

Rosemount[™] 470XA

Natural Gas Chromatograph



The Rosemount 470XA Natural Gas Chromatograph (GC), part of the XA series of Emerson gas chromatographs, is designed to provide greater ease of use and increased measurement performance for the C6+ BTU/CV analysis.

A unique feature of the 470XA is its Maintainable Module based on XA-series oven technology, which allows easy field replacement and service, greatly reducing downtime and overall operating costs.

Overview

Incorporating an operating method similar to previous gas chromatographs (GCs), the Rosemount 470XA provides the option of choosing a hydrogen or helium carrier gas and helium, nitrogen, or instrument air actuation gas.

The local operator interface (LOI), a standard feature in the 470XA, is a full color VGA display with an alpha-numeric keypad that allows its users to perform common tasks without having to connect to a computer. The LOI has built-in tutorials to guide even the most inexperienced operator through step-by-step instructions on how to safely operate and maintain the GC, therefore reducing the need for specialized technicians.

Features

Designed for custody metering of natural gas

- Four-minute C6+ standard analysis
- ±0.0125 percent repeatability of heating value (±0.125 BTU/1000 BTU) in controlled environments
- ±0.025 percent repeatability of heating value (±0.25 BTU/1000 BTU) over extended temperature range of -4 °F to +140 °F (-20 °C to +60 °C)
- Latest Gas Processors Association (GPA) 2145, GPA 2172, American Gas Association (AGA) 8, and International Organization for Standardization (ISO) 6976 calculations
- Analysis results storage in excess of the latest American Petroleum Institute (API) 21.1 requirements

Simplified functionality and ease of use

Full color local operator interface (LOI) with built-in software assistants to guide the operator through common tasks, such as:

- Module replacement
- Changing calibration gas
- Auto-valve timing
- Device start-up

Reduced installation costs

- 24 Vdc power with less than 55 Watts startup and less than 25 Watts (steady state) nominal power
- Pole and wall mount options
- No shelter required for most environments; optional enclosure available for extreme environments

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Lower operational costs

- Low carrier gas usage
- Automatic validation routine reduces calibration gas usage
- Maintainable Module replacement or service is quick and easy
- Optional utility gases: H₂, He, and N₂

The Rosemount 470XA is designed for online analysis of natural gas. The analysis uses a configuration of three 6-port valves with four separation columns to measure the common components found in natural gas.

Table 1: C6+ Standard Measurement Ranges

Component	Measurement range
Methane	60 to 100 mole %
Ethane	0 to 20 mole %
Propane	0 to 10 mole %
N-Butane	0 to 5 mole %
Iso-Butane	0 to 5 mole %
N-Pentane	0 to 1 mole %
Iso-Pentane	0 to 1 mole %
Neo-Pentane	0 to 1 mole %
Nitrogen	0 to 20 mole %
Carbon dioxide ⁽¹⁾	0 to 20 mole %
C6+	0 to 0.7 mole %

(1) When carbon dioxide exceeds 20%, consult gas chromatograph factory.

Maintainable Module

A key advantage of the Rosemount 470XA is the compact Maintainable Module including the columns, thermal conductivity detectors (TCDs), analytical valves, and solenoids, all within a single enclosure. When compared to other gas chromatographs (GCs) with no serviceable components, providing the technician easy access to key components inside a single enclosure is a cost-effective way to service or repair the module.

The Maintainable Module in the 470XA uses valves and column sets identical to the robust and industry-proven 700XA and 770XA Gas Chromatographs.

If the Maintainable Module needs repair, a technician can quickly and easily replace it in the field without causing major interruptions or delays. Once the replacement module has been properly installed and is back online, the GC will self validate and calibrate before automatically switching to **Analysis** mode.

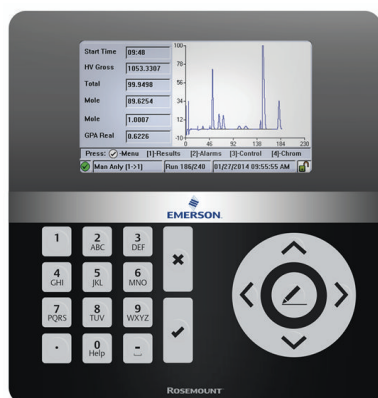
Figure 1: Maintainable Module



Local operator interface (LOI)

A challenging concern in the industry today is the declining experience of operators in the field and the lack of available time to provide routine maintenance service calls. The 470XA has a full-color LOI designed to simplify gas chromatograph (GC) operations in the field. The LOI uses a full VGA LCD display interface combined with a 19-key tactile feedback keypad rated for Class 1, Division 1 hazardous areas.

