

# Mass Spectrometry



Flange  
Mounted  
MS System

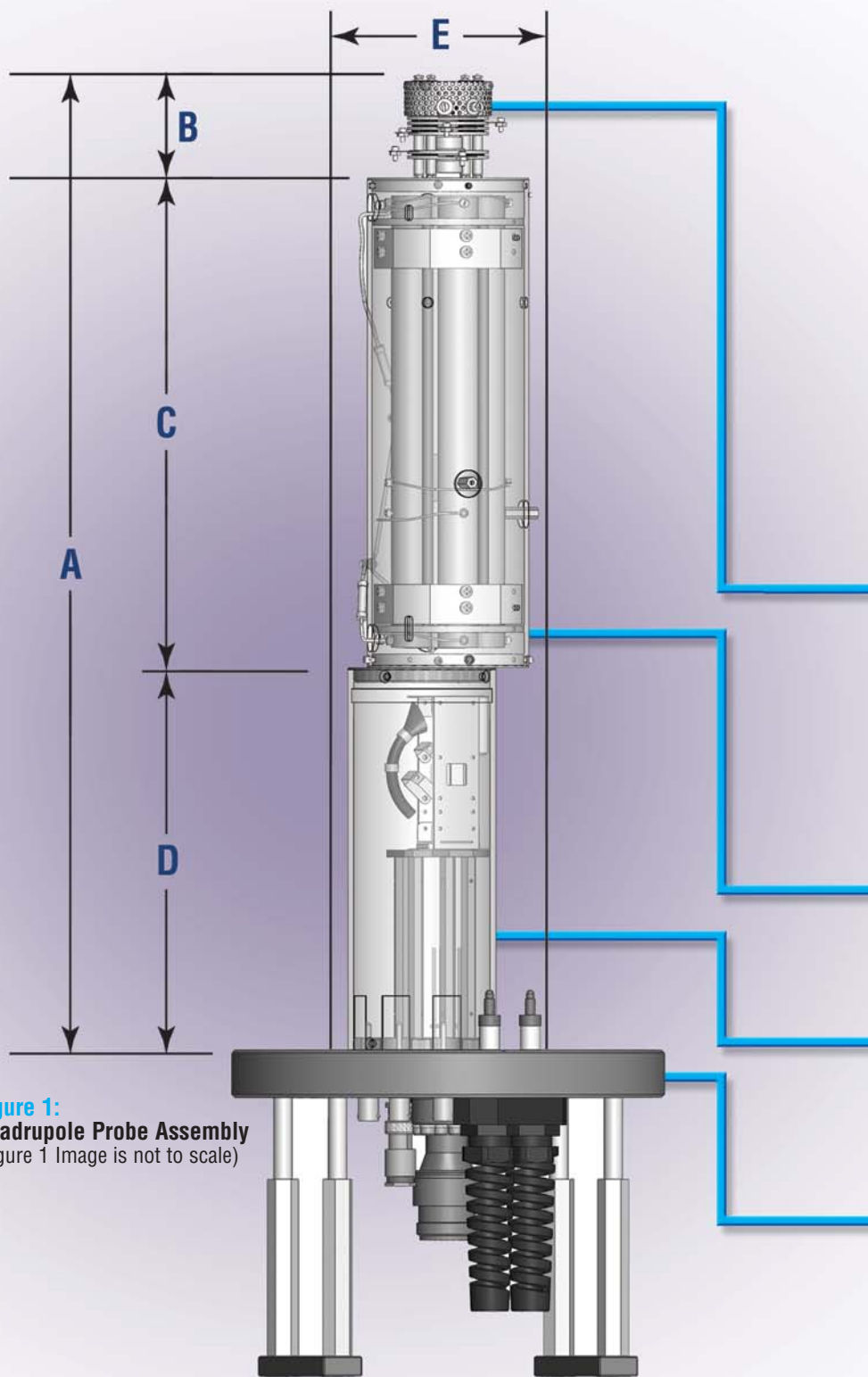
P R O D U C T N O T E



# Extrel MAX Flange Mounted MS System

**T**he Extrel® MAX Systems are UHV-compatible flange mounted Quadrupole Mass Spectrometers. The Ionizer, Quadrupole Mass Filter, and Detector on a Mounting Flange are designed for inclusion in your experimental vacuum chamber. The electronics consist of the rack mountable QCi (Quadrupole Control, integrated) Quadrupole Mass filter power supply and the Merlin CS (Command System). The Merlin mass spectrometer controller software completes the system.

