TSQ 9000 triple quadrupole GC-MS/MS system

Unstoppable GC-MS/MS analysis

Performance benefits

- Routinely detect low traces of target compounds/chemicals in difficult matrices or relieve matrix pressure on the analytical system with the new Advanced Electron Ionization (AEI) source, available in dedicated configurations

- Remove tuning complexity with SmartTune, a new simplified tuning tool

- Boost instrument productivity to unprecedented levels with the patented NeverVent™ technology

- Select from a full upgrade path, from base to advanced configurations, to increase flexibility and performance anytime you need it

Routine laboratories working in food, environmental and forensic/toxicology analysis face a dynamic environment of changing regulatory requirements, lower detection levels, more compounds, less time, lower margins and increased competition. In short, they need their analytical systems to be unstoppable.

The Thermo Scientific™ TSQ™ 9000 GC-MS/MS system is a GC triple quadrupole platform designed to revolutionize laboratory productivity by delivering unprecedented levels of performance, ease-of-use and uptime, with the ultimate goal of facilitating the reduction of cost-per-sample in the high-throughput environment.

Unlike other systems, the TSQ 9000 GC-MS/MS system offers laboratories the opportunity to select best-in-class SRM performance, even for high capacity methods, whilst still benefiting from increased analytical robustness.

The TSQ 9000 GC-MS/MS system is uniquely placed to offer truly scalable performance that addresses increasingly challenging regulatory requirements, as well as providing effective ease-of-use tools to deliver consistent, class leading results, by both experienced and newer users.

Keywords
TSQ 9000, triple quadrupole, GC-MS/MS, Advance Electron Ion (AEI) source, ExtractaBrite, NeverVent technology, SmartTune

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S C I E N T I F I C

TSQ 9000 triple quadrupole GC-MS/MS system specifications

Modes

- Electron Ionization (EI), with full-scan (FS), SIM, and FS/SIM simultaneous within sample injection, timed acquisition (t-SIM), and FS/t-SIM

- Multiple/Selected Reaction Monitoring (MRM/SRM), timed acquisition (t-SRM), combined SRM/FS, combined t-SRM/FS, product ion scan, precursor ion scan, neutral loss scan

- Ability to convert timed acquisition method (t-SIM/t-SRM) into general mode (segmented) method

Ion source types

- Thermo Scientific™ ExtractaBrite™ Electron Ionization (EI) source with dual filaments in all ionization modes, programmable to 350 °C

- Thermo Scientific™ Advanced Electron Ionization (AEI) source programmable to 350 °C

- Chemical Ionization (CI) with Positive Ion Chemical Ionization (PCI) and Negative Ion Chemical Ionization (NCI) source and Combination EI/PCI/NCI source (optional), available with the ExtractaBrite ion source

NeverVent™ technology

- Exclusively available on VPI-enabled systems, V-Lock isolates the vacuum region of the mass spectrometer from the column–this enables an industry exclusive method to change GC columns quickly, with no venting required

- Optional Vacuum Probe Interlock (VPI) removes the entire ExtractaBrite source or changes ionization modes without venting (available on TSQ 9000 GC-MS/MS system with VPI configuration)

Software features

- Automated SRM Development (AutoSRM)

- SIM Bridge—a tool used to import SIM and SRM acquisition tables in comma- separated-values (CSV) formats into AutoSRM and instrument method

- Automated acquisition window adjustment based on retention time

- Compound based acquisition method setup

- Customizable automated tuning

- Retention Time Alignment—this tool uses Void Time and Retention Time of a reference substance to provide a new column length and internal diameter (or corrected pressure or flow value) to realign retention times of all the peaks of the chromatograms

- SmartTune—an intelligent and simple tuning tool

Mass analyzer

- Heated, off-axis ion guide for noise reduction and solid, homogeneous, non-coated, maintenance-free quadrupole rods

- Fast quadrupole scanning, up to 20,000 u/s

Mass resolution and mass stability

- Automatic tuning down to 0.4 u and manual tuning

- Selectable SRM resolution settings in method at autotune preset values of 0.7 u, 1.5 u and 2.5 u or custom tune from 0.7–1.5 u

- Mass Stability better than 0.1 u/48 hours/$\Delta T \leq 2$ K

Collision energy range

- 0–60 eV

Mass range

- 1.2–1100 u with unit mass resolution

Detector

- Thermo Scientific™ DynaMax™ XR detection system, with off-axis 10 kV dynode, discrete dynode electron multiplier and electrometer, linear range of $>10^7$ (0–68 µA)

Scan speed and acquisition rate

- Up to 20,000 u/s

- Ability to acquire more than 97 scans/s in FS when scanning over a range of 125 u

- 0.5 ms minimum SRM dwell times

- Up to 800 SRM transitions/s

Pumping systems

- High-capacity (>300 L/s), dual-stage turbomolecular pump

- Mechanical rotary vane 3.3 m³/h oil pump

- Foreline convectron gauge

- Optional oil-free scroll pump

- Ion gauge (optional)

Electron energy
• Adjustable up to 150 eV dependent on ion source type

Emission current
• Up to 350 µA

Transfer line temperature
• Up to 400 °C

Microfluidics options for Thermo Scientific™ TRACE™ 1300/1310 GC system
• Dual Detector kit for splitting column effluent to two detectors (including MS)

