Sulfur Analysis in Natural Gas and Gaseous Fuels Using the Rosemount™ 700XA Gas Chromatograph

Sulfur measurement

A fundamental requirement for gas safety, quality, and contract sale of natural gas is to measure the amount of Hydrogen Sulphide (H_2S) and/or Total Sulfur. The level of these contaminants and sulfur-based odorants is strictly controlled to avoid pipeline corrosion, equipment damage, sulfur emissions, and risk to site personnel in transmission, gas processing and distribution infrastructure. Whether analyzing sulfur for unwanted compounds or for additives such as odorants, understanding its concentration by speciation is important. The Rosemount 700XA Gas Chromatograph provides measurements down in the ppb to ppm range for H_2S, Carbonyl Sulphide (COS), mercaptans, and sulfides (measured as RSH+). A micro Flame Photometric Detector (µFPD) is used to give high specificity to sulfur species and enables high sensitivity ppm level measurements.

Analysis of sulfur compounds using Rosemount 700XA Gas Chromatograph

Equipped with a µFPD, the Rosemount 700XA Gas Chromatograph measures H_2S and COS as discrete components and measures all other sulfur components as a single backflushed (RSH+) peak. The use of a backflush measurement is critical for Total Sulfur measurement as it allows all sulfur components to be grouped and measured, irrespective of their concentration. Without the use of a measured backflush peak, minor components can escape detection and a true Total Sulfur value cannot be determined. This method also simplifies the analysis and reduces cycle time by not trying to resolve individual sulfur components.

The Rosemount 700XA Gas Chromatograph also offers the unique value of an explosion-proof design in a field-mountable, transmitter-style analyzer, greatly minimizing footprint and the need for shelters, and eliminating instrument air requirements for purging. This results in significant reduction of installation and operating costs.

In addition, remote connectivity allows audit checks, making the Rosemount 700XA Gas Chromatograph an ideal solution for unmanned gas metering locations. A powerful software package provides automated processing and ensures operators, maintenance personnel, and management have access to GC performance and actionable insights.

Equipped with a micro Flame Photometric Detector (µFPD), the field-mountable, explosion-proof transmitter-style Rosemount 700XA Gas Chromatograph detects and quantifies trace amounts of sulfur and sulfur compounds, reducing costs and footprint and ensuring gas quality.

Features

- Micro Flame Photometric Detector (µFPD) for stable and sensitive ppm and sub ppm level sulfur component measurement
- Methodology and performance in accordance with ISO 19739 standards
- No instrument air for purge or oven required, reducing power consumption over traditional air purged units
- Remote ignition capability and flame temperature monitoring
- Configurable auto-ignition attempts of the FPD for flame-out detection alarms
- Automatic calibration, no specialized field visits required
- Remote connectivity and performance checks via MON2020™ software
- Low sample flow rate minimizes emissions

Total sulfur applications and measurement ranges

The Rosemount 700XA Gas Chromatograph is not only a practical solution to sulfur measurement, but it can also provide energy content measurement, hydrocarbon dew point (HCDP) calculations for accurate energy content reporting in two-phase gas flow streams, as well as deliver speciation and quantification of total sulfur compounds to trace levels–all in one analyzer. This allows operators to replace up to four analyzers with one gas chromatograph in specific applications, simplifying the scope of analyzers and reducing the overall cost and footprint.

The Rosemount 700XA Gas Chromatograph can perform Total Sulfur analysis in 3 minutes, a parallel C6+ hydrocarbon and Total Sulfur analysis in 6 minutes, or a full C9+ hydrocarbon dew-point (HCDP) measurement and Total Sulfur analysis in 6 minutes (see tables 1, 2, and 3).