The MAX Systems are based on Extrel's industry-leading mass spectrometer technology centered on our range of RF power supplies and our 9.5 mm and 19 mm tri-filter mass filters. With a broad range of capabilities and available options, as well as Extrel's ability to provide custom designs, the MAX Systems can be configured for an extensive variety of applications.



**Figure 1:**  
Quadrupole Probe Assembly  
(Figure 1 Image is not to scale)

**Table 1:**  
**MAX System Mass Range and Performance**

System	Quadrupole Mass Filter	Operating Frequency	Mass Range	Relative Transmission	Resolution (M/ $\Delta$ M FWHM)	General Sensitivity (mA/Torr)
MAX-16000	9.5 mm (3/8 inch) Tri	440 kHz	20-16000	15%	1000	0.075
MAX-4000	9.5 mm (3/8 inch) Tri	880 kHz	10-4000	20%	1200	0.1
MAX-4000HT	19 mm (3/4 inch) Tri	440 kHz	4-4000	50%	1500	0.75
MAX-2000	9.5 mm (3/8 inch) Tri	1.2 MHz	2-2000	25%	1500	0.3
MAX-1000	19 mm (3/4 inch) Tri	880 kHz	1-1000	50%	1800	1
MAX-500	9.5 mm (3/8 inch) Tri	2.1 MHz	1-500	30%	2000	0.4
MAX-500HT	19 mm (3/4 inch) Tri	1.2 MHz	1-500	60%	2000	2
MAX-120	19 mm (3/4 inch) Tri	2.1 MHz	1-120	65%	2500	3
MAX-50	19 mm (3/4 inch) Tri	2.9 MHz	1-50	75%	3000	4

Note: Performance specifications shown here are minimum production test requirements. Actual performance may be better.

