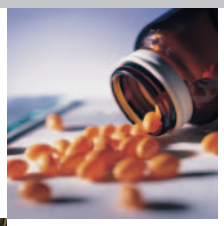
The Thermo Scientific TSQ Quantum GC defines a new standard of excellence in GC-MS/MS for multi-component target compound analysis in environmental, food safety, pharmaceutical, toxiological, and clinical research laboratories.

Thermo Scientific TSQ Quantum GC

The Next Evolution in GC-MS/MS Systems



- **Highest selectivity even in complex samples with enhanced resolution *(H-SRM)***
- **Analyze more than 1000 compounds per run, with two transitions each**
- **Simultaneous quantitation and confirmation with QED-MS/MS**
- **Mass range up to *m/z* 3000**
- **Scan speeds: up to 5000 u/s**
- **PPINICI™ – pulsed positive ion negative ion chemical ionization for sample screening**
- **Convertible between GC/MS and LC/MS**

With the TSQ Quantum GC™ Thermo Fisher Scientific continues the successful and well-known TSQ™ triple quadrupole mass spectrometer series, now combined with the power, performance and flexibility of the Thermo Scientific TRACE GC Ultra gas chromatograph.

The TSQ Quantum GC delivers unsurpassed performance, even in complex matrix, through the incorporation of the field-proven DuraBrite™ ion source, precision hyperbolic quadrupoles, highest ion transmission and innovative detection technology. The TSQ Quantum GC is the most selective and sensitive GC-triple quadrupole mass spectrometer available today.

State-of-the-art electronics and comprehensive diagnostics are hallmarks of our instruments. You have total instrument control at your fingertips through the easy-to-use Thermo Scientific Xcalibur software.

With these industry-leading features, the TSQ Quantum GC defines the new standard of excellence in GC-MS/MS analysis.

Hardware Features

DuraBrite Source

- DuraBrite source allows detection of low-level analytes in challenging matrices and provides unparalleled high uptime along with increased sensitivity
- No tools required for routine source maintenance
- Durable materials guarantee long life and simple maintenance
- Exchange ion volumes in minutes without breaking system vacuum
- Standard EI, CI, CEI or EI/CI ion volumes, maximizing performance in EI, positive ion CI, and negative ion CI
- Computer-controlled CI reagent gas flow control for high quantitative accuracy and day-to-day calibration stability
- Unique electron lens isolates filament from contaminants of the source, increases lifetime, and improves ionization efficiency
- Electron beam collimating magnets further increase ionization efficiency
- Electron energy adjustable between 0 and 140 eV
- Emission current up to 1000 µA
- Independently controlled heating from 125–300 °C for stable operation and superior chromatographic integrity
- GC interface temperature up to 350 °C

Triple Quadrupole Mass Analyzer

- Mass range of *m/z* 10–3000
- Patented HyperQuad™ mass analyzers provide superior and unique combination of resolution and sensitivity
- Highest compound selectivity with H-SRM at 0.4 Da peak width (FWHM)
- Multi-compound detection with up to 3000 SRM transitions in one run
- Fast scan speed of more than 300 SRM/s
- 90° high-efficiency square quadrupole collision cell with noise-reducing geometry
- CID gas pressure programmable through the software
- Variable peak width selection in all scan modes
- Scan rate of 5,000 u per second

Vacuum System

- Unique close-coupled triple inlet turbo molecular pumping 270 L/s
- Two stages of pumping provide optimal vacuum throughout GC/MS/MS analyzer
- Single mechanical pump 30 L/min, floorstanding

Inlet/Vacuum Interlock

- Allows easy exchange of ion volumes for fast switching from EI to CI, from GC to probe analysis, and for routine source maintenance without breaking vacuum

Detection System

- Patented detection system uses a fast switching (< 95 ms) post-acceleration conversion dynode with ±15 kV applied voltage
- Off-axis continuous dynode electron multiplier with increased dynamic range
- System integrated electron multiplier eliminates field emission and microphonic noise
- Centroid or profile data acquisition modes
- PPINICI mode to acquire positive ion CI and negative ion CI spectra in alternating scans

