

Thermo Scientific Q Exactive HF Orbitrap LC-MS/MS System

Higher-Quality Data, Faster Than Ever

- Scan speed up to 18 Hz with ultra-high-field Orbitrap Analyzer Technology
- Resolving power of up to 240,000 (FWHM) at m/z 200
- Advanced Quadrupole Technology (AQT) for superior precursor isolation
- Advanced Active Beam Guide (AABG) for greater sensitivity and maximum robustness
- Multiple approaches to quantitation including Selected Ion Monitoring (SIM), Parallel Reaction Monitoring (PRM), and Data-Independent Acquisition (DIA)
- Routine sub ppm mass accuracy
- Higher-Energy Collisional Dissociation (HCD)
- Enhanced analysis of intact proteins and protein complexes with optional intact protein mode



The Thermo Scientific™ Q Exactive™ HF benchtop LC-MS/MS combines a high-resolution accurate-mass (HR/AM) ultra-high-field Orbitrap analyzer and a high performance quadrupole precursor ion selection to deliver unsurpassed speed while maintaining sensitivity. It takes identification and quantitation to a new level, making it possible to identify, quantify, and confirm in a single analysis with a single instrument.

With much faster detection speed and higher resolution, the Q Exactive HF provides a significant boost in performance in important peptide, protein, and

small molecule applications. Advanced quadrupole technology optimizes precursor ion selection and transmission, improving quantitation of low-abundant ions in the most complex matrices. Sophisticated Parallel Reaction Monitoring and Data-Independent Analysis provide reproducible quantitation results while delivering complete qualitative confidence. Intact protein mode enhances analysis of intact proteins through sophisticated ion beam control and easy collision pressure adjustment. 240,000 maximum resolving power at m/z 200, ensures more confident structural confirmation in biopharma and omics applications.



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Hardware Specification

Thermo Scientific Ion Max API Source

- H-ESI II probe with dual desolvation zone technology
- Enhanced sensitivity and ruggedness
- Sweep gas to reduce chemical noise
- 60° interchangeable ion probe orientation
- Removable metal ion transfer capillary provides vent-free maintenance

Ion Optics

- S lens stacked-ring radio frequency (RF) ion guide captures and efficiently focuses the ions into a tight beam. Large variable spacing between electrodes allows for better pumping efficiency and improved ruggedness.
- Advanced Active Beam Guide (AABG) with prefiltering and second generation axial field bent flatpole ion guide reduces noise by preventing neutrals and high-velocity clusters from entering the quadrupole

Quadrupole Mass Filter

- Advanced Quadrupole Technology (AQT) featuring a segmented Thermo Scientific™ HyperQuad™ mass filter provides increased ion transmission and superior isolation window shape
- Variable precursor ion isolation width selection from 0.4 Da to full mass range

Vacuum System

- Differentially pumped vacuum system with final vacuum $<1 \times 10^{-9}$ mbar
- Two split-flow turbomolecular pumps and one rotary vane pump
- Seven vacuum regions

Orbitrap Mass Analyzer

- Nitrogen-filled C-Trap
- Highly efficient ion transfer to Orbitrap mass analyzer
- Straight multipole collision cell for HCD
- Ultra-high field Orbitrap mass analyzer with 5 kV central electrode voltage
- Low-noise image current preamplifier
- 16-bit signal digitalization