**Section I:**  
**Quadrupole Probe Assembly Hardware**

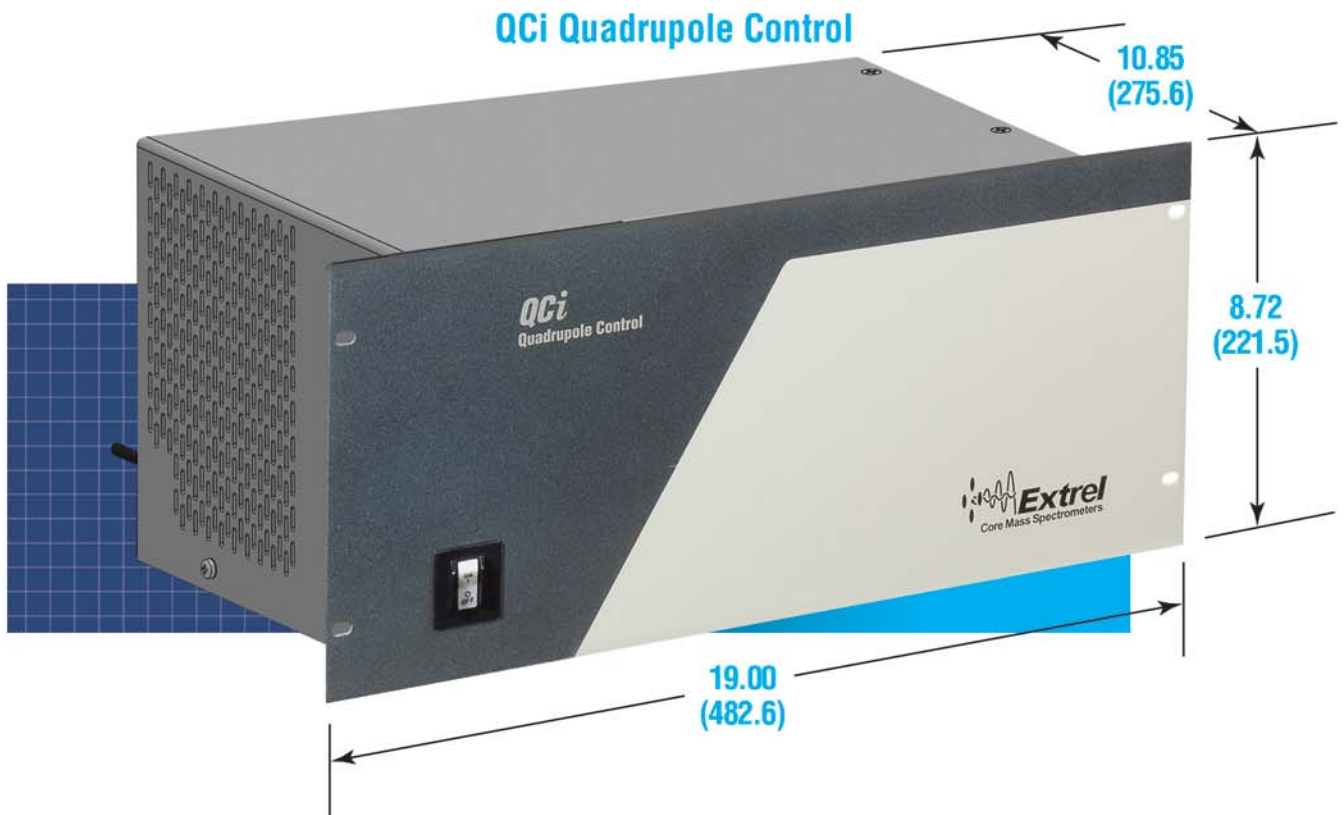
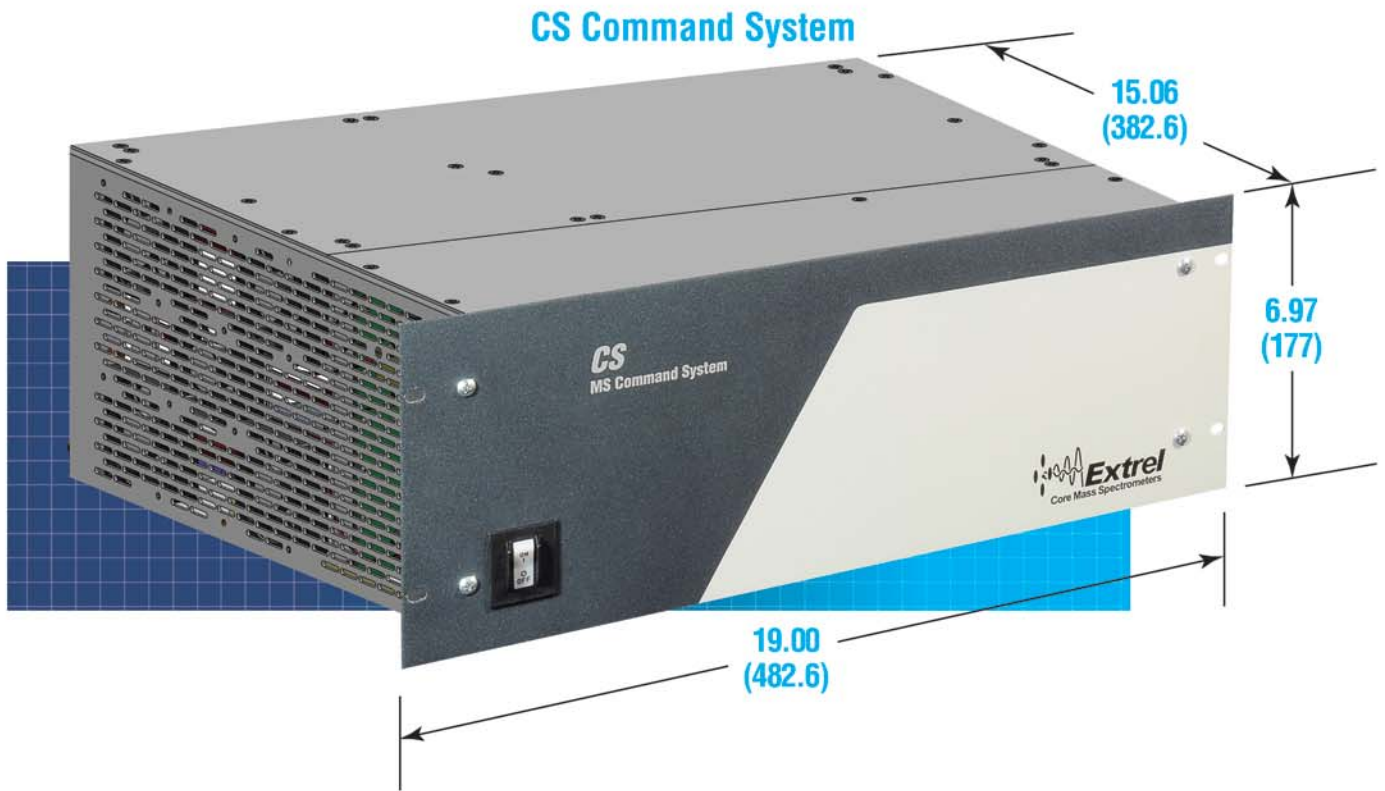
Item	Configurations
<b>Ionizer</b>	<p><b>Axial Molecular Beam Ionizers</b></p> <p>Options:</p> <ul style="list-style-type: none"> <li>Flat Aperture or Sampling Cone</li> <li>Solid or Mesh Shield</li> <li>Tungsten or Thoriated Iridium Filaments</li> </ul> <p><b>Cross Beam Deflector Ionizers</b></p> <p>Options:</p> <ul style="list-style-type: none"> <li>Flat Aperture or Sampling Cone</li> <li>Solid or Mesh Shield</li> <li>Tungsten or Thoriated Iridium Filaments</li> </ul> <p><b>RGA Ionizer</b></p> <ul style="list-style-type: none"> <li>Flat Aperture, Mesh Shield, Tungsten Filaments</li> </ul> <p><b>Cross Beam Ionizers for Photo Ionization</b></p> <ul style="list-style-type: none"> <li>Solid Shield with Tungsten or Thoriated Iridium Filaments</li> </ul> <p><b>Tandem Ionizer, Energy Analyzer</b></p> <p>Options:</p> <ul style="list-style-type: none"> <li>Flat Aperture or Sampling Cone</li> <li>Solid or Mesh Shield</li> <li>Tungsten or Thoriated Iridium Filaments</li> </ul>
<b>Quadrupole Mass Filter</b>	<p><b>9.5 mm (3/8") or 19 mm (3/4") tri-filter mass filter</b></p> <ul style="list-style-type: none"> <li>Solid or Vented Housing</li> <li>Entrance and Exit Lenses</li> </ul>
<b>Detector</b>	<p><b>Counting Electron Multiplier with Conversion Dynode</b></p> <p>≤ 90 cps Noise at 2800 VDC in (-)Ion Mode</p> <p><b>Low Noise CEM with Conversion Dynode</b></p> <p>≤ 3 cps Noise at 2800 VDC in (-)Ion Mode</p>
<b>Mounting Flange</b>	<p><b>100 CF (6") or 150 CF (8") Mounting Flange</b></p> <ul style="list-style-type: none"> <li>35 mm Axial Glass Viewport</li> <li>RF feedthroughs for single quad</li> <li>Single 10-pin feedthrough (Other configurations available)</li> </ul>