Figure 2: Rosemount 470XA LOI



Most GC routine maintenance functions can be directly performed from the LOI. In most cases, the GC can be installed, configured, and placed online without using a computer.

Routine maintenance functions

■ Changing calibration gas

When replacing the standard calibration gas, built-in software assistants in the local operator interface (LOI) will provide walk-through assistance in these basic steps:

1. Validate the existing calibration according to the thermal conductivity of each of the components.

2. Change the calibration bottle.
3. Enter new values.
4. Purge the calibration gas.
5. Analyze the calibration gas to validate the new concentration values.
6. Calibrate to the new standard.
7. Return to automatic analysis of the stream.

■ **Auto-valve timing**

Over time, restrictions can build up inside the analytical flow-paths of a gas chromatograph (GC) oven. The auto-valve timing adjusts the analytical valve timings and integration events to optimize the analysis to account for these changes. This reduces the need for fully trained GC experts in the field and ensures that the analyzer is maintaining the tight tolerances required to reduce measurement errors.

■ **Module replacement**

When a module is replaced in the field, the LOI initiates the purge, validation, and calibration sequence. The status and progress of the module initiation sequence can be monitored from the LOI and will confirm when the analyzer is back online.

Additionally, many of the functions historically performed with a computer can now be done with the LOI, including:

- Viewing, accepting, and clearing alarms.
- Stopping and starting the analysis cycle.
- Viewing chromatograms.
- Viewing calibration and validation reports.
- Viewing archive data and trends.
- Viewing and configuring communication settings.

Flexible communication with inputs and outputs (I/O)

The gas chromatograph (GC) can also be connected to supervisory systems, such as flow computers, Remote Terminal Units (RTUs), or Supervisory Control and Data Acquisition (SCADA) systems using two RS-232/485 serial ports or two Ethernet ports.

Each serial or Ethernet port can be configured with unique Modbus® maps providing individual read/write access control. The industry standard SIM_2251 Modbus map or a fully customized map can be used based on either the Enron™ (one register per floating point) or Modicon™ (two registers per floating point) data formats.

Additionally, the following are available on the GC:

- Two analog outputs
- One analog input
- One digital input
- One digital output

One of the Ethernet ports has an RJ-45 connector to connect to a local computer for maintenance and diagnostic access. The Ethernet port has a switchable Dynamic Host Configuration Protocol (DHCP) server able to assign an Internet protocol (IP) address to the connected computer.

Data archiving and reports

Every analysis is time and date stamped and archived for retrieval by the MON2020 software. With MON2020, pre-configured reports can be:

- Displayed
- Printed

- Stored

Results can be directly trended or easily exported to several common formats, including:

- ASCII text
- HTML
- Microsoft® Excel™

Available data storage types

Archiving	Assuming a four-minute analysis time, the GC archives up to 85 days of analysis records and up to 370 days of calibration records (one calibration per day) automatically by time and date.
Chromatograms	The GC permanently stores over four days worth of analysis chromatograms, 370 final calibration chromatograms (depending on the analysis time), and user-selected protected chromatograms.
Drawings and documents	The GC stores manuals and drawings in several file formats retrievable with MON2020, eliminating the risk of manuals and drawings being misplaced. User-generated documents can also be uploaded, such as maintenance checklists or installation drawings, to the GC for later retrieval.

Standard logs and reports

Audit logs	Data and event logs fully conformed to API report 21.1 for metering audit purposes and backup to primary systems (flow computer, SCADA, DCS)
Event logs	A continuous record of all operator changes with time, date, and user-identified records
Maintenance logs	Track maintenance or testing performed on the gas chromatograph
Average reports	■ Hourly ■ 24-hour ■ Weekly ■ Monthly ■ Variable
Analysis reports	Physical property calculations for component and group analysis and alarms
Raw data reports	Retention times, peak areas, detector number, method, integrations start/stop, and peak width for analysis
Calibration reports	Raw component data, new response factors, retention times, and deviation from last calibration
Final calibration reports	Results from the calibration response factors and retention time adjustments

MON2020

Emerson has designed the gas chromatograph (GC) to operate unattended. MON2020, Emerson proprietary desktop software, allows complete control of the GC locally or remotely.