Scan Functions

- Highly sensitive Full-Scan MS in Q1 or Q3
- Selected Ion Monitoring (SIM) in Q1 or Q3
- Selected Reaction Monitoring (SRM) for demanding quantitative assays
- Highly Selective Reaction Monitoring (H-SRM) for optimal selectivity
- Product Ion Scan
- Precursor Ion Scan
- Neutral Loss Scan

Advanced Data-Dependent™ Experiments

- Available from all scan functions
- Dynamic Exclusion™ allows acquisition of MS/MS spectra from lower intensity ion species
- Polarity switching capabilities
- AutoSIM
- Quantitation-enhanced Data-dependent MS/MS (QED-MS/MS) for simultaneous compound confirmation and quantitation
- Reverse Energy Ramp MS/MS spectra (RER) gives information rich MS/MS spectra for solid compound identification

TRACE GC Ultra Gas Chromatograph

See the TRACE GC Ultra™ product specification for additional specifications for the gas chromatograph.

- Multi-level temperature program with seven ramps and eight levels settable from 0.1–120 °C/min
- Eight independent, heated zones for individual control of injectors and detectors plus auxiliary zones
- Capillary split/splitless injectors with Digital Pressure and Flow Control (DPFC) including gas saver
- Maximum oven temperature 450 °C
- Superior oven cool-down for increased sample productivity, from 450 °C–50 °C in 250 seconds

GC Options

- Broad range of GC options for maximum versatility
- Sub-ambient cooling to -99 °C with LN_2 or -55 °C with CO_2
- Optimized Geometry Split/splitless injector (SSL), temperature range 50 °C to 400 °C in 1 °C increments. Standard with large volume splitless capability for injection volumes up to 50 µL with concurrent solvent recondensation.
- B.E.S.T. PTV cold injection system for split/splitless, large volume and automated on-column injections, heating rate: up to 14.5 °C/sec (870 °C/min). Programmability: 3 ramps/4 plateaus. Air-cooled down to few degrees above ambient temperature. Sub-ambient: -50 °C with liquid N_2, -30 °C with CO_2 options.
- AI/AS 3000 Series II autosampler ideal for routine liquid sample injections
- TriPlus autosampler for liquid, headspace and solid phase microextraction (SPME*) sampling capabilities
- Purge and Trap, thermal desorption and other autosampler options available

Direct Probe System Option

- Quick, simple method for sample introduction directly into the ion source
- Direct Inlet Probe (DIP) for using aluminum crucibles, max. temp. 350 °C
- Direct Exposure Probe (DEP/DCI) analysis of highly polar, thermally labile, or suspended solid compounds using fast heating filament with max. temp. ca. 1600 °C
- Powerful screening techniques that are compatible with all modes of ionization and mass analysis
- Switch to probe in under three minutes with GC interface undisturbed

LC-MS Options

- Convertible to LC-MS mode by replacing EI/CI source with an optional dedicated LC-MS source
- Interchangeable ESI and APCI ionization probes
- Ion Max™ API source
- Enhanced sensitivity and ruggedness
- Sweep gas reduces chemical noise
- Optimal 60-degree spray angle for best sensitivity and ruggedness
- APPI/APCI combination probe
- Removable ion transfer tube provides vent-free maintenance
- High temperature, self-cleaning APCI heater employing state-of-the-art ceramic heater technology
- X, Y, and Z probe positioning adjustments for all ionization probes
- Automatic source recognition for ease of use and simplified data logging

- Automated valve for making manual loop injections or diverting LC flow stream to waste
- Automated infusion with syringe pump
- Automated loop injection from syringe pump for analyte optimization

** Sold under license from Supelco®*

System Control

- Embedded computer with Motorola PowerPC processor
- Integrated Serial Peripheral Interconnect (SPI) bus
- I/O coprocessor with nonvolatile memory
- AD SHARC digital signal processor (DSP) for dedicated instrument control
- 100BASE-T Ethernet port for instrument data system communications

