PolarisQ Series
Quadrupole Ion Trap GC/MS™

Optimized for Real-World Sample Analysis

- Dependable performance in ion trap technology
- Unmatched sensitivity in full-scan operation
- Advance to the power of MS™ for incredible selectivity in the dirtiest of matrices
- External source for maximum productivity, reliability, and classical, library searchable spectra

Thermo
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Analyze • Detect • Measure • Control™
The PolarisQ Series GC/MSn from Thermo Electron Corporation is widely recognized in the analytical community for unmatched results, day in and day out – whether it’s in a government environmental lab monitoring the water quality near industrial facilities or a state forensic laboratory tracking clues in a criminal investigation.

Since its introduction, our scientists and engineers have continued to expand the capabilities of the PolarisQ Series and companion Xcalibur™ data system. We have developed new techniques to make this valuable analytical tool an even more powerful performer. Now, in addition to full-scan MS and MSn modes, dual PCI/NCI (PP/NCI™)* and smart Data Dependent™ scanning allow you to more quickly collect data, confirm the identity of compounds, and further reduce sample cleanup costs. The new variable damping gas option, available only on the PolarisQ Series, improves GC/MS sensitivity up to 5x or more across a broad range of real-world samples.

* Pulsed Positive Ion/Negative Ion Chemical Ionization

### PolarisQ Series Quadrupole Ion Traps

The only benchtop ion traps with tandem mass spectrometry at the sensitivity of GC-specific detectors.

The variable damping gas option greatly enhances trace-level detectability for many compounds.
Dirty Samples = No Problem

If you are analyzing complex, real-world samples like milk, vegetables, or even human hair, you know how time-intensive sample cleanup can be. One of the greatest benefits of external ionization ion trap mass spectrometry and MS/MS analysis is the ability to limit interference from the sample matrix. This is possible because MS/MS removes interfering matrix ions, thereby allowing the user to select from one of the product ions for quantitation and confirmation. The advantage is clearly apparent. Compounds can be quickly and confidently identified from a clean “fingerprint” based on their unique structure, eliminating the uncertainties that are inherent in traditional SIM analysis. With external ionization, spectral integrity is also preserved and the ion trap stays clean – injection after injection.

The Advantages of GC and GC/MS Combined in One Versatile Instrument

Every GC/MS system relies on the gas chromatograph to deliver the highest quality separation of the sample to the analyzer. The PolarisQ is paired with the reliable TRACE™ GC Ultra which incorporates a proprietary Column Evaluation feature that locks in retention times for consistent results. At the touch of a button, the GC analyzes each column and automatically sets gas flow and pressure to compensate for column-to-column variations.

The TRACE GC Ultra features industry-leading split/splitless, PTV and Cold On-Column Large Volume Injectors, as well as a wide selection of GC detectors. The GC can be configured with up to two traditional detectors including FID, TCD, ECD, FPD, NPD, PDD, and PID. The Xcalibur data system controls each detector and simultaneously acquires data from the two analog detectors and the PolarisQ mass spectrometer.

For a space-saving option, the PolarisQ paired with the FOCUS GC offers a compact, effective solution for those with limited bench space.
Exchange Ion Volumes in Minutes
Removable ion volumes provide added versatility and convenience for all types of analysis. For example, you can easily switch from GC/MS to probe analysis in under three minutes. With the vacuum interlock option, you can exchange the ion volume without breaking vacuum. This allows you to quickly replace a dirty ion volume with a clean one or change to an ion volume optimized for electron ionization (EI), chemical ionization (CI), or the combined EI/CI ion volume, depending on your application. With the versatile EI/CI volume, use digital CI with Data Dependent acquisition to obtain the molecular ion, the MS/MS spectra, and the EI library-searchable spectra. Now that's a way to increase your sample throughput – fast!

Rugged, High Temperature Source
The PolarisQ features a unique, high temperature ion source that effectively handles the problem of dirty samples and significantly improves overall response stability. The enhanced source incorporates an external passive collector and utilizes construction materials that are able to withstand higher operating temperatures. With an upper limit of 300°C, the source stays cleaner and hundreds of samples can be analyzed before routine source maintenance is required.

Innovation is the Key to Productivity
Thermo's years of continuous innovation make a difference when it comes to offering the best GC/MS for your application.
Wider Dynamic Range

Quantitative performance is a vitally important aspect of any GC/MS system. Our engineers have taken the strength of our system and made it even better. Improvements to the algorithms used to trap ions have enhanced linear dynamic range and spectral quality. The quantitation and spectral consistency range now extends from femtograms (fg) up to nanograms (ng) and beyond.

