

Powering Dioxin and POPs analysis around the world

DFS Magnetic Sector GC-HRMS

Keywords: Magnetic Sector, Dioxin analysis, PCDD/F, PCBs, PBDEs and other POPs, global compliance, food and environmental samples

Benefits

- Global compliance with official methods
- Proven leadership
- Sensitivity combined with robustness for ultimate confidence in routine analysis
- Exceptional productivity and flexibility with unique options for double-GC and DualData XL configurations
- Future committed

The Thermo Scientific™ DFS™ Magnetic Sector GC-HRMS is the gold standard for performing Dioxin and Persistent Organic Pollutants (POPs) analysis. It empowers you to achieve full compliance with any official Dioxins, PCB, or PBDE method around the world.



For over a decade, the global scientific community has chosen Thermo Scientific DFS Magnetic Sector GC-HRMS for its superior performance in routine quantitative analysis of Dioxins and POPs. Today, the DFS Magnetic Sector GC-HRMS continues to set the gold standard in providing robust performance and high-confidence results.

Global compliance

Contamination of food and the environment are global concerns. Both food import-export control and environmental analyses require compliance with numerous government and analytical methods. The DFS Magnetic Sector GC-HRMS is the only GC-MS compliant with any existing official methods and regulations, including US EPA, EU, and JIS methods.

Proven leadership

Thermo Fisher Scientific is committed to providing solutions that enable our customers to lead in the analysis of Dioxins and POPs. With proven technology, the DFS Magnetic Sector GC-HRMS is the system of choice for experts who desire ultimate analytical confidence and routine reliability.

Ultimate confidence and robustness

Failing to determine if samples are non-compliant or toxic can have serious consequences. You need to be sure of your analysis and the defensibility of your data. The DFS Magnetic Sector GC-HRMS provides robust, confident quantitation, down to very low femtogram levels.

Exceptional productivity and flexibility

Labs face a wide array of sample loads and application demands. To meet these needs, the DFS Magnetic Sector GC-HRMS can be equipped with up to two Thermo Scientific™ TRACE GCs and four GC columns. Add the DualData XL Module to maximize sample throughput with up to twice as many injections per unit time compared to a single GC system. Multiple ionization modes and probe choices provide unmatched analytical flexibility.



Future committed

Innovation and support for the DFS Magnetic Sector GC-HRMS are aimed at addressing emerging needs and new regulatory methods—today and into the future.

Hardware specifications

Ion source

The ion source has been designed with special emphasis on sensitivity and durability for increased productivity, low maintenance and increased uptime.

- Plug-in ion source with optimized box design for quick exchange including built in ion extraction lens for ease of maintenance
- Exchange of ion volume and filament without venting
- Optimized long lifetime filaments for EI and CI
- Independent source temperature control
- Simple source design – clean quickly
- Inert composition – clean less frequently

Reference inlet

An independent reference calibrant system that is continuously flow adjustable and can be individually evacuated and heated. It allows syringe introduction of liquid or gaseous samples. By separating the reference inlet from the GC interface, maintenance is reduced and uptime maximized.

Vacuum interlock

The DFS Magnetic Sector GC-HRMS is equipped with a vacuum interlock for quick exchange of ionization volumes and filaments without venting.

- Pneumatically actuated by system control
- Eliminates improper manual operation

Tuning

The DFS Magnetic Sector GC-HRMS uses the same Thermo Scientific tuning software found on other Thermo Scientific GC/MS & LC/MS solutions; TunePlus™. Designed with automation and simplicity in mind; the tuning process, experiment and sequence set-up is intuitive and rapid. The DFS Magnetic Sector GC-HRMS enables the reliable, routine use of AUTOTUNE in all ionization modes without restrictions, including slit control and automated resolution settings.

Mass calibration

Thermo Fisher Scientific invented the field calibration method of scanning magnetic mass spectrometers. The DFS Magnetic Sector GC-HRMS offers full data system control of field calibration scanning.

The mass scale needs to be calibrated only once. The operator can change mass range and scan speed without the need for recalibration. It is the same approach and handling as known from benchtop GC/MS systems.