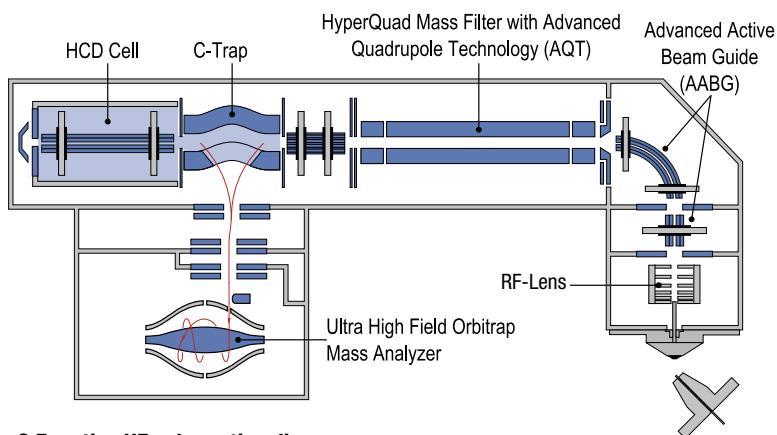
Data Acquisition

- Ultrafast real-time data acquisition and instrument control system
- Fully automated calibration via instrument control software
- Automatic Gain Control

Performance Characteristics

Resolving power	240,000 @ m/z 200
Mass range	50 to 6,000 m/z
Scan rate*	Up to 18 Hz at resolution setting of 15,000 @ m/z 200
Mass accuracy *	Internal: <1 ppm RMS External: <3 ppm RMS
Sensitivity	Full MS: 500 fg buspirone on column S/N 100:1 SIM: 30 fg buspirone on column S/N 100:1
Dynamic range	>5000:1
Polarity switching	One full cycle in <1 sec (one full positive mode scan and one full negative mode scan at a resolution setting of 60,000)
Multiplexity	Up to 10 precursors/scan
Analog inputs	One (1) analog input (0–1 V) One (1) analog (0–10 V)

*Under defined conditions



Q Exactive HF schematics diagram

Options

- Intact Protein Mode for protein analysis
- Thermo Scientific™ EASY-Spray™ ion source offers state-of-the-art performance from an effortless and robust plug-and-spray solution.
- Thermo Scientific Nanospray Flex ion source offers ultimate nanospray flexibility, with excellent spray stability and efficiency for the widest range of nanoflow columns
- ESI probe compatible with liquid flow rates of <math><1\ \mu\text{L}/\text{min}</math> to 1 mL/min without splitting
- APCI source compatible with liquid flow rates of 50 $\mu\text{L}/\text{min}$ to 2 mL/min without splitting
- APCI/APPI source compatible with liquid flow rates of 50 $\mu\text{L}/\text{min}$ to 2 mL/min without splitting
- Metal needle kits for high- and low-flow analyses

Software Features

Data System

- High-performance PC with Intel® microprocessor
- High-resolution LCD color monitor
- Microsoft Windows 7® operating system
- Microsoft Office® software package
- Thermo Scientific™ Xcalibur™ instrument control and data processing software
- Workflow-based method editor

Operation Modes

- Full MS with high-resolution accurate-mass detection
- Selected Ion Monitoring (SIM) with high-resolution accurate-mass detection
- Parallel Reaction Monitoring (PRM) for improved screening and quantitative confidence
- Data-Independent Acquisition (DIA) for unbiased identification and quantitative analysis
- All-Ion Fragmentation (AIF) in the HCD collision cell with high-resolution accurate-mass detection
- In-source fragmentation of all ions
- Positive/negative ion switching on chromatographic timescale
- On-the-fly data-dependent decision making
- Timed SIM for scheduled data acquisition of the targets of interest

Exclusive Technologies

- Automatic Gain Control (AGC) ensures that the Orbitrap mass analyzer is always filled with the optimum number of ions for all scans
- High-performance HCD collision cell for highest performance MS/MS fragmentation
- Collision energy profiling using different collision energies for HCD fragmentation
- Advanced signal processing
- Interleaved operation
- Spectrum multiplexing for simultaneous detection of up to 10 precursor ions in the Orbitrap mass analyzer



Q Exactive HF mass spectrometer with Nanospray Flex ion source and Thermo Scientific™ EASY-nLC™ 1000 liquid chromatograph

Installation Requirements

Power

- 2 x 230 VAC \pm 10% single phase, 15 A, 50/60 Hz, with earth ground for the instrument
- 120 or 230 VAC single phase with earth ground for the data system