Systems Custom Built to Your Specifications

One of the benefits of the PolarisQ’s design is the ease with which it can be customized with a variety of options and accessories. This allows you to conveniently order a turn-key system with the added benefit of comprehensive support and training from a single supplier.

Select a standard EPA package or extend your capabilities with single or dual liquid/headscape autosamplers, sample concentrators, specialized injectors, or additional GC detectors. Specify a system that meets your exact requirements; when your applications change, simply reconfigure it right in your lab.

Affordable EI-Only Packages for Routine Analysis

The standard EI version (PolarisQ EI) is fully automated and designed for the analyst who performs routine, high volume GC/MS applications. The optimized external ion source design meets all standard tuning requirements and allows quantitation of samples from the low picogram to the mid-nanogram range.

Whether it’s used for routine environmental analysis, industrial quality control, spectral confirmation, or as a university training instrument, the PolarisQ EI fits the need with an attractive entry-level price.

- Value-packed system for any budget
- Superior software from the MS leader
- Enhanced low mass spectral quality

PolarisQ Features

- Mass range of 10 – 1000 amu
- Wide spectral/quantitative dynamic range
- Combination EI/CI ion volume
- Removable ion volumes
- ± 10 kV conversion dynode
- Powerful Xcalibur data system

Analytical Versatility

- Full-scan EI mode for identifying unknowns – library search information
- MS/MS and MS² modes for targeting difficult compounds
- PCI for molecular weight confirmation
- NCI (ECD-MS) for ultimate sensitivity and selectivity
- Simultaneous full-scan MS and MS/MS in a single analysis
- Variable damping gas option for enhanced sensitivity
- PPINICI – hardware/software option with alternating PCI/NCI scans
- Data Dependent scanning option for advanced spectral pattern recognition

Expanded Capabilities

- Vacuum interlock
- Liquid and headspace autosamplers
- DEP/DIP solids probes
- High-capacity, 250 L/s turbopump system
- Two positions available for traditional GC detectors
- Turn-key applications packages
Sub-picogram Sensitivity with Tandem MS

GC/MS/MS is the most powerful tool available for the chromatographer who has a difficult chromatographic analysis to perform. This is the most selective chromatography technique for samples in difficult matrix. It is applicable to most compounds, and is as simple to use as single ion monitoring (SIM). The superb selectivity allows detection and quantitation at sub-picogram levels for target analytes in matrices such as plant and animal tissues, soils and sludge, biological fluids, and milk.

MS/MS is as easy to use and set up as single ion monitoring. In fact, they are quite similar. SIM requires you to know the expected retention time and the desired ion to monitor. MS/MS uses the same retention time and SIM ion. The major difference in SIM and MS/MS is one added step to calculate the energy required to perform MS/MS. This is determined in a simple automated fashion with the powerful Xcalibur software. In a matter of one or two injections for method development, you can be performing MS/MS analyses.

- Unequalled performance in difficult matrices
- Setup as simple as single ion monitoring
- Far higher degree of confidence – eliminates false positives and false negatives

Selective Matrix Elimination

Adding the power of MS/MS allows the analyst to routinely test for compounds that cannot be detected with other GC/MS techniques. It provides the ultimate in selectivity for target analytes, eliminating false positives and false negatives.
Mass chromatograms of the MS/MS analysis of 2,3,7,8-TCDD in milk and nonane standard from a spike of the CS3 calibration mixture into a 25 gram cow’s milk extract. This is equivalent to 10 pg/µL injected or 40 pg/g (parts per trillion) in the cow’s milk. This is a 2 µL split injection (15:1), theoretically 1.3 pg injected on-column.

Flame Retardant in Pond Water

4 ppt 2,2',4,4',6-Pentabromobiphenyl ether in pond water

Full-scan spectrum of 4 fg/µL 2,2',4,4',6-PBDE spiked into pond water.

MS/MS product ion of 2,2',4,4',6-PBDE spiked into pond water.

MS/MS product ion of 2,2',4,4',6-PBDE spiked into benzene.

Theoretical product ion cluster of a pentabromodiphenyl ether.

Dioxins in Cow’s Milk

40 ppt 2,3,7,8-TCDD in milk matrix and nonane standard

Full-scan spectrum of 4 fg/µL 2,3,7,8-TCDD in milk matrix.

MS/MS product ion of 2,3,7,8-TCDD in milk matrix.

MS/MS product ion of 2,3,7,8-TCDD in nonane standard.