- Constant mass calibration based on magnetic field measurement
- Calibration independent of mass range, scan speed, scan mode (including linked scan MS/MS), ion polarity and ionization technique
- No recalibration required after change of ion volume or ionization technique

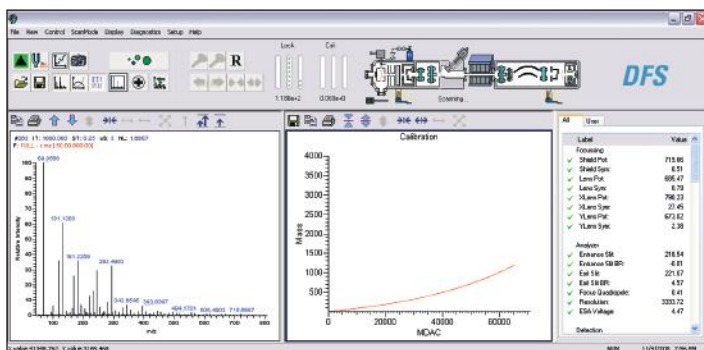


Figure 1. DFS Instrument Control Software

Analyzer

The newly designed DFS Magnetic Sector GC-HRMS analyzer has virtually no image aberrations. It is perfectly double focusing; employing an ultra high precision toroidal electrostatic analyzer and a carefully refined magnetic analyzer. This directly translates into stability and ruggedness.

- Novel ion optics design is based on the proven reverse Nier-Johnson geometry
- Mass independent focus with uniform resolution throughout the mass range
- Ion optics optimized for an acceleration voltage of 5 kV
- All ionization techniques operational with full acceleration voltage
- High precision, data system controlled, continuously variable Tantalum entrance and exit slits for fast response and long lifetime

- Low hysteresis, radially laminated H-type magnet of special metal alloy with mass independent focal length, deflection radius 350 mm, deflection angle 65°
- Innovative Rogowsky magnet entrance pole pieces for optimum sensitivity regardless of ionization method
- Novel electrostatic analyzer (ESA) using a computer optimized toroidal design for highest mass precision and ion transmission with virtually no image errors
- All focusing and detection elements housed in a single monoblock vacuum chamber
- Entire DFS Magnetic Sector GC-HRMS analyzer assembled on an integrated shock mounted platform for isolation from floor vibration

Performance characteristics

- Sensitivity (EI GC/MS):
>200:1 for 20 fg 2378TCDD
at m/z 322, $R = 10,000$, $S/N = \text{PtP } 4\text{SD}$.
- Mass accuracy <2 ppm
- Resolution (static) >60,000 (10% valley)
- Scan rates 0.1 to 10,000 seconds/decade (continuously variable)
- Mass range 2 – 6000 Da;
2 – 1200 Da at full accelerating voltage

The specification for sensitivity, mass accuracy and resolution are installation specification.

This means that they are demonstrated to the customer during the installation of the DFS Magnetic Sector GC-HRMS.

Detection system

The long lifetime noise-free secondary electron multiplier of the DFS Magnetic Sector GC-HRMS analyzer always provides optimal signal amplification for all ionization modes including negative CI.

- Long lifetime off axis secondary electron multiplier detection system
- Post-acceleration/conversion dynode, variable to ± 20 kV
- Quick change mount on an individual flange

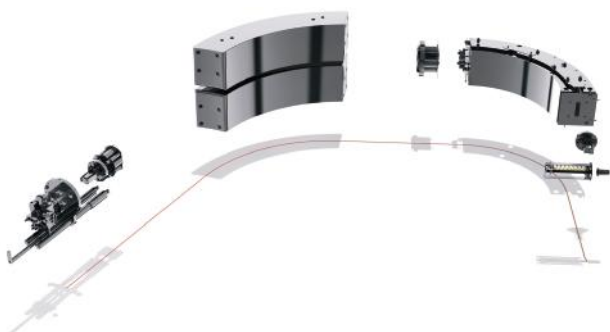
Vacuum system

The clean high vacuum background produced by turbomolecular pumps enables the DFS Magnetic Sector GC-HRMS to achieve lower detection limits routinely.

