Application Note: PI2027.0407

The Thermo Scientific SOLA II — Field Sulfur Analyzer for Clean Fuels Distribution

Key Words

- Pipelines
- Environmental Regulations
- Sulfur Analyses
- 24 hours a day, 7 days a week
- Sulfur Concentration
- Field Sulfur Analyzer
- ASTM D5453
- ISO 20846

Introduction

Refined product pipelines and terminals play a major role in the distribution of motor fuels. Many pipelines use a common system to distribute a wide variety of refined products with dramatically different sulfur content. Environmental regulations make it necessary for product pipeline and terminal operators to deliver ultra low sulfur motor fuels to the market. These operators use sulfur analyses to:

- Determine sulfur content of fuels entering the pipeline system.
- Enable rapid corrective action through identification of sulfur contamination sources.
- Prevent downgrading of valuable ultra low sulfur fuels by enabling fuel blending.

Unique features of the SOLA II field sulfur analyzer system are:

- At-line capability for grab sample analyses by non-laboratory personnel
- Rapid initial response time (< 60 seconds) for the online mode
- Automated wireless diagnostics to ensure maximum on-stream time.

Online Sulfur Analysis with the SOLA II

When operating in the online mode, the Thermo Scientific SOLA II automatically samples the pipeline 24 hours a day, 7 days a week. The SOLA II field analyzer provides initial response to changes in sulfur concentration in 60 seconds or less. The turnkey SOLA II field analyzer system comes complete with all sample conditioning accessories necessary for sample transport and filtration. Sulfur data may be communicated to your control system by traditional 4-20 mA signals and/or Modbus. Correction of ppm S (w/w) for changes in product gravity is accomplished by a 4-20 mA input from a field gravitometer. A gravitometer can be supplied as part of the turnkey SOLA II field sulfur analyzer system.

figure 1 — Thermo Scientific SOLA II

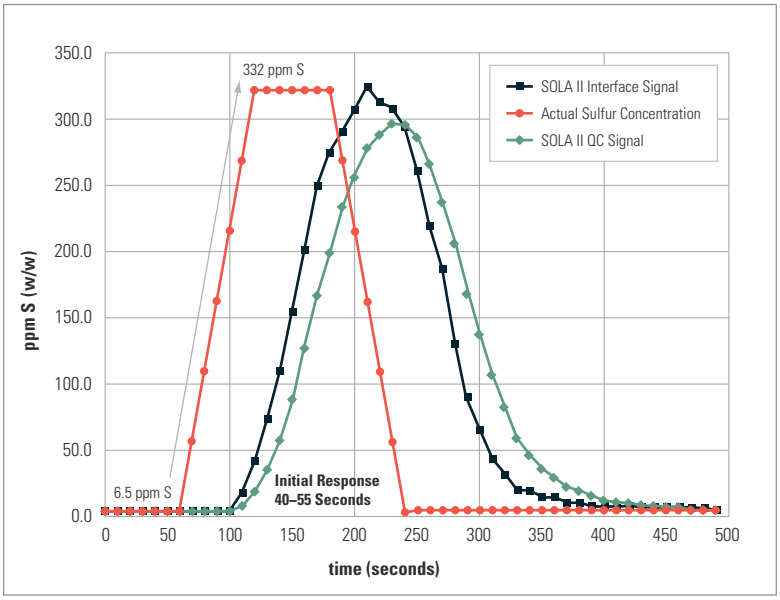

figure 2 – Online analysis with the SOLA II, response to simulated "slug" of sulfur contamination

At-Line Sulfur Analysis with the SOLA II

At-line sulfur analysis takes laboratory analysis to the field. The SOLA II is an industrialized field sulfur analyzer intended for use by non-laboratory personnel. When configured for at-line sulfur analyses, the SOLA II provides a simple straightforward means of determining grab sample sulfur content. The at-line sulfur