Theoretical product ion cluster of a pentabromodiphenyl ether.
Positive Ion Chemical Ionization (PCI)

Positive ion chemical ionization is well established as a tool to determine the molecular weight of compounds. It is also used for quantitative analysis of target analytes that do not have structurally significant ions in the traditional EI mode. Other uses include trace analysis of components where the reagent gas selectively reacts with the analytes of interest preferentially to the matrix.

The reagent gas pressure inside the ion source determines the quantitative reproducibility. These variations are minimized in the PolarisQ by incorporating electronic flow control of the reagent gas. The method software controls this flow so that any time the data system activates the analytical method, a precise flow of the CI reagent gas is delivered to the mass spectrometer. Calibration curves are stable from day to day and quantitative precision is improved.

- Digital electronic flow control of reagent gas
- Improved quantitative accuracy and precision
- Reproducible ion ratios

Negative Ion Chemical Ionization (NCI)

Negative ion chemical ionization is a selective and extremely sensitive technique for the type of compounds that typically respond in an electron capture detector (ECD). These include electronegative compounds such as PCBs, dioxins, explosives, derivatized drugs, and others. Negative CI quantitation and day-to-day reproducibility is, of course, enhanced with the use of electronic reagent gas flow control. In addition, the combination of MS/MS with negative CI is the most selective analytical tool available when using a benchtop GC/MS. Femtogram sensitivities are possible for electronegative compounds.

- Ultimate selectivity for electronegative compounds
- Negative CI is the best solution for ultra-trace levels
- Precise day-to-day quantitation with digital reagent gas flow control

PCI, complete with confirmatory adduct ions, is a powerful complementary tool for toxicological analysis.
**PPINICI**

The new PPINICI (Pulsed Positive Ion/Negative Ion Chemical Ionization) option is a valuable instrument control technique that allows the simultaneous acquisition of positive and negative ions formed by chemical ionization. In effect, one injection yields two chromatograms—one from positive ion CI, the other from negative ion CI. Because of the complementary nature of positive and negative ion spectra, providing both types of data concurrently results in a more thorough mass spectrometric analysis. PPINICI can be combined with full-scan MS or MS/MS, to give comprehensive information on a compound in a minimum amount of time.

Below are the key elements that make PPINICI possible with the PolarisQ:

- External ionization allows both positive and negative ion CI
- The CI option supplies high pressure methane or other reagent gases to ionize molecules by the indirect chemical ionization process
- The conversion dynode’s fast (<25 ms) voltage switching allows alternating polarities between scans
- Xcalibur software filters the raw data into different chromatograms based on polarity or mass scanning technique

**Variable Damping Gas Control**

Only the PolarisQ GC/MS includes a variable damping gas option. This allows you to increase the amount of helium pressure in the ion trap independent of the column carrier gas. The increased helium pressure traps more ions per unit time thereby increasing detectivity, especially in MS/MS mode. This option can increase the detected area of compounds 500% or more.

Trace levels of pesticides in a vegetable matrix, such as in the example shown at right, could go undetected using standard GC/MS or GC/MS/MS methodology.

Full-scan MS and MS/MS analysis of o-phenyl phenol at 3.3 pg/µL in carrot matrix showing enhanced detectivity with increasing damping gas flow.
Data Dependent™ Scanning Facilitates Method Development

Data dependency is a powerful and time-saving tool for dynamic and complex qualitative analyses. Data dependent algorithms probe mass spectra for ions matching given mass selection settings. The list of ions is compiled in an intensity-sorted dependent mass list that is used for MS/MS scans in subsequent events. Data dependency allows MS^n methods to be written without knowing in advance what specific precursor ions may be found during an analysis. Additional data are obtained without spending time running multiple methods. You benefit from library-searchable full-scan MS spectra and additional structural information from the MS^n data.

Solids Probe

Solids probes are most often used for qualitative or semi-quantitative analysis of materials that are difficult, if not impossible to elute chromatographically.

With a GC injection, polar high-molecular weight compounds will often decompose during the volatilization process leaving the analyst with a spectrum containing the desired compound as well as the decomposition products. Our Direct Exposure Probe (DEP) and Direct Insertion Probe (DIP) are especially suited to analysis of thermally labile compounds. Both are controlled by a single, easy-to-use controller.

• Ideal for thermally labile samples
• Convenient, interchangeable probe types

Interchangeable solids probe tips:
(1) Direct Exposure-DEP
(2) Direct Insertion-DIP

The ion ratio dependence algorithm can be used to locate [M + H]^+ ions by the [M + 29]^+ and [M + 41]^+ methane CI adduct ions. The MS/MS product-ion spectra of [M + H]^+ ions reveal the ions necessary to separate co-eluting compounds into separate mass chromatograms.