- Ultra fast pump down times; reduces installation and maintenance time -maximizing productivity
- Oil-free high vacuum turbo molecular pumps reduce the high chemical background observed with other pumping technologies
- Directly coupled high speed differential pumping system with three turbo molecular pumps
- Push-button control
- Automated protection system

Electronics cabinet

Integrated electronics cabinet for low space requirements. Optimized air flow for efficient cooling of magnet power supply. Effective potential decoupling between digital electronics and mass spectrometer high voltage and power supplies. The universal input/output for Ready/Start allows communication with external devices using programmable signal logic.



Direct inlet options

Direct probe base unit (optional)

- Port for direct insertion probe
- Required to attach any of the following probe options
- Contains exchange lock and probe electronics

Water cooled DI probe (DI/DIP) (optional)

- Direct insertion probe
- Data system controlled, liquid cooled
- Using disposable aluminum crucibles
- Heating rates: 20 °C to 200 °C in 30 s, 200 °C to 300 °C in 30 s
- Temperature range from 25 °C above ambient to maximum 400 °C

DCI Probe (optional)

- Direct chemical ionization probe
- Full data system control
- Using reusable filaments (up to 1600 °C)
- Ultra fast heating rates of >500 °C/s
- High temperature tip for DCI probe (optional and up to 800 °C)
- Using reusable quartz crucibles

Software specifications

Thermo Scientific SmartTune Operating Software

The DFS Magnetic Sector GC-HRMS is operated fully automatically by the Thermo Scientific™ DFS Software Package, which is based on Thermo Scientific Xcalibur Software Platform.

It features:

Thermo Scientific™ DFS SmartTune™ Operating Software for streamlined everyday tasks: from instrument optimization and troubleshooting to routine method development.

Thermo Scientific™ DFS TargetQuan™ Data Evaluation Software for the quantification of dioxins and other POPs, according to isotope dilution requirements.

The DFS Magnetic Sector GC-HRMS uses advanced control software for high and low resolution operation, multiple ion detection MID, selection of positive or negative ions, peak matching, and full control of analyzer and inlet systems supporting the following capabilities:

- Intensity autotune: automated optimization of tune peak for maximum sensitivity
- Resolution tuning: computer controlled slit settings for maximum selectivity
- Control of standard and optional inlet systems
- Instrument diagnostics: full advanced suite of instrument diagnostics including integrated parameter logging
- Xcalibur application software, incorporating all mass spectrometry processing tasks such as chromatogram and spectrum display, integrated NIST library search (optional spectra libraries), CMASS for accurate mass conversion and averaging, elemental composition and isotopic pattern calculation.
- MS data import and export using the ANDI/netCDF formats, conversion from Xcalibur raw file formats, ASCII text export

Thermo Scientific TargetQuan Data Evaluation Software (optional)

TargetQuan Data Evaluation Software for automated data evaluation on target compounds includes:

- Dioxin method setup
- Support of instrument and quantitation
- Response file and reporting programs
- Data evaluation for isotope dilution methods as well as relative response factors
- Compliant with the published EPA methods for dioxin measurements and data evaluation according e.g. EPA 1613, EPA 8280, EPA 8290, EPA 23, EPA 513, EN 1948 and equivalent JIS methods
- Compliant with the requirement for TEQ low-med-upper bound reporting
- Transparent LOQ and LOD calculations for compliance with e.g. latest EU Guidelines
- Standardized output into Microsoft Excel file format for integration to LIMS systems

Software licenses

Each TargetQuant Data Evaluation Software package is supplied with two licenses for installation on two different PCs.

New instrument software releases are supplied free of charge within 12 month after delivery.



Gas Chromatography options

For the specifications of the Gas Chromatography systems, please refer to the corresponding data sheets.

- Thermo Scientific™ TRACE GC Series
- Thermo Scientific™ TriPlus RSH Autosampler

Installation requirements

Detailed installation requirements are provided in the DFS Magnetic Sector GC-HRMS Preinstallation Requirements Guide PN/1194630.