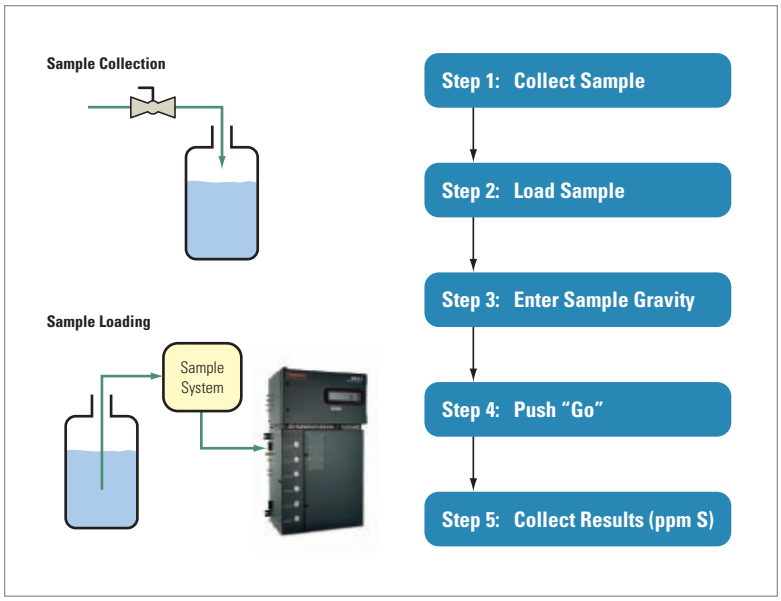

figure 3 – At-line sulfur analysis with the SOLA II

analysis is accomplished in five easy steps. All sample preparation is fully automated. Loading of vials, syringes or sample cups is not necessary. Onboard statistical analyses check the validity of each analysis to ensure accuracy. Pipeline and terminal operators use the SOLA II field analyzer to quickly and confidently check the sulfur content of any fuel sample.

SOLA II Principle of Operation

The SOLA II employs pulsed ultraviolet spectrometry (PUVF) for determination of total sulfur. To determine the total sulfur content of hydrocarbon samples by PUVF, all organically bound sulfur is converted to sulfur dioxide (SO_2) by sample combustion. Irradiation of SO_2 with a specific wavelength of ultraviolet light forms an electronically excited form of SO_2. The electronically excited SO_2 relaxes to its ground state by the emission of light or fluorescence. The intensity of the emitted light is directly proportional to the SO_2 concentration and thus the hydrocarbon's total sulfur concentration. The SOLA II contains all apparatus necessary for sample combustion and total sulfur measurement by PUVF.

figure 4 – SOLA II typical field installation

The SOLA II is an Online Adaptation of the Well-Accepted:

- ASTM D5453 "Determination of Total Sulfur in Light Hydrocarbons, Motor Fuels and Oils by Ultraviolet Fluorescence"
- ISO 20846 "Petroleum Products – Determination of Sulfur Content of Automotive Fuels – Ultraviolet Fluorescence"

Turnkey Sulfur Analyzer System

The SOLA II field sulfur analyzer is offered as a turnkey system and includes a stainless steel, climate controlled cabinet complete with all sample conditioning components. The cabinet arrangement is suitable for installation where the expected ambient temperature is within -15°C to +50°C (+5°F to +122°F). In colder climates, a climate controlled, walk-in shelter is recommended. Alternatively, the SOLA II field analyzer system can be rack mounted for installation in an existing test room or shelter. The turnkey system can be configured to provide all equipment necessary for online and at-line sulfur analyses. The user only provides a concrete mounting pad, compressed air at 80 psig and electrical power. Unique features include the cell phone link for remote diagnostics and the low utility requirements. Cylinder gases are not required.

