

PRODUCT BROCHURE

# MAX300-EGA

Evolved Gas Analysis



## Fast Response

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## Process Control

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## Stable Measurement

- Delivers continuous gas analysis
- Real-time control parameters reporting
- Complete quantitative stream composition
- Precise process control
- Multi-port systems for 160+ sample streams
- Low maintenance

## Introducing the MAX300-EGA™

The latest system from Extrel® optimized for Evolved Gas Analysis. A part of the MAX300 family, the MAX300-EGA features Extrel's industry-leading 19 mm quadrupole. Combining this mass filter with high-temperature, rapid sampling and the knowledge and experience of a company that has been providing mass spectrometry solutions since 1964, the MAX300-EGA brings the precision, speed and flexibility you need for your evolved gas application.

By coupling a quadrupole mass spectrometer to a thermogravimetric analyzer, or differential scanning calorimeter, the off-gas of the furnace can be characterized, identifying the molecule associated with each mass loss. Using the MAX300-EGA to monitor the outflow of a microreactor, or reaction headspace, researchers can quantify components leaving the system in the gas phase. The MAX300-EGA can provide vital insight into the underlying processes at work in your lab.

## Evolved Gas Analysis (EGA)

Evolved Gas Analysis (EGA) is the analysis of the effluent of analytical equipment and chemical processes. Whether the off-gas is coming from a thermal analyzer or a reaction vessel, the most important consideration is protecting the sample integrity all the way to the mass spectrometer. The inner capillary of the MAX300-EGA's low-volume transfer line is made of chemically-inert silica. It is heated to 200°C, standard,\* and differentially pumped to rapidly move sample and keep it under vacuum. This prevents condensation and chemical interactions, keeping your sample intact and your equipment running.

In addition to the heated interface, the MAX300-EGA is factory configured for data syncing and sharing. The ability to input and output digital and analog signals, as well as communicate with OPC and serial protocols, means that the Questor5 control software has the flexibility to get you data in the form you need.

\* 300 and 400°C options available



Figure 1. The MAX300-EGA, a quadrupole mass spectrometer optimized for Evolved Gas Analysis

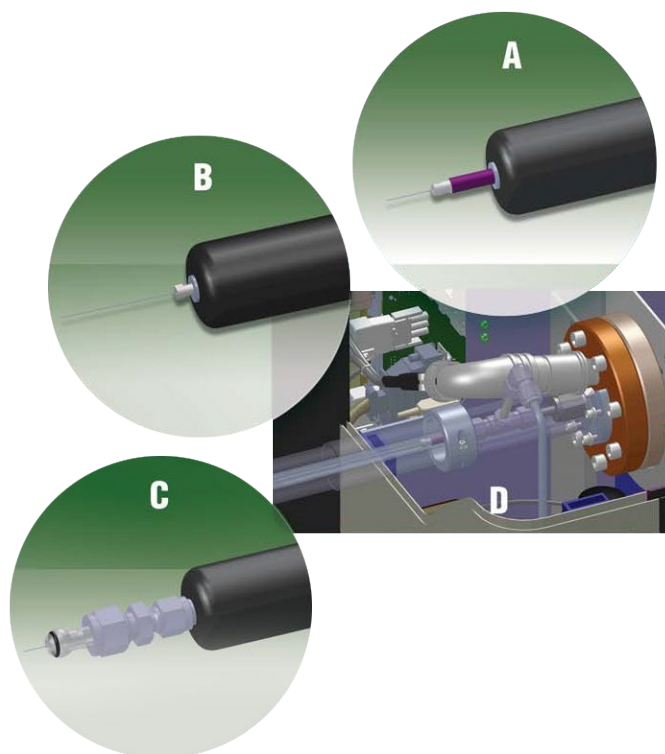


Figure 2. The sample end of the MAX300-EGA transfer line is custom designed to interface with the TGA model or other equipment you are using.