# Extrel MAX Flange Mounted MS System

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## Section II: MAX Systems Electronics

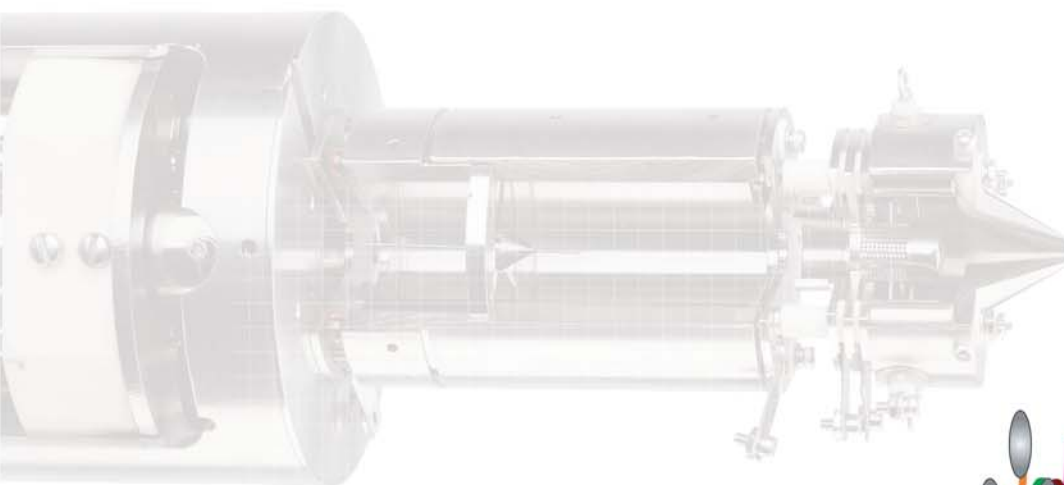


**Table 3:  
Merlin CS & QCi**

Module	Function/Connections
Baseboard	<ul style="list-style-type: none"> <li>■ I/O Connections - 16 Digital I/O, 6 Analog Inputs, 20 Analog Outputs (optional)</li> <li>■ 3 Relay Connections</li> <li>■ 1 Ion Gauge Connection</li> </ul>
Pole DC Supply	<b>DC Voltage and Mass Command for Mass Filter</b> <ul style="list-style-type: none"> <li>■ RF Oscillator Connection</li> </ul>
Filament Supply	<b>Electron Impact Filament Power Supply</b> <ul style="list-style-type: none"> <li>■ Filament Connection</li> <li>■ Ionizer Heater</li> </ul>
Computer Interface	<b>Data System and Raw Signal Data</b> <ul style="list-style-type: none"> <li>■ Preamp</li> <li>■ Vacuum Interlock</li> <li>■ Data System</li> </ul>
Optics Raw Supply	<ul style="list-style-type: none"> <li>■ Optics Source Voltages</li> </ul>
Optics Module	<b>Optics Supply Outputs</b> <ul style="list-style-type: none"> <li>■ 2 +/- 100 VDC Lens Boards</li> <li>■ 4 +/- 400 VDC Lens Boards</li> </ul>
Bipolar Dynode Module	<b>Dynode Power Supply</b>
Bipolar Multiplier Module	<b>Electron Multiplier Power Supply</b>

**MAX System Preamplifier Options**

Item	Standard	Options
Preamplifier	Analog or Positive Ion Pulse Counting	<ul style="list-style-type: none"> <li>■ None</li> <li>■ Analog and Positive Ion Pulse Counting</li> <li>■ Positive and Negative Ion Pulse Counting</li> </ul>