Optional recirculating water chiller

The DFS Magnetic Sector GC-HRMS requires water for cooling various instrument parts and the DI devices. Optionally, the DFS Magnetic Sector GC-HRMS can be purchased with a suitable recirculating chiller, which is available from Thermo Fisher Scientific. The chiller makes the DFS Magnetic Sector GC-HRMS independent from any cooling water supply in case no in-house cooling system is available in the customer laboratory. For technical requirements refer to the DFS Preinstallation Requirements Guide PN/1194630.

Supplies

Power

The DFS Magnetic Sector GC-HRMS is designed to operate at a nominal voltage of 230 V AC, 50/60 Hz. The minimum and maximum voltage tolerances are in compliance with IEC 950, Amend 2, 1993. Approximate consumption values for regular operation are:

- 0,9 kW for GC operation
- 1,9 kW for MS operation
- 1,6 kW for chiller

Helium

For GC carrier gas: 99.996%, ultra-high purity. Total hydrocarbons should be less than 2.0 ppm.

Compressed air

Compressed air with a pressure of 6 bar (87 psi) is required to operate the pneumatic valves of the instrument. A suitable compressor can be ordered from Thermo Fisher Scientific.

Space requirement

DFS Magnetic Sector GC-HRMS

- HxD 140.6 cm (55.4") x 156.8 cm (62.5")
- Width with one GC installed 161.1 cm (63.5")
- Width with two GCs installed 209.1 cm (82.4")
- MS console with analyzer and magnet 900 kg (2000 lb)
- Data system 130 kg (<290 lb)
- GC with console 35 kg (78 lb)

TRACE 1310 GC

- Dimensions (H x W x D): 45 x 44 x 67 cm
- Weight (Kg): 35 Kg main unit plus 0.8 Kg each module (78 lb)
- Column Oven (H x W x D): 27 x 27 x 17.7 cm; 12.9 L

TriPlus RSH autosampler

Overall dimensions on the GC:

- Length (X axis) 80 cm
- The extended extended model length is 120 cm
- Height approximately 70 cm, dependent on mounting kit

Environment

Room temperature

Laboratory room temperature must be maintained between 15 °C and 26 °C (59 °F and 79 °F). The optimum operation temperature is between 18 °C and 21 °C (65 °F and 70 °F).

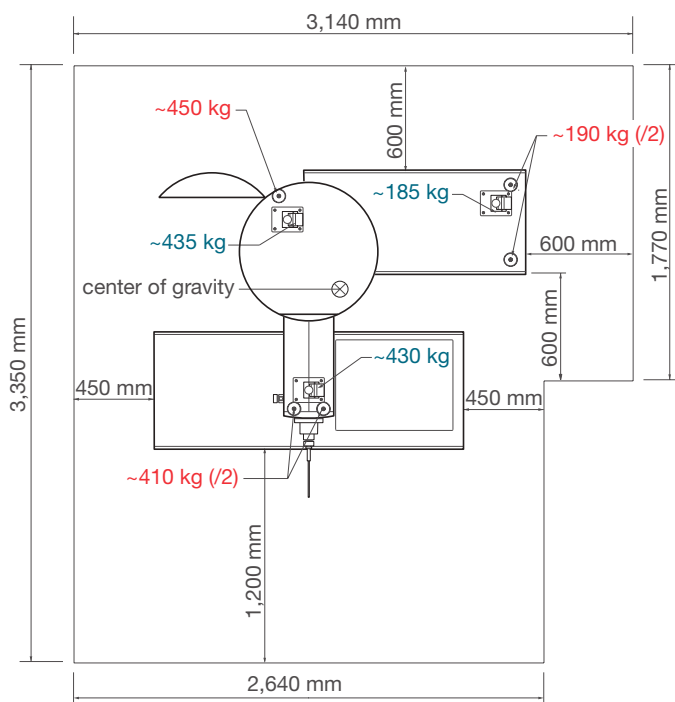
Air conditioning load

The average power dissipation during analysis operation for a basic DFS Magnetic Sector GC-HRMS including gas chromatograph and data system, is approximately 4.7 kW (4.5 BTU/s). For dual GC configuration, the average air conditioning load amounts approximately to 4.9 kW (4.7 BTU/s).

Humidity

The relative humidity of the operating environment must be between 30% and 70%, with no condensation.

Recommended instrument clearances and weight distribution



Find out more at thermofisher.com/DFS