

# DFS High Resolution GC/MS

High Performance Magnetic Sector GC/MS

The Thermo Scientific DFS high resolution GC/MS is the highest performance, most efficient and simple to operate magnetic sector mass spectrometer ever built.



- **Performance** - Modern innovations in ion optics, magnet and electric sector design, provide industry leading specificity for trace target compound analysis; whilst delivering unrivalled signal to noise characteristics for reliable peak integration and quantification.
- **Simplicity** - The DFS mass spectrometer is simple to operate and feels like a benchtop GC/MS. Automated tune and mass calibration ease adoption of the technology into the laboratory, whilst freeing the analyst for other tasks.
- **Efficiency** - Lowest in class running costs, combined with high throughput capabilities of dual GC configurations, significantly increase laboratory sample capacity whilst reducing cost per sample.

## DFS Mass Spectrometer

The DFS is a high resolution magnetic sector mass spectrometer like none before. It has been designed from the ground up to benefit from new innovations and modern production techniques. Cumulative advances in modern component design and manufacture, combine to provide the most powerful high resolution GC/MS ever for the most demanding confirmatory POPs analyses.

## 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. 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 mass spectrometer 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

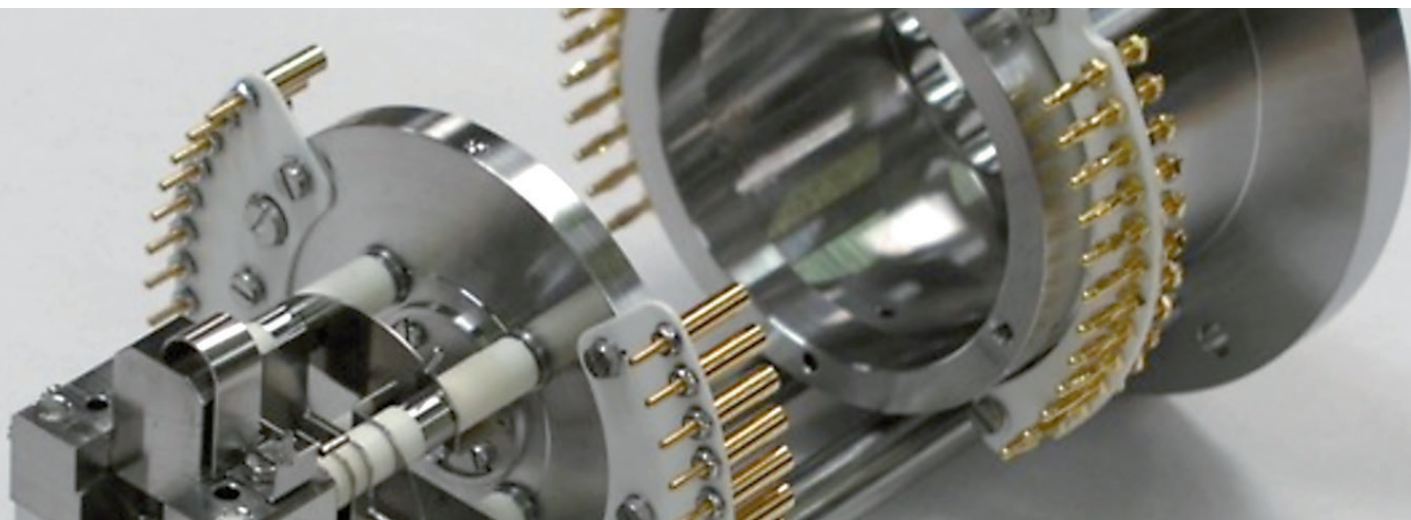
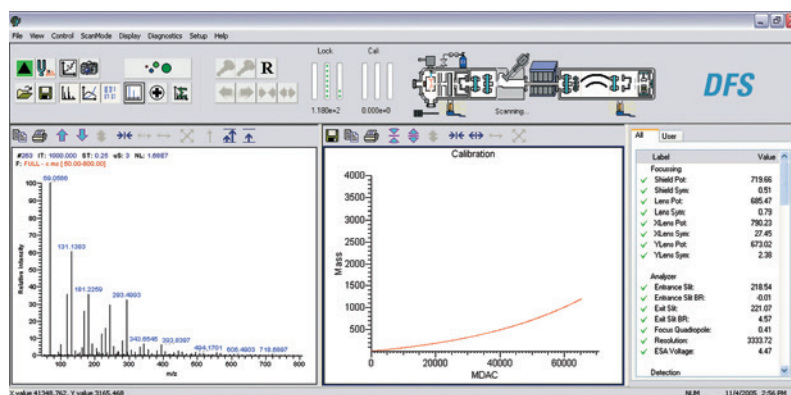
The DFS system uses the same Thermo Scientific tuning software found on other Thermo Scientific GC/MS & LC/MS instruments; TunePlus™. Designed with automation and simplicity in mind; the tuning process, experiment and sequence set-up is intuitive and rapid. The DFS mass spectro-meter enables the reliable, 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 system 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