Some examples:

- A. The sample interface for use with a NETZSCH® TG 209 F1 Libra® TGA
- B. The sample interface for use with a TA Instruments® Q5000IR TGA
- C. The sample interface for use with a PerkinElmer® Pyris™ 1 TGA
- D. The transfer line is designed to eliminate cold spots and pull sample quickly into high vacuum

## Evolved Gas Analysis Applications:

- Thermogravimetric-Mass Spectrometry (TGA-MS)
  - Pharmaceuticals
  - Materials Science
  - Plastics
- Microreactors/Continuous Flow Systems
- Reaction Monitoring
- Organic Chemistry
  - Natural Product Analysis
  - Synthesis Studies
- Pilot Scale Process/R&D
- QA/QC

## TGA-MS

Thermogravimetric analysis (TGA) is a powerful approach to the study of the thermal behavior of solid and liquid samples. The interface of TGA with a quadrupole mass spectrometer allows researchers to characterize and quantify the compounds in the off-gas in real-time along with each mass loss.

The MAX300-EGA comes equipped to import a start-of-heating signal from the TGA for easy data syncing and features a chemically-inert transfer line designed to guard against condensation and chemical interactions; it keeps the sample hot and under vacuum all the way to the ionizer.

## Applications:

- Materials Science
  - Composites
  - Coatings
  - Adhesives
- Pharmaceuticals
  - Solvent Content
  - Formulations
  - Excipients
- Plastics
  - Elastomers
  - Thermoplastics

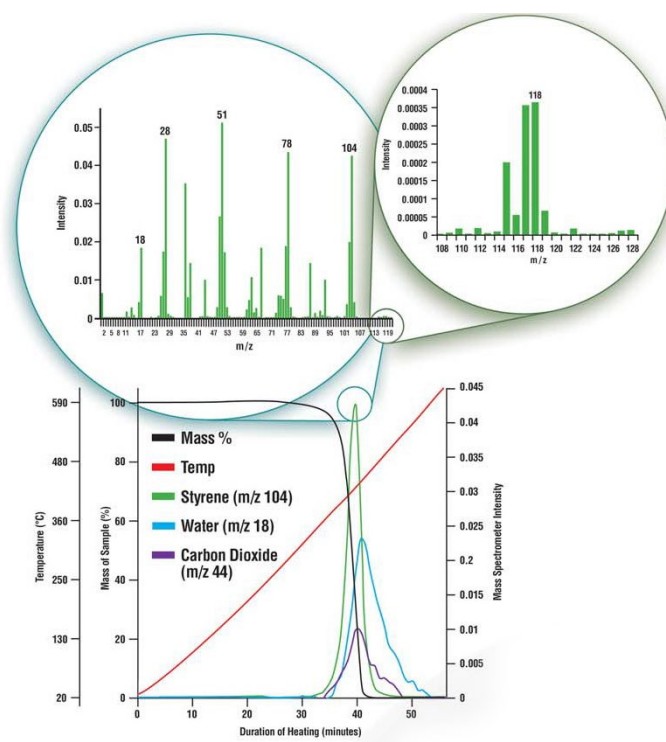


Figure 3. The thermal decomposition of polystyrene

Some examples:

- Mass loss data from the TGA shown with the intensity trends from the mass spectrometer. Water and carbon dioxide are shown leaving the sample along with styrene.
- The mass spectrum of the evolved gas captured at 39.75 minutes. The peaks at  $m/z$  18, 44, and 104 are from water, carbon dioxide, and styrene, respectively.
- A portion of the mass spectrum, rescaled. The peaks at  $m/z$  115-128 are from a styrene molecule still bound to a methyl group that has broken off of the parent molecule.

## Reaction Monitoring

Understanding the dynamic composition of the gases released by continuous flow systems can reveal the mechanisms at work within the experiment. When energy or a reagent is added to a reaction, changes to the off-gas can occur instantaneously. The MAX300-EGA has the speed and sensitivity to detect even small shifts in the evolved fraction as they occur, allowing the researcher to characterize unknown samples, quantify solvent composition, and pinpoint reaction kinetics. The heated transfer line can interface with a wide array of equipment, and signals and data can be imported into the mass spectrometer for trending and calculation, or exported for manipulation on another platform.