When adjustments are needed, MON2020 can be used to:

- Start or stop analysis, calibration, or validation cycles.
- Generate and save current and historical analysis and calibration reports.
- Review and modify analytical settings.

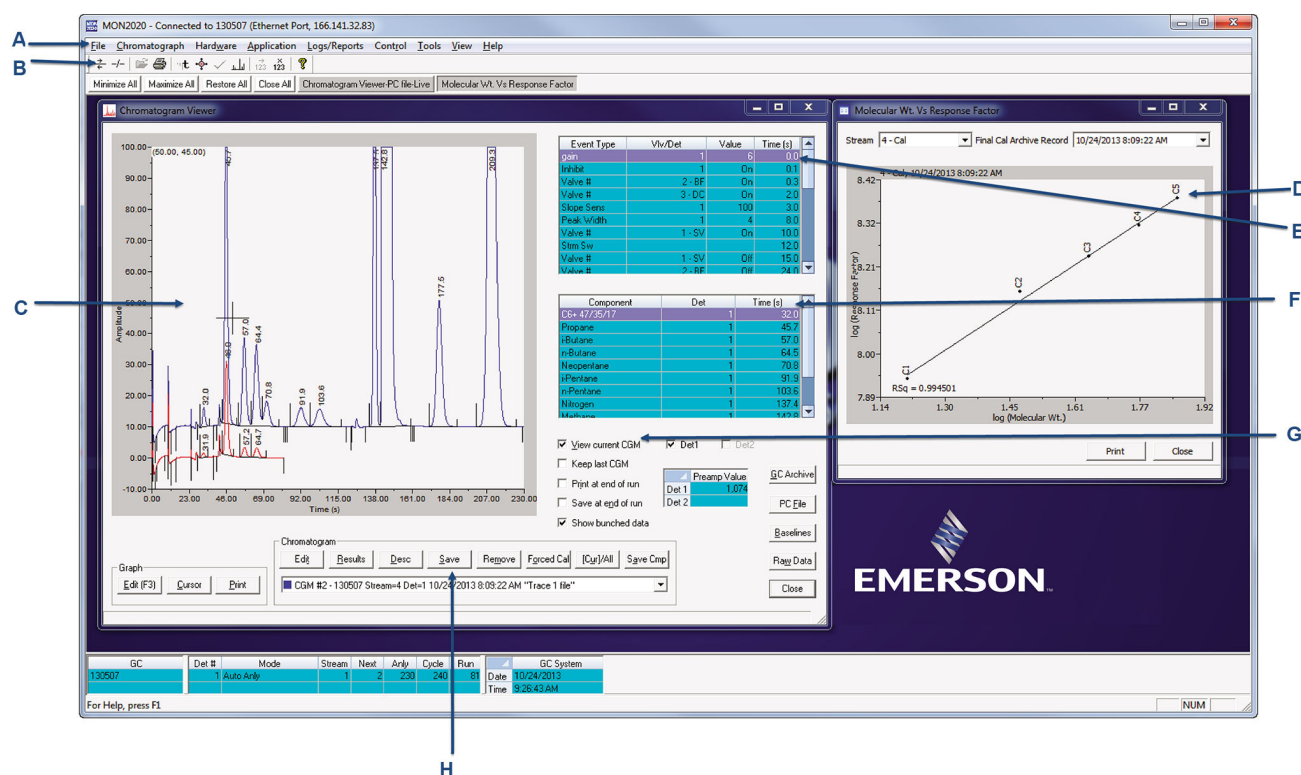
- Upload and display multiple chromatograms for comparison.
- Upload and trend any of the measured results.
- Export data to text, HTML, or Microsoft® Excel™ for use in third-party applications.
- Check on original calibration against the last calibration.
- Perform GC operation checks and modifications simultaneously.
- Upload and view manuals and drawings stored in the GC.