## Analyzer

The newly designed DFS 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 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,  $R = 10,000$ ,  $S/N = PtP$  4SD.
- 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

## Detection System

The long lifetime secondary electron multiplier of the DFS 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  $\pm 20$  kV
- Quick change mount on an individual flange

## Vacuum System

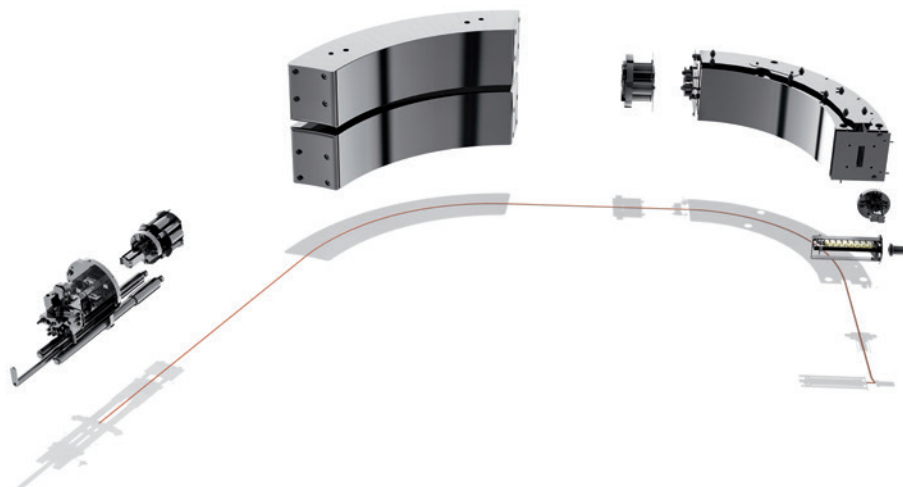
The clean high vacuum background produced by turbomolecular pumps enables the DFS system to achieve lower detection limits routinely.

- 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.

- Universal input/output for Ready/Start communication with external devices using programmable signal logic
- Analog in
- Digital in/out



## 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 10 °C above ambient
- Maximum temperature 350 °C

### DCI Probe (optional)

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



## Software Specifications

### Thermo Scientific Xcalibur Data System

Xcalibur™ is the uniform software platform for system control of the Thermo Scientific GC/MS and LC/MS systems.

The DFS mass spectrometer uses the Xcalibur instrument control software for high and low resolution operation, multiple ion detection MID, selection of positive or negative ions, linked scans, 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 AUTOTUNE: 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, CMASS for accurate mass conversion and averaging, elemental composition and isotopic pattern calculation.
- QuanBrowser: quantification package
- MS data import and export using the ANDI/netCDF formats, conversion from Finnigan MassLab data file formats, ASCII text export
- Standardized output to LIMS systems

### Thermo Scientific TargetQuan Software Suite (optional)

The special Xcalibur DFS software package for automated data evaluation on target compounds including:

- 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
- Standardized output to LIMS systems

### Library Options

- NIST Library
- Wiley Library
- Pfleger-Maurer-Weber Library
- Thermo Scientific Pesticide Library

### Software Licenses

The DFS Xcalibur software licenses are supplied for instrument control as well as reprocessing.