Data Acquisition

- Real-time, high-speed, digital signal processing with dedicated AD SHARC DSP
- Digital sampling rate up to 195,000 samples per second
- High-resolution centroiding

Instrument Diagnostics

- Graphical diagnostics for all power supplies, electronic circuits and pumping system
- Remote access allows Thermo Fisher Scientific engineers to troubleshoot via modem
- Electronic logbook of diagnostic results

Data System

- Xcalibur™ processing and instrument control software
- Autotune
- Autocalibration
- Data system control of GC, MS and autosamplers
- Superior comprehensive instrument diagnostics
- QuanLab™ Forms 2.5 software for routine data analysis and reporting
- Automated optimization of all instrument parameters including gas pressures and collision energy within an experiment
- High performance PC with Intel® Core™ 2 Duo and Microsoft® Windows® operating system
- 19-inch viewable ultra sharp flat-screen display monitor

Optional Application-Specific Software

- ToxLab™ Forms and EnviroLab™ Forms are ideal for toxicology and environmental applications
- LCQUAN™ quantitation software supports 21 CFR Part 11 compliance
- MetWorks™ – automated metabolite identification using spectral trees
- Mass Frontier™ – spectral interpretation and classification software to identify unknowns
- NIST library, now including MS/MS spectra
- Wiley library
- Maurer-Weber-Pfleger library
- Pesticide library

Performance Specifications

GC/MS Specifications

All evaluations performed using a TRACE™ TR-5MS SQC, 15 m x 0.25 mm ID (0.25 micron film thickness) fused silica capillary column.

Installation Specifications

Electron Ionization SRM

Hot splitless injection of 1 µL of a 100 fg/µL standard of octafluoronaphthalene (OFN) in iso-octane will produce a minimum signal-to-noise ratio of **500:1** for the transition of *m/z* 272 to the product ion of *m/z* 241 when operated in selected reaction monitoring mode (SRM) at five scans per second, using resolution of 0.7 Da FWHM.

Positive Chemical Ionization SRM

Hot splitless injection of 1 µL of a 100 fg/µL standard of benzophenone (BZP) in *n*-heptane will produce a minimum signal-to-noise ratio of **150:1** for the transition of the protonated molecular ion at *m/z* 183 to the fragment ion at *m/z* 105 when operated in selected reaction monitoring mode (SRM) at five scans per second with resolution set to 0.7 Da FWHM and methane as reagent gas.

Typical Specifications

Electron Ionization Full Scan

Hot splitless injection of 1 µL of a 1 pg/µL standard of octafluoronaphthalene (OFN) in iso-octane will produce a minimum signal-to-noise of **400:1** for *m/z* 272 when scanning from 200 – 300 Da at five scans per second.

Electron Ionization SIM

Hot splitless injection of 1 µL of a 50 fg/µL standard of octafluoronaphthalene (OFN) in iso-octane will produce a minimum signal-to-noise of **50:1** for *m/z* 272 when operated in selected ion monitoring mode (SIM) at five scans per second, with resolution set to 0.7 Da FWHM.

Positive Chemical Ionization Full Scan

Hot splitless injection of 1 µL of a 10 pg/µL standard of benzophenone in *n*-heptane will produce a minimum signal-to-noise of **25:1** for the protonated molecular ion at *m/z* 183 when scanning from 80 – 230 Da at 2 scans per second with methane as reagent gas.

Negative Chemical Ionization Full Scan

Hot splitless injection of 1 µL of a 1 pg/µL standard of OFN in iso-octane will produce a minimum signal-to-noise of **5000:1** for *m/z* 272 when scanning from 200–300 Da at five scans per second with methane as the reagent gas.

Negative Chemical Ionization SIM

Hot splitless injection of 1 µL of a 10 fg/µL standard of OFN in iso-octane will produce a minimum signal-to-noise of **150:1** for *m/z* 272 when operated in selected ion monitoring mode (SIM) at five scans per second, with resolution set to 0.7 Da FWHM and methane as reagent gas.