MON2020 is a Microsoft Windows®-based software program simplifying:

- Analyzer configuration
- Maintenance
- Data collection

With intuitive drop-down menus and fill-in-the-blank tables, new users can quickly navigate through the software.

Figure 3: MON2020 interface



- A. Simple drop-down menus
- B. Connect to any GC with a mouse click
- C. Full featured chromatogram display
- D. **Response Factor** fidelity chart
- E. Fully detailed **Timed Events** table
- F. Automatic listing of measured components
- G. Quickly add chromatograms to overlay; GC archive
- H. Save chromatograms to hard drive

With its abilities to communicate with an enterprise network and export to numerous file types, MON2020 is a powerful tool ensuring operators, engineers, maintenance personnel, and management have access to critical data, such as current and archived chromatograms, alarm history, event logs, and maintenance logs.

The software's chromatogram viewer allows viewing and comparing both live and archived chromatograms simultaneously. Despite its small size, the chromatogram file includes analysis and calculation results, integration and valve time settings, retention time settings, and raw peak data.

The trend viewer makes it easy to trend multiple variables on a single chart. To help diagnose process or analysis issues, the trend viewer allows selection of single or multiple points; the chromatograms associated with the selected points will open in the chromatogram viewer. The trend files can be saved or exported as text, CSV, or Excel files.

MON2020 can connect to a GC via Ethernet directly or over a local or wide area network. The software is equipped with multi-level username and password security settings to limit and control access to the GC and provide levels of access authority ranging from read-only access to full control of the GC and its data.

Applications

Natural gas custody transfer

Rosemount gas chromatographs (GCs) are synonymous with calorific value/BTU measurement on gas transmission and distribution pipelines. Emerson designed the analyzer with simplicity and ease-of-use in mind, eliminating the complexity often perceived with GC installations.

Gas chromatographs (GCs) are synonymous with natural gas custody transfer and known for improving gas measurement analysis and reducing Lost and Unaccounted for (LAUF) gas.

The 470XA can perform International Organization for Standardization (ISO), Gas Processors Association (GPA), or American Gas Association (AGA) physical property calculations and store the analysis results in non-volatile memory for up to 85 days. Operators can easily retrieve the stored data using Rosemount MON2020 software or Modbus[®] communication. The GC uses industry standard SIM_2251 Modbus maps as the default serial communication protocol. The GC can be customized to accommodate other requirements as needed.

Designed to replace aging C6+ GCs currently installed in the network, the 470XA does not require configuration changes to the Supervisory Control and Data Acquisition (SCADA) system or flow computer.

Production gas measurement

Analyzing production gas in the gathering network has traditionally been done with manual or automatic samplers. However, the ongoing costs of collecting and analyzing these samples and the time delay between collecting the sample and receiving the results is leading many producers to look at installing online gas chromatographs (GC) closer to the wellhead.

The infrastructure and field knowledge that a traditional GC requires for installation and ongoing maintenance often does not exist in the production and gathering network environment. The Rosemount 470XA addresses these concerns by decreasing the infrastructure and utility requirements for installation and operation and using the local operator interface (LOI) to guide operators through the most common maintenance functions.

The GC can be installed outdoors using a 4 in. (102 mm) diameter pole mount with a sun shield. For other areas where snow or inclement weather is more prevalent, a small cabinet enclosure is available, eliminating the high cost of a full shelter. In addition, low power requirements make solar or natural gas power generators feasible at locations off the power grid.

Power generation and furnace gas control

Tighter emissions regulations and the need for maximum burner efficiency require the air/fuel ratio to be optimized based on the energy content and quality of the incoming gas. The composition and energy content of the natural gas supplied can vary significantly with little or no notice from the gas provider.

Feed gases with Wobbe Index values outside of the burner's design parameters can result in damage to the burner tip or inefficient combustion leading to flame-outs. Monitoring the feed gas can provide a check on the natural gas supply and help avoid burner damage or unexpected flame-outs.

Because the Rosemount 470XA can measure the quality of the incoming gas and calculate its Wobbe Index to provide feed-forward control to the fuel/air ratio, when compared to flue gas measurements providing feedback control, using the 470XA can result in:

- significant improvements in burner efficiency
- lower emissions

Using the Wobbe Index value from the GC, the burner management system can adjust to changes in gas quality before the oxygen, nitrogen, or carbon monoxide levels in the flue gas streams increase.