## Applications:

- Microreactor/Continuous Flow Monitoring
- Headspace Analysis
- Organic Chemistry  
– Synthesis Studies
- R&D
- Catalysis Research
- Pilot Scale Process

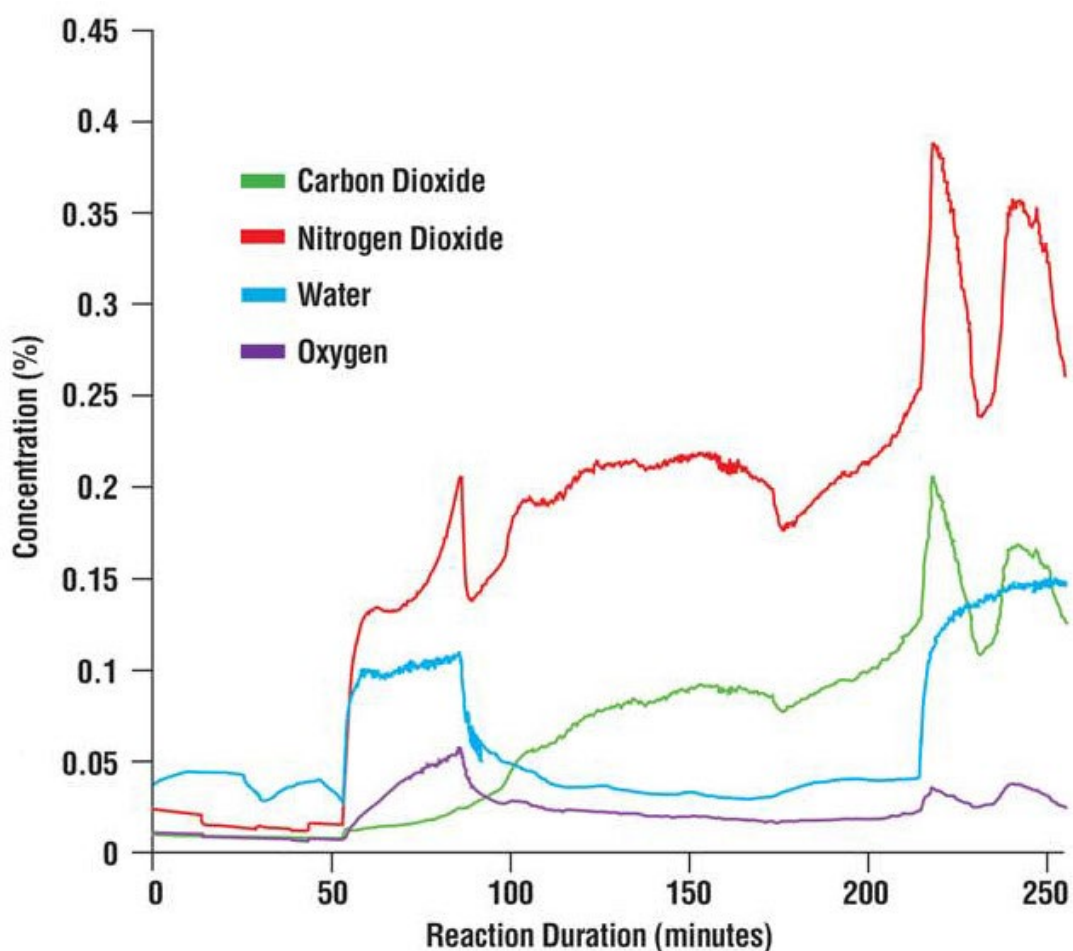


Figure 4. Changes in the off-gas reveal events in the reaction vessel as they occur



## The MAX300-EGA

The MAX300-EGA features the precision, speed and flexibility of the Extrel MAX300 family, optimized for evolved gas analysis.