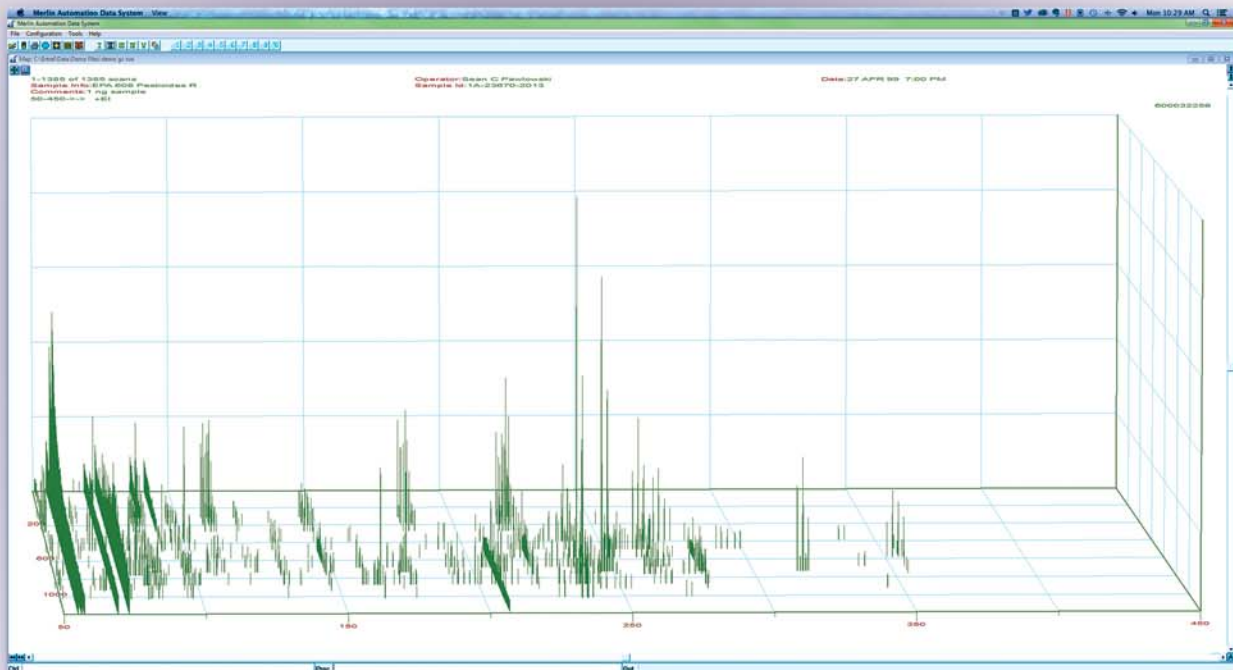
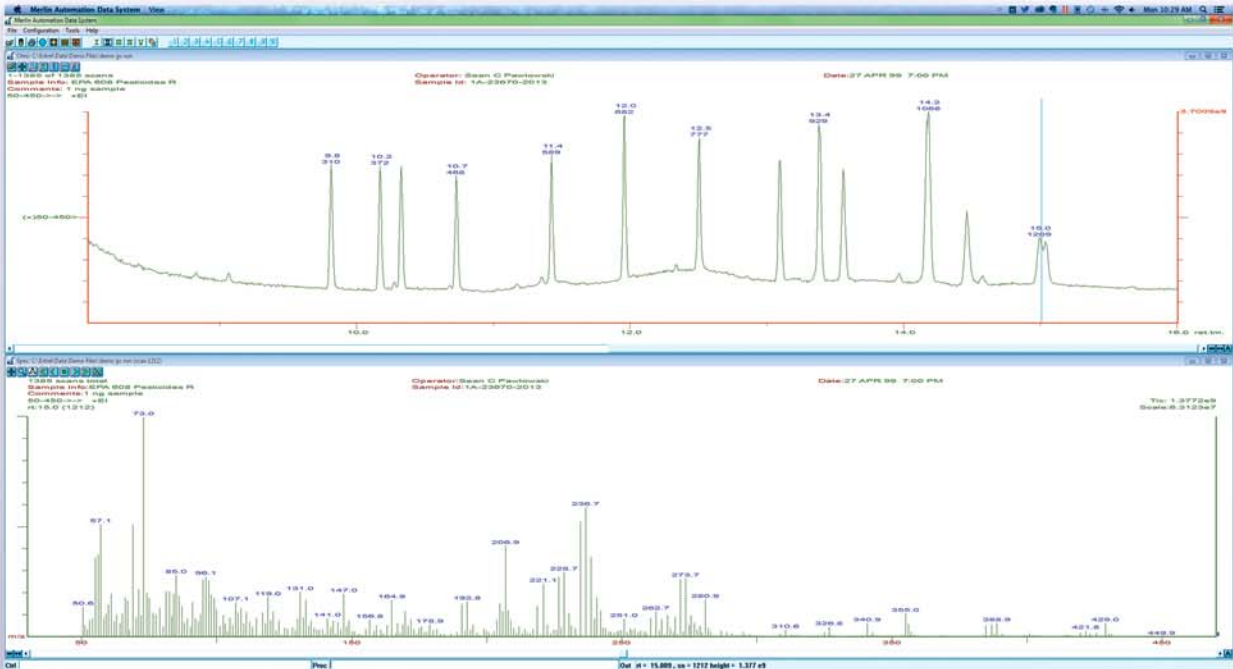
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## Section III: Merlin Automation™ Data System Software