Maintenance

Thermo Fisher Scientific offers several levels of maintenance contracts to ensure the SOLA II field sulfur analyzer delivers maximum on-stream time. Should you select our all inclusive maintenance contract, Thermo Fisher takes care of all

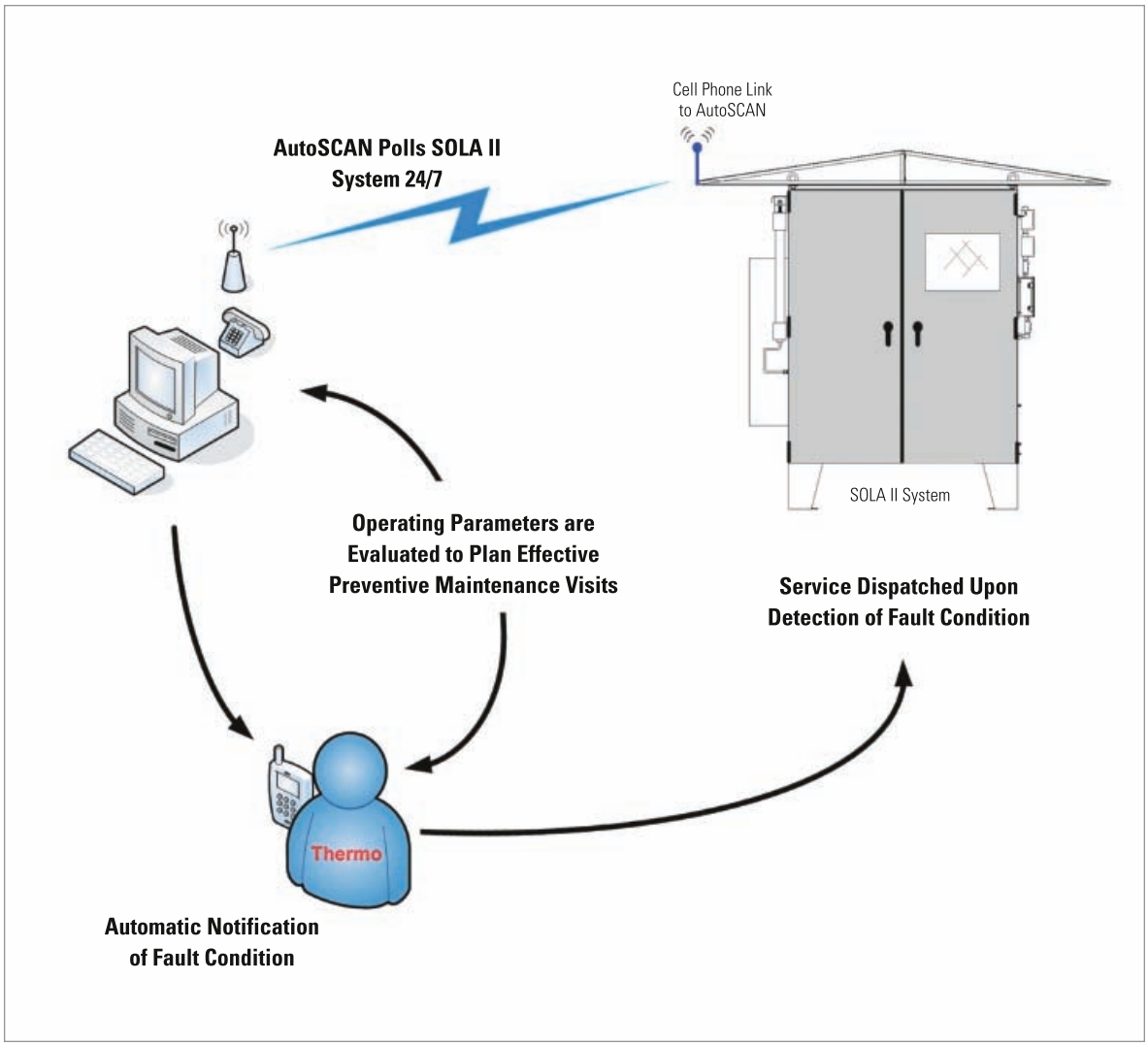

figure 5 – SOLA II / AutoSCAN integrated analyzer maintenance management system

SOLA II maintenance and spare part needs. Under the all-inclusive maintenance contract, we will make four preventive maintenance visits per year. Between preventive maintenance visits, Thermo Fisher will monitor your SOLA II with our proven AutoSCAN® system. AutoSCAN automatically polls the SOLA II via a cell phone link, 24 hours a day, seven days a week. Should AutoSCAN detect a fault condition, our service department is automatically notified and a service engineer is dispatched. Our service engineers review reports of system operating parameters prior to dispatching any service staff to ensure all preventive maintenance visits are conducted as efficiently as possible.

Summary

- The SOLA II field sulfur analyzer system rapidly determines sulfur content in motor fuels.
- The SOLA II provides product pipeline and terminal operators with a single, turnkey system for all grab sample and online sulfur measurement needs.
- The SOLA II's reliable online analysis ensures shippers consistently deliver ultra low sulfur fuels at the targeted sulfur specification.
- All-inclusive maintenance contracts, in combination with the unique SOLA II / AutoSCAN integrated analyzer maintenance system, enable users to keep the SOLA II in top operating condition.

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Specifications

Field Enclosure	
Material of Construction	304 SS
Dimensions (not including sun shade)	78 in W x 60 in H X 24 in D (selected options may alter final dimensions)
Ambient Temperature Limits	-15°C to +50°C (+5°F to +122°F)
Hazardous Area Classification	NEC Class I, Div. 1, Groups B, C, D or NEC Class I, Div. 2, Groups B, C, D CSA with associated "C/US Mark" Class I, Div. 1, Groups B, C, D or Class I, Div. 2, Groups B, C, D ATEX Zone 1, EEx p IIC T2 (T3, T4 optional) or Zone 2, EEx p IIC T2 (T3, T4 optional) CE Mark for other classifications consult factory