Optional LC/MS Specifications

Electrospray (ESI)

A 5 µL loop injection of a 2 pg/µL (3.250 fmol/µL) reserpine solution at a flow rate of 400 µL/min 50/50 IPA/water will produce a minimum signal-to-noise ratio of 100:1 for the transition of the protonated molecular ion at *m/z* 609.3 to the fragment ion at *m/z* 195.1 when operated in selected reaction monitoring mode (SRM) with Q1 and Q3 resolution set to 0.7 Da FWHM.

Atmospheric Pressure Chemical Ionization (APCI) and Atmospheric Pressure Photoionization (APPI)

A 5 µL loop injection of a 2 pg/µL (3.250 fmol/µL) reserpine solution at a flow rate of 1 mL/min 50/50 IPA/water will produce a minimum signal-to-noise ratio of 100:1 for the transition of the protonated molecular ion at *m/z* 609.3 to the fragment ion at *m/z* 195.1 when operated in selected reaction monitoring mode (SRM) with Q1 and Q3 resolution set to 0.7 Da FWHM.

Product Specifications

System Dimensions/Weights

Complete GC/MS system requires 2.5 m of workbench space. Optional LC will require additional workbench space.

TSQ Quantum GC

(height x width x depth)
69 x 56 x 79 cm (27 x 22 x 31 in)
Weight: 118 kg (260 lbs)

TRACE GC Ultra

44 x 61 x 65 cm (17 x 24 x 26 in)
Weight: 55 kg (121 lbs)

Minitower Computer

48 x 18 x 43 cm (19 x 7 x 17 in)
Weight: 14 kg (31 lbs)

Monitor

41 x 41 x 43 cm (16 x 16 x 17 in)
Weight: 5 kg (11 lbs)

Forepump

30 x 20 x 64 cm (12 x 8 x 25 in)
Weight: 34 kg (75 lbs)

Laser Printer

20 x 41 x 46 cm (8 x 16 x 18 in)
Weight: 7 kg (15 lbs)

Installation Requirements

Power

TSQ Quantum GC System

- One 230 V AC ± 10% at 30 amps, 50/60 Hz, single phase, with earth ground, dedicated to the instrument

Data System

- 120 V AC at 10 amps or 230 V AC at 5 amps, single phase, with earth ground

Optional Liquid Chromatograph**

- 120 V AC at 10 amps or 230 V AC at 5 amps, single phase, with earth ground
- Stable voltage, free of spikes

*** Values are for the Thermo Scientific Accela system. Other LC systems will vary.*

Gas

- Collision gas: 99.995% pure Argon
- Helium: purity 99.999% with less than one ppm each of water, oxygen, and total hydrocarbons
- Collision gas pressure: 135 ± 70 kPa (20 ± 10 psig)
- CI reagent gases: methane, isobutane, ammonia or carbon dioxide with purity 99.99%
- One high-purity (99% pure) nitrogen gas supply for the API source (optional). Required pressure is 690 ± 140 kPa (100 ± 20 psi). Maximum consumption of nitrogen gas is 20 L/min (56 SCFH). (Optional, for LC/MS)

Environment

- System averages 4,420 W (15,380 Btu/h) output when considering air conditioning needs. Operating environment must be 15–27 °C (59–81 °F) and relative humidity must be 40–80% with no condensation.
- Optimum operating temperature is 18–21 °C (65–70 °F)
- Functional temperature range: 15–27 °C (59–81 °F)
- Optimal temperature range: 18–21 °C (65–70 °F)
- Particulate matter: < 100,000 particles of > 5 µm diameter per cubic foot of air (< 3,500,000 particles per cubic meter of air)
- Relative humidity: 20–80%, without condensation
- Floors must be free of vibration

Thermo Fisher Scientific, San Jose, CA USA is ISO Certified.

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