The ability to speciate hydrocarbons and sulfur along with mercaptans using the µFPD-based Rosemount 700XA Gas Chromatograph offers advantages over the limitations of other analysis technologies. Colorimeters and lead acetate tape analyzers are selective to H_2S only. Also, the frequent replacement requirements of lead acetate tape add to the lifetime cost of the analyzer and environmental impact. On the other hand, Tunable Diode Laser Absorption Spectroscopy (TDLAS) analyzers are susceptible to interference from hydrocarbons which can affect measurement results.

Flame photometric detector (FPD) theory of operation

A FPD measures trace sulfur compounds. It uses the reactions of sulfur components in a hydrogen rich flame as a source for analytical detection. The source of the FPD's signal is derived from the light produced by an excited molecule created in the flame's combustion. An optical filter allows only the light wavelength of the emission band for sulfurs to pass through to the sensors.

MON2020 software

The Rosemount 700XA Gas Chromatograph is designed to operate unattended. If adjustments are needed, Emerson's exclusive MON2020™ software allows control of your gas chromatographs – either locally or remotely.

Using MON2020 software, you can:

- Start or stop analysis, calibration, or validation cycles.
- Generate and save current and historical analysis and calibration reports.
- Review and modify analytical settings.
- Upload and display multiple chromatograms for comparison.
- Upload and trend any of the measured results.
- Export data to text, HTML, or Excel for use in third party applications.
- Check on original calibration against the last calibration.
- Perform GC operation checks and modifications simultaneously.

Table 1 - Total Sulfur Analysis (TS1) in 3 Minutes

Component	Measurement range (ppm)
H_2S	0.2 – 10
COS	0.2 – 10
RSH+	0.3 – 30
Total Sulfur (H2S + COS + RSH)	0.2 – 50

Table 2 - C6+ and Total Sulfur Analysis (TS6) in 6 Minutes

Component	Measurement range
Methane	65 – 100%
Ethane	0 – 20%
Propane	0 – 10%
I-Butane	0 – 5%
N-Butane	0 – 5%
Neo-Pentane	0 – 1%
I-Pentane	0 – 1%
N-Pentane	0 – 1%
C6+	0 – 0.7%
N_2	0 – 20%
CO_2	0 – 20%
Hydrogen Sulfide (H_2S)	0.2 – 10 ppm
Carbonyl Sulfide (COS)	0.2 – 10 ppm
Mercaptans (RSH+)	0.2 – 10 ppm
Total Sulfur (H_2S, COS, RSH)	0.2 – 30 ppm

Table 3 - C9+ and Total Sulfur Analysis (TS9) in 6 Minutes

Component	Measurement range
Methane	65 – 100%
Ethane	0 – 20%
Propane	0 – 10%
I-Butane	0 – 5%
N-Butane	0 – 5%
Neo-Pentane	0 – 1%
I-Pentane	0 – 1%
N-Pentane	0 – 1%
C6's	0 – 0.5%
C7's	0 – 0.3%
C8's	0 – 0.2%
C9+	0 – 0.1%
N_2	0 – 20%
CO_2	0 – 20%
Hydrogen Sulfide (H_2S)	0.2 – 10 ppm
Carbonyl Sulfide (COS)	0.2 – 10 ppm
Mercaptans (RSH+)	0.2 – 10 ppm
Total Sulfur (H_2S, COS, RSH)	0.2 – 30 ppm

MON2020 is a Microsoft® Windows™-based software designed to make analyzer configuration, maintenance, and data collection easy. With intuitive dropdown menus and fill-in-the-blank tables, even new users can quickly navigate through the software.

With its ability to communicate with your enterprise network and export to numerous file types, MON2020 software is a powerful tool that ensures operators, engineers, maintenance personnel, and management have access to critical data when they need it, in a format they can use.

MON2020's chromatogram viewer allows you to view and compare both live and archived chromatograms simultaneously. Despite its small size (less than 100 kb), the chromatogram file (.xcgm) includes analysis and calculation results, integration and valve timing settings, retention time settings, and raw peak data.