### System Highlights

#### Heated transfer line

Length: 2 m  
200°C standard  
300 and 400°C options available

#### Mass analyzer

19 mm quadrupole filter

#### Operating frequency

1.2 MHz

#### Mass range

1-200 amu standard  
– 1-300, and 1-500 amu options available

#### Detectable components

Any gas or vapor with a molecular weight or fragment ion within the mass range

#### Dynamic range

Can measure components from  
100% to 10 ppb\*

#### Ionizer

Disposable EI source  
– Plug and Play for ease of maintenance  
– Filaments: One active and one spare with automatic switchover

\*As documented on trace analysis of benzene in air

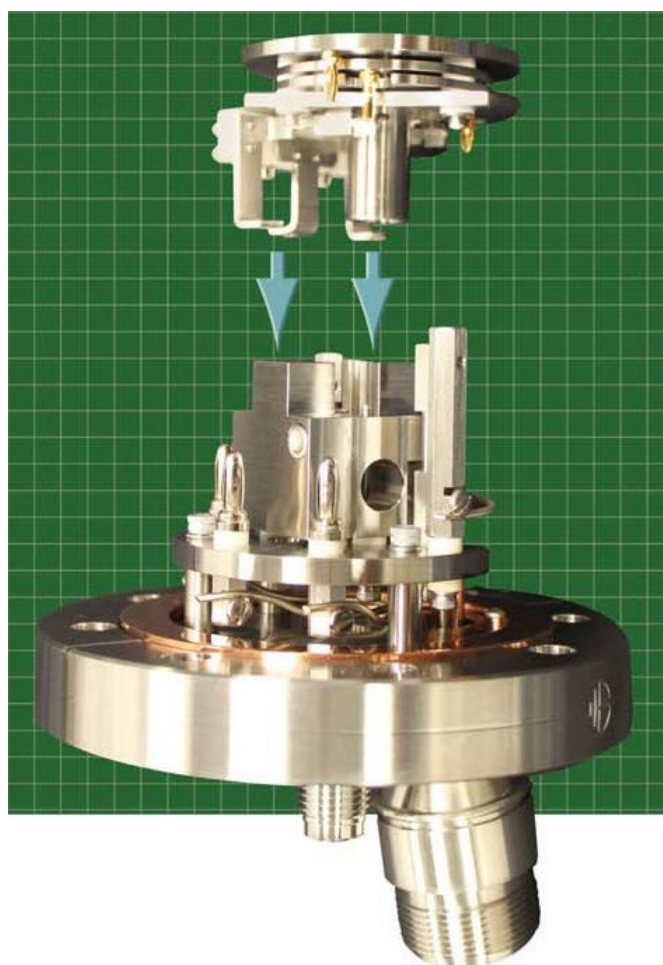


Figure 5. The dual filament assembly is included in the Plug and Play ionizer. The no-tools replacement eliminates the need for ionizer cleaning in dirty applications.



Figure 6. Extrel's 19 mm quadrupole next to a 6 mm mass filter

# The Extrel Questor5 Software

Powerful and intuitive, Questor5 is the perfect tool for gathering the qualitative or quantitative data you need.

## System Highlights

### Platform

Software runs on Windows® XP and Windows 7 Operating Systems

### Extensive compound library

- NIST and other 3rd party database formats also supported

### Configured standard for start-of-heating input

### Security

Meets government requirements for 21 CFR part 11

### Quantitative analysis

- Analysis Rate: 400 milliseconds per component
- Precision:  $\pm 0.0025$  absolute\*
- Stability:  $\pm 0.005$  absolute, over 30 days\*
- Flexible method design
- Unlimited components