A Full Range of Analysis and Reporting Options

Probe generated methane CI spectrum from the analysis of a Viagra tablet. [M + H]^+ and [M + 29]^+ confirm the identity of Sildenafil.
Xcalibur – A Unified Platform for MS

One intuitive platform for GC/MS, LC/MS and Advanced MS instruments provides confident control from method development to reporting.

Xcalibur is the most powerful data system available today, delivering a unique combination of functionality, system control, and ease of use. The software is designed to guide you through your daily analytical tasks. This powerful simplicity combined with the advanced features of the Microsoft® Windows® Operating System and Microsoft Office productivity tools provides an analytical platform second to none.

PolarisQ generates library-searchable, quality spectra regardless of matrix and concentration. This is a vital asset when dealing with complex unknown samples. Use commercial libraries, NIST, Wiley, Pfleger-Maurer-Weber, or build your own. Xcalibur allows simple exporting of spectra and has powerful editing tools to aid you in quickly generating your own user libraries. Xcalibur also allows you to search multiple libraries simultaneously. Thus, you can easily match your unknown against multiple libraries for confident identification.

Xcalibur provides complete control of the TRACE GC Ultra or FOCUS GC, mass spectrometer and optional liquid and headspace autosamplers. Xcalibur contains a built-in audit trail to ensure compliance with your laboratory's SOP's and Quality programs.

Generating and producing reports from your data has never been easier than with the Merlin reporting package in Xcalibur. Merlin allows you to quickly specify each piece of information, mass trace, instrument setting, etc. you wish to include in your report. Simple drop-down menus and "drag-and-drop" objects provide complete flexibility for your reporting needs. The report template is saved in a standard Microsoft Word .doc format, which is automatically activated at the end of a run or sequence. Any number of templates can be created to meet the sample type requirements.

Integrates layered applications including:
- Open Access™ – Select from predefined methods for "click and go" sample analysis.
- Mass Frontier™ – Interpret mass spectral data with tools for fragments, structures, isotope patterns, spectral classification, and more.
- EnviroLab™ Forms – Automated reporting forms package designed for the regulated environmental laboratory.
- ToxLab™ Forms – User-friendly layered application providing automated reports for the toxicological laboratory.

Merlin quantitative reports, such as this EPA 8270 list, show concentration levels of target compounds in any given sample.

Library match for DFTPP.
Routine Maintenance is Quick and Tool Free

The PolarisQ has been designed for maximum uptime but when routine maintenance is required, it is easier than ever to perform. The entire PolarisQ ion trap assembly offers tool-free access and lifts out for easy cleaning. An optional vacuum interlock system allows the user to exchange ion volumes and be up and running again in under three minutes.

Standard Options/Accessories

MS/MS and MS\(^{n}\) analysis, variable damping gas control, CI, PPNICI, Data Dependent scanning, solids probe, liquid and headspace autosamplers, purge and trap concentrators, or additional GC detectors.

Major Application Areas

Environmental, Sports Medicine, Forensic Toxicology, Food and Agriculture, Drugs of Abuse, Arson Investigation, Pesticides, Water, Soil, Sludges, Adulteration, Additives, Flavor and Fragrances, Pharmaceuticals, Residual Solvents, Petroleum and Petrochemicals, MW Determinations, Chemical Synthesis

† Minimum specifications change frequently, call for latest.

Thermo Columns and Consumables

Thermo’s enhanced TRACE GC columns, syringes and consumables, including injection port liners, ferrules, and septa, are designed to complement Thermo’s innovative range of GC and GC/MS systems. This wide range of consumables and accessories is designed to offer application-focused solutions to customers in the environmental, forensic, toxicology, food and beverage, and pharmaceutical industries.

In addition to these offices, Thermo Electron Corporation maintains a network of representative organizations throughout the world.

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Laboratory Solutions Backed by Worldwide Service and Support

State-of-the-art instruments are only the beginning with Thermo Electron. Comprehensive service and support programs are offered on our products worldwide by a network of factory trained and highly qualified scientists and engineer

Tap our expertise throughout the life of your instrument. As an industry leader in analytical instruments, Thermo extends its support throughout our worldwide network of Thermo-trained and certified engineers who are experts in laboratory technologies and applications. Put our team of experts to work for you in a range of disciplines, from system installation, training and technical support, to complete asset management and regulatory compliance consulting. Improve your productivity and lower the cost of instrument ownership through our product support services. Maximize uptime while eliminating the uncontrollable cost of unplanned maintenance and repairs. When it’s time to enhance your systems, Thermo also offers certified parts and a range of accessories and consumables suited to your application.

To learn more about our products and comprehensive service offerings, visit our Web site at www.thermo.com.