

The Thermo Scientific
TSQ Quantum GC™ defines
a new standard of excellence
in GC-MS/MS for environmental
food safety, pharmaceutical, and
clinical research laboratories.

TSQ Quantum GC

The Next Evolution in GC-MS/MS Systems



- **Switchable between GC/MS and LC/MS**
- **Mass range up to m/z 3000**
- **Scan speeds: up to 5000 u/s**
- **Over 300 SRM transitions per second**
- **Highest selectivity with enhanced resolution (H-SRM)**
- **Simultaneous quantitation and confirmation with QED-MS/MS**
- **PPINICI™—pulsed positive ion negative ion chemical ionization for sample screening**

With the TSQ Quantum GC Thermo Fisher Scientific continues the successful and well known TSQ™ triple quadrupole mass spectrometer series.

The TSQ Quantum GC incorporates the field-proven sensitive and rugged DuraBright™ source, which, in conjunction with our precision hyperbolic quadrupoles that provide the highest ion transmission and peak shape, and detection technology, results in the most sensitive triple quadrupole instrument 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 Xcalibur™ software.

With these industry-leading features, the TSQ Quantum GC, with the TRACE GC Ultra™ and the TriPlus™ Autosampler, defines the new standard of excellence in GC-MS/MS analysis.

Hardware Features

DuraBright Source

- DuraBright source allows detection of low-level analytes in challenging matrices and provides unparalleled high uptime along with increased sensitivity
- No tools required for source maintenance
- Durable materials guarantee long life and simple maintenance
- Exchangeable ion volumes
- Standard EI and CI 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 μ A
- 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
- H-SRM (Q1, Q3) at 0.4 FWHM
- 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, floor-standing

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 option 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 the most demanding quantitative assays
- Product Ion Scan
- Precursor Ion Scan
- Neutral Loss Scan

Advanced Data-Dependent™ Experiments

- Available from all scan functions
- Dynamic Exclusion™ allows acquisition of MSⁿ 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

- 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

- Sub-ambient cooling to -99 °C with LN₂ or -55 °C with CO₂
- Optimized Geometry Split/splitless injector (SSL), temperature range 50 °C to 400 °C in 1 °C increments.
- B.E.S.T. PTV cold injection system for split/splitless 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 N₂, -30 °C with CO₂ options.
- TriPlus liquid, headspace or solid phase micro extraction (SPME) autosampler(s)
- Purge and Trap and other autosampler options available

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

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

- Ion Max™ API source
- Enhanced sensitivity and ruggedness
- Sweep gas reduces chemical noise
- Optimal 60-degree spray angle for best sensitivity and ruggedness
- Interchangeable ESI and APCI ionization probes
- 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

* Sold under license from Supelco®

- 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

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 all instrument parameters
- Superior comprehensive instrument diagnostics
- Automated optimization of all instrument parameters including gas pressures and collision energy within an experiment
- High performance PC with Intel® Pentium® microprocessor and Microsoft® Windows® operating system
- 19-inch viewable ultra sharp flat-screen display monitor
- Black and white laser printer

Optional Application-Specific Software

- 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
- Pflieger-Maurer-Weber library
- Pesticide library

Performance Specifications

- *GC/MS Specifications*
All evaluations performed using an Rtx®-5MS, 15 m × 0.25 mm ID (0.25 micron film thickness) fused silica capillary column.
- *Electron Ionization Full Scan*
Hot splitless injection of 1 µL of a 1 pg/µL (3.67 fmol/µL) standard of octafluoronaphthalene (OFN) in iso-octane will produce a minimum signal-to-noise of 100:1 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 (183.8 amol/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. Q1 or Q3 resolution set to 0.7 Da FWHM. If required this specification can also be performed with Q1 or Q3 resolution set to 0.4 FWHM.
- *Positive Chemical Ionization Full Scan*
Hot splitless injection of 1 µL of a 10 pg/µL (54.9 fmol/µL) standard of benzophenone in n-heptane will produce a minimum signal-to-noise of 10:1 for the protonated molecular ion at m/z 183 when scanning from 80–230 Da at 2 scans per second with methane as the reagent gas.
- *Positive Chemical Ionization SRM*
Hot splitless injection of 1 µL of a 2 pg/µL (11.0 fmol/µL) standard of benzophenone in n-heptane will produce a minimum signal-to-noise ratio of 200:1 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 Q1 and Q3 resolution set to 0.7 Da FWHM with methane as the reagent gas. If required this specification can also be performed with Q1 resolution set to 0.4 FWHM.

- *Negative Chemical Ionization Full Scan*
Hot splitless injection of 1 µL of a 1 pg/µL (3.67 fmol/µL) standard of OFN in iso-octane will produce a minimum signal-to-noise of 1000:1 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 (36.7 amol/µL) standard of 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. Q1 or Q3 resolution set to 0.7 Da FWHM with methane as the reagent gas. If required this specification can also be performed with Q1 resolution set to 0.4 FWHM.

Optional LC/MS Specifications

- *Electrospray (ESI) at Unit Resolution and H-SRM (0.4 FWHM)*
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. If required this specification can also be performed with Q1 resolution set to 0.4 FWHM.
- *Atmospheric Pressure Chemical Ionization (APCI) and Atmospheric Pressure Photoionization (APPI) at Unit Resolution and H-SRM (0.4 FWHM)*
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. If required this specification can also be performed with Q1 resolution set to 0.4 FWHM.

Installation Requirements

Power

- TSQ Quantum GC System
One 230V AC $\pm 10\%$ at 30 amps, 50/60 Hz, single phase, with earth ground, dedicated to the instrument
- Data System
120V AC at 10 amps or 230V AC at 5 amps, single phase, with earth ground
- Optional Liquid Chromatograph
120V AC at 10 amps or 230V AC at 5 amps, single phase, with earth ground
- Stable voltage, free of spikes

Dimensions

Complete GC/MS system requires 2.5 m of workbench space.

- TSQ Quantum GC: 69 × 56 × 79 cm (h × w × d)
- TRACE GC Ultra: 44 × 61 × 65 cm (h × w × d)
- Minitower computer: 48 × 18 × 43 cm (h × w × d)
- Monitor: 41 × 41 × 43 cm (h × w × d)
- Forepump: 30 × 20 × 64 cm (h × w × d)
- Laser printer: 20 × 41 × 46 cm (h × w × d)

Weight

- TSQ Quantum GC: 118 kg
- TRACE GC Ultra: 55 kg
- Minitower computer: 14 kg
- Monitor: 5 kg
- Forepump: 34 kg
- Laser printer: 7 kg

Gas

- Collision gas: 99.995% pure Argon
- Collision gas pressure: 135 \pm 70 kPa (20 \pm 10 psig)
- Helium: purity 99.999% with less than one ppm each of water, oxygen, and total hydrocarbons
- 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 \pm 140 kPa (100 \pm 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 to 27 °C (59 to 81 °F)
- Optimal temperature range: 18 to 21 °C (65 to 70 °F)
- Particulate matter: < 100,000 particles of > 5 μ m diameter per cubic foot of air (< 3,500,000 particles per cubic meter of air)
- Relative humidity: 20 to 80%, without condensation
- Floors must be free of vibration.

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