### Sequence mode

Fully automated calibration, or Start-of-Batch

### External communications

Ethernet, digital I/O, analog I/O, OPC, modbus serial

\*Based on the analysis of a 1% argon sample

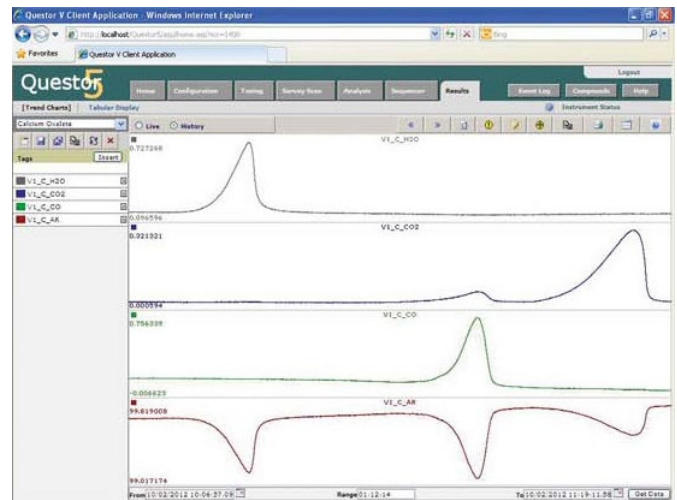


Figure 7. Quantitative trending in REAL-TIME

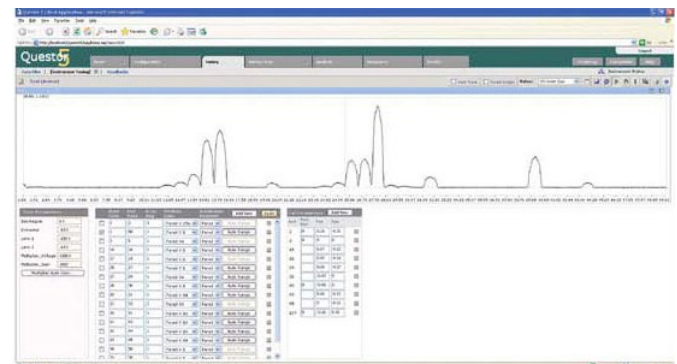


Figure 8. Scan the entire mass range in seconds

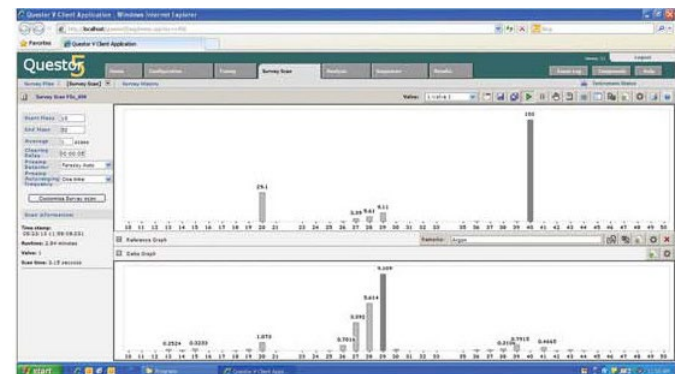


Figure 9. Survey the off-gas for unknown compounds, match their spectra against the built-in library

## Application and Service Support

Since 1964 Extrel has worked hand-in-hand with analytical researchers and understands that each application has its own unique demands. Extrel has experienced salespeople, application scientists, and service engineers ready to provide support and solutions to customers worldwide.

## System Overview

### Mass Spectrometer for Evolved Gas Analysis

- 19 mm quadrupole filter
- Mass range options: 1-200, 1-300, 1-500 amu
- Qualitative characterization
- Quantitative analysis

### Evolved Gas Analysis applications

- Thermogravimetric Analysis-Mass Spectrometry (TGA-MS)
- Pharmaceuticals
- Materials science
- Microreactors/continuous flow systems
- Organic synthesis studies
- Natural product analysis

## Installation Requirements

### Recommended power supply

110 VAC, 50/60 Hz, 10 A circuit  
220 VAC 50/60 Hz, 10 A circuit

### Output power

Nominal: 700 W  
Maximum: 770 W

### Ambient temperature

55-80°F (13-27°C)

### Relative humidity

0-90% non-condensing

### Area classification

General purpose

### Analyzer weight

Approximately 165 lbs (75 kg)

### Analyzer dimensions

Height: 23.5" (60 cm)  
Width: 26.5" (68 cm)  
Depth: 19.0" (49 cm)



## PREMIUM INSIGHTS – GAIN REAL-TIME INSIGHT INTO YOUR PROCESS

Process Insights' products and solutions deliver innovative and differentiated analysis and measurement solutions and technologies that add high value to our customers and protect the environment.

Our commitment is to deliver smart and affordable innovation that optimizes process, improves safety, and transforms our world.

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