Gas

Nitrogen

- High-purity nitrogen gas supply (99% pure at 800 ± 30 kPa (8.0 ± 0.3 bar, 116 ± 4 psi))

Environment

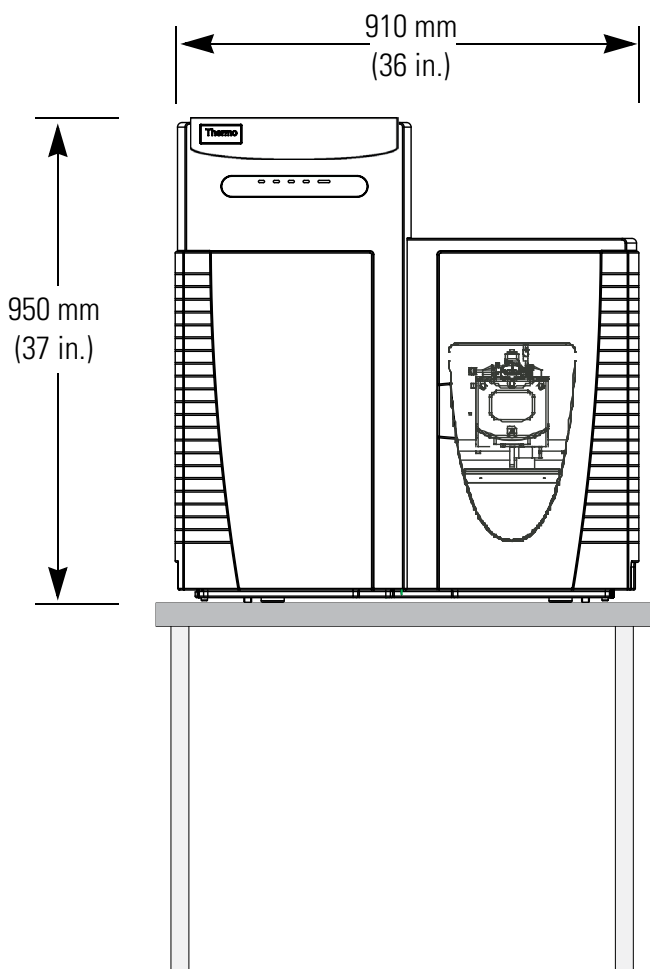
- System averages 2,500 W (~9,000 Btu/h) output when considering air conditioning needs
- Operating environment must be 15–26 °C (59–78 °F) and relative humidity must be 40–70% with no condensation

Weight

- Q Exactive HF mass spectrometer: 182 kg (400 pounds) without forevacuum pump
- Forevacuum pump: 62 kg (136 pounds)

Dimensions

- Q Exactive HF mass spectrometer: (h \times d \times w) 950 \times 830 \times 910 mm (37 \times 33 \times 36 inches)



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Africa +43 1 333 50 34 0

Australia +61 3 9757 4300

Austria +43 810 282 206

Belgium +32 53 73 42 41

Canada +1 800 530 8447

China 800 810 5118 (free call domestic)
400 650 5118

Denmark +45 70 23 62 60

Europe-Other +43 1 333 50 34 0

Finland +358 9 3291 0200

France +33 1 60 92 48 00

Germany +49 6103 408 1014

India +91 22 6742 9494

Italy +39 02 950 591

Japan +81 45 453 9100

Latin America +1 561 688 8700

Middle East +43 1 333 50 34 0

Netherlands +31 76 579 55 55

New Zealand +64 9 980 6700

Norway +46 8 556 468 00

Russia/CIS +43 1 333 50 34 0

Singapore +65 6289 1190

Spain +34 914 845 965

Sweden +46 8 556 468 00

Switzerland +41 61 716 77 00

UK +44 1442 233555

USA +1 800 532 4752

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