MON2020's trend viewer makes it easy to trend multiple variables on a single chart. To help diagnose process or analysis issues, you can select single or multiple points on the trend viewer and the chromatograms associated with these points open in the chromatogram viewer. The trends can be saved as trend files or exported as text, CSV, or Microsoft Excel® files. MON2020 can connect to a Rosemount 700XA via Ethernet directly or over your local or wide area network.

MON2020 is equipped with multi-level user name and password security settings to limit and control access to the GC and provide five levels of authority ranging from read-only access to full control of the GC and its data.

MON2020's unique *Diagnostic File* feature makes remote diagnostics and documenting the analyzer performance easy and consistent. The diagnostic data file includes chromatograms, alarm logs, event logs, and configuration details into a single file that is time and date stamped. The generation of the diagnostic file is a simple menu selection and not only creates the file, but also creates an email with the time stamped file attached, ready for dissemination.

Part number ordering matrix

Your part number is determined by your specific application needs.

700XA -BR -_ - F - AC - _ - _ - _ - N - S4H - _ - S - _

Branding	
BR	Rosemount Standard Casting
Hazardouz Area Rating and Approvals (GC ONLY)	
A	ATEX/IEC-Ex
C	CSA - Class I, Division 1/Zone 1
Mounting	
F	Floor-mount
Gas Chromatograph Power	
AC	Universal 85 to 240 VAC
DC	24 VDC (21–30 VDC)
Front Panel	
SK	LCD - Color Local Operator Interface
SN	Standard Switch Panel - 8 Stream Switches
Additional* I/O and Serial/Modem Communications - Slot A	
AI	Additional IO Port - 4 Additional Channels of Analog Inputs (Isolated)
AD	Additional IO Port - 8 Additional Channels of Digital Inputs (Isolated)
AP	Additional IO Port - 4 Additional Channels of Analog Outputs (Isolated)
A4	Additional Serial Port - (1) RS 422 or 485 (Factory/Field Configurable)
AS	Additional Serial Port - (1) RS 232 (Factory/Field Configurable)
A5	Additional IO Port - 5 Additional Channels of Digital Outputs (Isolated)
AN	None
Additional* I/O and Serial/Modem Communications - Slot B	
BI	Additional IO Port - 4 Additional Channels of Analog Inputs (Isolated)
BD	Additional IO Port - 8 Additional Channels of Digital Inputs (Isolated)
BP	Additional IO Port - 4 Additional Channels of Analog Outputs (Isolated)
B4	Additional Serial Port - (1) RS 422 or 485 (Factory/Field Configurable)
BS	Additional Serial Port - (1) RS 232 (Factory/Field Configurable)
B5	Additional IO Port - 5 Additional Channels of Digital Outputs (Isolated)
BN	None
FOUNDATION™ fieldbus Interface	
N	None
Stream Switching	
S4H	Internal (up to) 3 Sample Streams & 1 Calibration Stream (Single Block) – Sulfur-Inert Tubing
Oven Assembly/Application	
TS1	Total Sulfur Analysis with µFPD - 3 minutes
TS6	Standard C6+ and Total Sulfur Analysis with µFPD - 6 minutes
TS9	Standard C9+ and Total Sulfur Analysis with µFPD - 6 minutes
Internal Interconnect Cable and 2nd Solenoid Driver Board	
S	Single Interconnect Cable and Single Solenoid Driver Board
Application Software	
P	Results in ppm
M	Results in mg/m3

Emerson Automation Solutions
North America
10241 West Little York, Suite 200
Houston, Texas 77040
USA
Toll Free + 866 422 3683
+ 713 396 8880
+ 713 466 8175
gas.csc@emerson.com
www.Emerson.com/RosemountGasAnalysis

Linkedin.com/company/Emerson-Automation-Solutions
Twitter.com/Rosemount_News
Facebook.com/Rosemount
YouTube.com/user/RosemountMeasurement

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