The Merlin Automation Data System is a powerful tool that helps you get the most from your Extrel Quadrupole Mass Spectrometer. Operating in a Windows® XP, or 7 environment, the Merlin Automation Data System Software allows you to simultaneously do high-speed data acquisition

and sophisticated data processing. It is extremely flexible and can be customized for individual applications using simple, easy to write macros. The MAX system comes with everything needed to connect to your PC.



**Table 5:  
Merlin Automation Data System Software Features**

Feature	Description
Spectra Scan	■ 20 separate non-overlapping mass ranges, more available using customer-written Macros
	■ Real-time profile, histogram and chromatograph (TIC) display
	■ Single scan, continuous and external trigger
Single Ion Monitoring	■ 20 SIM masses, more available using customer-written Macros
	■ Real-time profile, histogram and chromatograph (TIC) display
	■ Single scan, continuous, external trigger
MS/MS	■ Monitor and control combinations of up to 4 separate quadrupoles, hexapoles, or octupoles using optional TQMS module
System Control Data Manipulation	■ Averaging and data smoothing
	■ Background subtraction
	■ Trend plotting
	■ Post acquisition centroid
	■ Chromatographic quantitation
	■ Calibration curves

### Serviceability

In building genuine relationships with our customers since 1964, Extrel is focused on providing the support our customers need to meet their goals. We believe that every sale is the beginning of a cooperative effort to achieve the customer's objective. We recognize that every customer requires different levels of support, which is why our systems feature many parts that can be serviced by the user, instead of the instrument needing returned to the factory.

### User-Serviceable

- Multiplier Replacement
- Filament Basket Replacement
- Probe Cleaning
- CS Module Replacement

For those issues which require additional support, Extrel's knowledgeable Factory Trained and Certified support personnel can resolve a variety of customer concerns ranging from simple software issues to more complex application questions without requiring the time or expense of an on-site visit.

Extrel offers a variety of quality training courses that are designed to give you the tools to maintain your system for optimum performance. These courses range from a basic 1-day overview course to a more comprehensive 5-day course conducted at our facility in Pittsburgh, PA or on-site at your facility. Training courses are limited in size to provide the personal attention to address your specific technical and application questions. Regardless of the location, you will receive only Factory Trained and Certified instructors.

### System Upgrades

System upgrades are a fraction of the cost of a new system, and offer the user many of the benefits of a new system. System upgrades typically use the existing vacuum components but replace the obsolete software and hardware to provide the best alternative to a new system. Please contact Customer Service and Support at [support@extrel.com](mailto:support@extrel.com) for current upgrade options.



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## Specifications:

- **Mass Range:**  
1-500 amu  
Other mass ranges available upon request.
- **Stability:**  
Better than  $\pm 0.1$  amu after thermal equilibrium  
Long term stability  $\pm 0.01$  amu
- **Ionization Source:**  
Electron Impact (EI) ionization
- **Mass Filter:**  
Single 19 mm (3/4 inch) or 9.5 mm (3/8 inch) diameter rod Tri-filter  
Quadrupole with RF only  
Pre-filter and Post-filter  
or Triple Quadrupole  
Mass Filter available
- **Detection:**  
Positive and negative ions using electron multiplier with continuous dynode
- **Masses:**  
Continuous monitoring of up to 20 masses or mass windows. Additional masses or mass ranges can be added using easy-to-write Macros.
- **Data System:**  
Merlin Automation data system with Windows 7 or XP compatibility
- **Power Requirements:**  
115 Vac, 50/60 Hz, two 20 A circuits  
Optional 220 VAC version



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QUALITY MANAGEMENT SYSTEM  
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RPF103A