• Consists of low-volume, highly inert Thermo Scientific™ SilFlow™ technology with finger-tight connectors

Direct sample probe system option (VPI enabled systems only)
• Switch to probe in <3 min with GC undisturbed

• Available in two styles: rapid heating filament Direct-Exposure Probe (DEP, capable of flash vaporization or pyrolysis at up to 1600 °C) or slower volatilization Direct-Insertion Probe (DIP, capable of accommodating powders and solid samples in a quartz or aluminum crucible) up to 450 °C

Data system software and options
• Thermo Scientific™ Chromeleon™ 7.2 Chromatography Data System (CDS) software for chromatographers using MS, a common platform for GC, GC-MS, LC, LC-MS, IC, and IC-MS quantification

• Thermo Scientific™ TraceFinder™ software, a common platform for routine GC, GC-MS, LC, and LC-MS quantification

  – TraceFinder software for Environmental and Food Safety, with Compound Data Base of over 1300 pesticide SRM transitions

  – TraceFinder software for Clinical Research

  – TraceFinder software for Forensic/Toxicology

• Retention Time Alignment tool to easily and quickly maintain retention time during routine operation

• Instrument control and data connection via Ethernet

• Virtual Touch Screen for TRACE 1300 Series GC systems (optional)

• Computer supplied with instrument equipped with three Ethernet (8P8C RJ-45) ports

• Commercial mass spectral library (latest edition) options, including:

  – NIST Mass Spectral Library with RI and MS/MS

  – Wiley Mass Spectral Library

  – Maurer/Pfleger/Weber Mass Spectral Library for Drugs, Poisons, Pesticides, Pollutants and their metabolites

Performance specifications
GC triple quadrupole mass spectrometers are most frequently applied to trace quantitative analysis in complex matrix. This means that the ability of the system to select against matrix (reduce chemical noise) is a critical performance factor to be taken into consideration. This can be demonstrated with a signal-to-noise ratio (S/N). In addition, a S/N ratio also provides a guarantee against instrument contamination on installation. Finally, low level precision and instrument detection limits (IDL) provide the complete picture.

AEI installation specifications
In SRM mode, with He carrier gas and either the Thermo Scientific™ AI/AS 1310 Series Autosampler, Thermo Scientific™ TriPlus™ 100 LS Liquid Autosampler, or TriPlus™ RSH™ Autosampler[§] (required and configured for liquid injections), eight sequential 1 fg octafluoronaphthalene (OFN) splitless injections monitored for SRM 272/222 produce the following instrument detection limit (IDL), calculated from the chromatographic peak area with 99% confidence interval: **IDL ≤ 0.4 fg[†]**

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Standard installation and factory specifications* for the TSQ 9000 GC-MS/MS system

Ion Source/Concentration	He[†]	H₂[†]
With AEI, 1 µL of 1 fg/µL OFN will produce the following minimum S/N for transition *m/z* 272 to *m/z* 222.	300:1	NA
With ExtractaBrite EI, 1 µL of 100 fg/µL OFN will produce the following minimum S/N for transition from *m/z* 272 to *m/z* 222	16,500:1	4,000:1[‡]
In **PCI mode**, 1 µL of 5 pg/µL benzophenone will produce the following minimum S/N for transition from *m/z* 183 to *m/z* 105	2,500:1	800:1[‡]
In **NCI mode**, 1 µL of 1 pg/µL OFN will produce the following minimum S/N for *m/z* 272	10,000:1[‡]	3,300:1[‡]

* He (H₂) standard specifications are performed using a 15 (30) m × 0.25 mm ID × 0.25 µm System Qualification Column (SQC). The installation specifications are performed with either He or H₂ but not both.

[†] IDL and S/N vary based on configuration purchased, the most sensitive TSQ 9000 configuration can yield this IDL and S/N.

[‡] Not always tested as an installation, these are factory specifications for reference.

[§] In the case that an autosampler is not present at install, a single injection of 1 fg OFN will be run to demonstrate the S/N install spec.

System dimensions/weights

Total width of the connected GC/MS system is 90 cm (35.5 in). Allow 16 cm (6 in) of clearance behind the instrument (32 cm if using autosampler). Additional space should be allotted for data system and printer.

Equipment	System Dimensions (height × width × depth)	Weight
Mass spectrometer	44 × 40 × 89 cm (17.5 × 16 × 35 in)	61 kg (135 lbs)
TRACE 1300 GC system	45 × 44 × 60 cm (18 × 17 × 24 in)	35 kg (77 lbs)
TRACE 1310 GC system	45 × 44 × 67 cm (18 × 17 × 26 in)	35 kg (77 lbs)

Configuration	IDL
Medium turbo with ExtractaBrite EI source	≤ 4 fg*
Large turbo with ExtractaBrite EI source	≤ 2 fg*
Large turbo with AEI source	≤ 0.4 fg**

* Eight sequential 5 fg OFN splitless injections

*** Eight sequential 1 fg OFN splitless injections

Find out more at **thermofisher.com/TSQ9000**

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