Specifications

Electronics specifications

Power supply	24 Vdc (standard) at the unit
	21-30 Vdc (operating range) at the unit
	Class 2 and SELV as specified by CEC, C22.1, and National Electrical Code (NEC®), National Fire Protection Association (NFPA)

NOTICE

Provide the gas chromatograph (GC) with one 5-amp circuit breaker for protection.

Power consumption at +72 °F (+22 °C)	55 Watts (start-up)
	25 Watts (steady state)

Construction specifications

Environmental temperature	-4 °F to +140 °F (-20 °C to +60 °C)
Enclosure protection rating	IP65 and Type 4X
Dimensions (without sample system or mounts)	height x width x depth 18 in. x 12 in. x 11 in. (460 mm x 305 mm x 280 mm)
Dimensions (without sample system or mounts)	height x width x depth 18 in. x 15.6 in. x 11 in. (460 mm x 396 mm x 280 mm)
Mounting options	Pipe Wall Bench
Weight (without sample system or mounts)	50 lb. (23 kg)

Performance specifications

Standard applications	4-minute C6+ standard analysis, order code 604
	3 minute C6+ analysis, order code 603
	Landfill gas C3+ analysis without H ₂ S measurement, order code LF8
	C3+ carbon dioxide purity, order code CCU
	RNG/biogas raw gas with H ₂ S, order code RNG

Note

Custom light process applications available upon request.

Repeatability (standard C6+ analysis)	Controlled environment:	±0.0125% calorific value ±0.125 BTU/scf per 1,000 BTU/scf
	Uncontrolled environment: -4 °F to +140 °F (-20 °C to +60 °C)	± 0.025% calorific value ± 0.25 BTU/scf per 1,000 BTU/scf
Metrology approvals	Measurement Canada (July 2024)	
	Note For current approvals and certifications information, see Emerson.com/global .	
Calculations	International Organization for Standardization (ISO) 6976 American Gas Association (AGA) 8 Gas Processors Association (GPA) 2172 (using the GPA 2145 physical properties table)	
Recommended carrier gas	Purity Moisture content Hydrocarbon content Supply pressure Carrier gas flow	
Zero-grade helium at 90 psig (6.2 barg) or hydrogen at 30 psig (2.1 barg)	99.995% (zero-grade) Less than 10 ppm Less than 0.5 ppm 90 psig (6.2 barg) for helium; 60 psig (4.1 barg) for hydrogen 20 cc/min for helium, 10 cc/min for hydrogen	
Recommended actuation gas	Moisture content Particulate Supply pressure	
Helium, nitrogen, or clean, dry air at 90 psig (6.2 barg)	Less than 10 ppm Less than 2 microns 90 psig (6.2 barg)	
Recommended sample (calibration) gas input pressure range	20 psig (1.4 barg)	
Valves	Three 6-port diaphragm analytical valves	
Oven	Airless iso-thermal	
Detector	Thermal conductivity detector (TCD)	
Streams	Four streams total for sample and calibration. Configurable.	
Vibration	Meets ASTM-4169 specifications	

Standard communications

Ethernet	Two available connections with 10/100 mbps	One RJ-45 plug-in port One 4-wire termination
Analog input	One standard input filtered with transient protection, 4-20 mA that is user scalable and assignable.	

Analog outputs	Two isolated outputs, 4-20 mA	
Digital inputs	One input	User assignable Optically isolated Rated to 30 Vdc at 0.5 A
Digital output	One user-assignable output, Form C and electro-mechanically isolated, 24 Vdc	
Serial ports	Two termination blocks, configurable as RS-232 or RS-485	

