It is produced from many sources, such as natural gas, bio-gas, coal or water electrolysis. Measuring total sulfur in hydrogen ensures that corrosive impurities do not contaminate hydrogen products in transportation, storage and usage.



Natural gas processing plants are used to purify the raw natural gas extracted from underground gas fields. After removal of liquid water and condensates, acid gases like hydrogen sulfide ( $H_2S$ ) and carbon dioxide ( $CO_2$ ), are typically removed by an amine scrubber. Continuous detection of  $H_2S$  is conducted before and after the acid gas removal process to ensure proper operation of the purification process. Monitoring of the incoming gas to the plant to assess corrosion of the pipeline is also commonly done to ensure pipeline integrity.





#### Carbon Capture, Utilization and Storage (CCUS)

Carbon Dioxide  $(CO_2)$ , a well known green house gas, is a byproduct of hydrogen gas production in a refinery. To reach net zero emission goals, industrial plants are tasked to use advanced process techniques to remove  $CO_2$  from waste gas, and utilize the captured  $CO_2$  in the most commercially and environmentally friendly way. The untreated captured  $CO_2$ contains all types of industrial waste gases and flammable residual gases that require additional purification. Total sulfur is a critical process quality measurement to ensure the integrity of the  $CO_2$  purification process and final product safety, before purposed for utilization or storage.



<b>Detection Method</b>	UV-Fluorescence
Converter Method	Flame Combustion Converter Module (FCCM)
Analysis	Continuous
Compliance	Designed to meet requirements of ASTM D6667
Range	Min: 0-1 ppm* Total Sulfur Max: 0-500 ppm Total Sulfur Single Range, factory preset and calibrated *for 100% Hydrogen only, minimum range for non-H2 services is 0-10 ppm TS
Repeatability	± 2% of full scale
Response Time	90% of full scale in less than 100 seconds
Temperature	41° to 104°F (5° to 40°C)
Zero/Span Noise	Less than 1% of full scale
Zero/Span Drift	2% of full scale per week
Alarms	One system alarm and two concentration alarms Form-C relays rated at 3A 125VAC
Supply Voltage	110 or 220 VAC, 50/60 Hz
Power Consumption	500W
Outputs	4-20 mADC (isolated)
Load Impedance	500 ohms
Flow Rate	10 SCFH (5 LPM) standard
Utility Gases	Air (Converter):UHP Grade, 40 psig, 1 LPM, Sulfur FreeAir (Drier):25 psig, 3 LPM, -40°C dew pointHydrogen:UHP Grade, 40 psig, 30 ccm, Sulfur FreeNitrogen or Air (Purge):Plant grade, 40 psigZero and Span calibration gases
Dimensions	36.0"W x 62.7"H x 12.0"D (91.4 x 159.26 x 30.48 cm)
Area Classification	IECEx:Ex px IIC T3 GbATEX: $\langle \widehat{Ex} \rangle$ II 2 G Ex px IIC T3 Gb $-20^{\circ}C \leq Ta \leq 40^{\circ}C$



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