Disconnect Switches	One for each 120 VAC circuit
Junction Boxes	Separate signal and 120 VAC junction boxes
Utility Requirements	
Compressed Air	8 SCFM @ 80 psig, minimum (air clean-up system included)
Electrical Power	120 VAC (selected options will determine number of circuits and wattages)
SOLA II Field Sulfur Analyzer	*(see SOLA II data sheet for complete specifications)*
Method of Analysis	Pulsed Ultraviolet Fluorescence, PUVF
Data Communications (Outputs)	RS 485 Modbus and/or 4-20 mA analogs
Required Inputs	A 4-20 mA input from a densitometer (gravitometer) is required for density compensation
Sampling Frequency	Two injections per minute
Initial Response Time	60 seconds or less, not including sample transport time
Optional Densitometer	*(see Thermo's Sarasota FD 910 data sheet for complete specification)*
Model	Sarasota FD910
Principle of Operation	Vibrating Tube
Power Supply	Powered by SOLA II
Sample Conditioning System	
Fast Loop	Sized to minimize sample transport time, includes: isolation valves, flow control/indication and filtration
Optional Fast Loop Sample Pump	Class I, Division 2, Group C, D; 120 VAC: self priming, sized per site requirements
Slipstream	Delivers sample from fast loop to SOLA II, includes: isolation valves, flow control/indication, secondary filtration, sample flow switch and high/low flow select valve to minimize consumption of validation and/or calibration fluids
Stream Selection	Automatic pneumatically operated valves to select online or at-line analysis mode (optional)
At-Line Analysis Option	Includes dedicated self priming Class I, Division 2, Group C, D pump for introduction of grab samples (pressurization of sample containers not required) all required flow control apparatus and pneumatically operated sample select valves
Validation/Calibration Sample Selection	Requires optional at-line analysis mode or pressurized validation/calibration tank
Validation/Calibration Tank	20 liters (5.3 gal) included with at-line analysis option

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