Archived data storage capabilities

Table 2: Archived Data Storage Capabilities

Type ⁽¹⁾	Maximum number of records	Notes
Analysis results	86,464	240 days with 4-minute cycle time
Final calibration results	370	1 year of final calibration results
Calibration results	100	
Final validation results	370	1 year of final validation results
Validation results	100	
Analysis chromatogram	3,406	Approximately 9.4 days assuming 4-minute cycle time
Final calibration chromatograms	370	1 year of final calibration chromatograms ⁽²⁾
Final validation chromatograms	370	1 year of final validation chromatograms ⁽²⁾
Protected chromatograms	100	User-selectable
Hourly averages (up to 250 variables) ⁽³⁾	250	10.4 days
Daily averages (up to 250 variables) ⁽³⁾	365	1 year
Weekly averages (up to 250 variables) ⁽³⁾	58	1 year
Monthly averages (up to 250 variables) ⁽³⁾	12	1 year
Variable averages (up to 250 variables) ⁽³⁾	250	
Every run (up to 250 variables) ⁽³⁾	250	
Alarm logs	1,000	
Event logs	1,000	

(1) Based on four-minute BTU with daily calibration application.

(2) The gas chromatograph (GC) can store final calibration or final validation chromatograms for up to a year, provided that no more than one calibration or validation is run per day, and the cycle time is less than 15 minutes. If the cycle time exceeds 15 minutes, the oldest final calibration or validation chromatograms are deleted to make room for newer ones.

(3) Users can have a total of up to 250 averages of all types, including hourly, 24-hour, weekly, monthly, variable, and every run averages.

Vent specifications

The flows of the vents are:

Sample vent	10-50 cc/min of sample gas for approximately 3.5 minutes of the four-minute cycle
Measure vent	Continuous flow of less than 20 cc/min of carrier gas and 20 cc sample gas per analysis cycle

Sample bypass

Continuous flow of 150-200 cc/min of sample gas

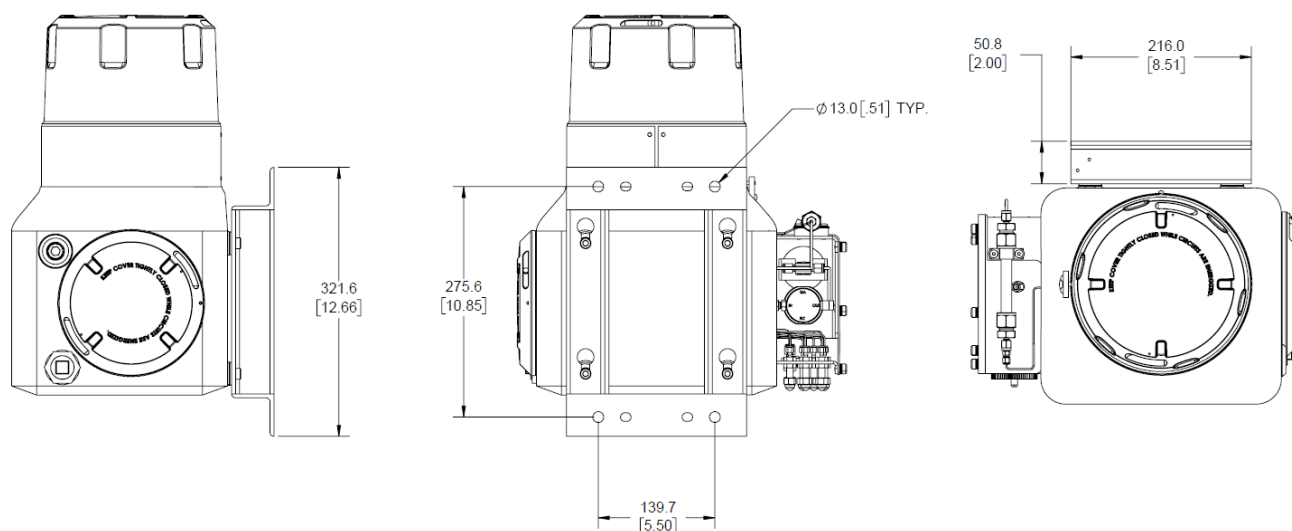
Product certifications

For product certifications, see the [Rosemount 470XA Gas Chromatograph Quick Start Guide](#).

Recommended installation

The drawings in [Figure 4](#) represent the minimum recommended installation guidelines for Rosemount 470XA Gas Chromatographs. For more information, consult Emerson for detailed installation recommendations for a specific application.

Figure 4: Mounting dimensions

**Note**

Dimensions are in millimeters with inches in brackets.

For more information: [Emerson.com/global](https://emerson.com/global)

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