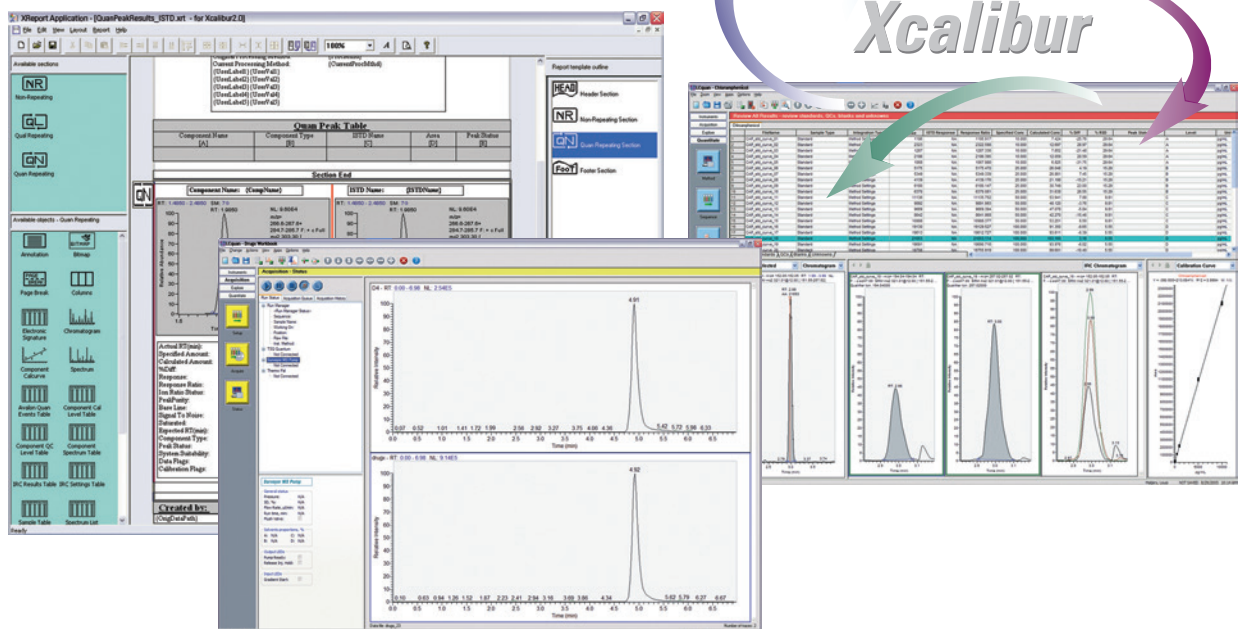
New instrument software releases are supplied free of charge within 12 month after delivery.

## Data System

**Personal Computer in the following minimum configuration\*:** Dell Optiplex 990 MT Core i3-2100

- 3.1 GHz Processor
- Mini Tower case
- 4096 MB 800 MHz DDR2 RAM
- 1TB SATA II hard disk
- DVD-RW drive
- DVI Add-in card
- Network card 10/100
- 2 PCI and 1 PCI-Express slot space
- 1 parallel port
- 2 serial ports
- 12 USB 2.0
- Graphics chip on board, up to 128 MB of memory
- 10/100/1000 Ethernet chip on board
- U.S. keyboard black
- Dell USB 6-Button Optical Mouse Black
- Microsoft Windows 7 Professional Operating system (32Bit OS)
- Microsoft Office 2010 Professional
- Mouse and Keyboard
- High resolution 22 inch TFT color monitor
- Optional laser printer, BW, 1200 x 1200 dpi, up to 25 pages/min

\* Minimum data system specifications may change without prior notice in case of technological improvement. Call for latest configuration.



### Thermo Scientific TRACE 1310 Gas Chromatograph

The TRACE™ 1300 Series GC consists of two models designed to meet the specific needs of all laboratories. The TRACE 1310 GC features a complete icon-driven touch-screen user interface ideal for direct instrument control in larger routine and method development laboratories. The TRACE 1300 GC is the budget-conscious investment for the basic routine laboratory looking for an intuitive single-button system, that provides ease of use with minimal instrument interaction. Both instruments offer the same user-exchangeable, instant connect injector and detector modules and fast oven performance with exceptional retention time stability to reach an incredibly high lab productivity at reduced cost of ownership.

#### Performance Specifications

- Typical Retention Time Repeatability: <0.0008 min
- Typical Peak Area Repeatability: <0.5 % RSD

#### Oven Specifications

- Column Oven (H × W × D): 27 × 27 × 17.7 cm; 12.9 L
- Operating Temperature Range: ambient +3 °C to 450 °C
- Cryogenic Option Minimum Temperature: -100 °C with liquid Nitrogen; -50 with liquid CO<sub>2</sub>
- Temperature Set Point Resolution: 0.1 °C
- Number of Ramps/Plateaus: 32/33
- Maximum Heating Rate: 125 °C/min

T Range °C	Heating Rate °C/min	
	Model: 220 Volts	Model: 110 Volts
50 to 70	125	90
70 to 115	100	65
115 to 175	80	50
175 to 300	50	30
300 to 450	35	20

- Oven Cool-Down (22 °C ambient): 450 °C to 50 °C in <4 minutes
- Ambient Rejection: <0.01 °C per 1 °C

### IEC (Integrated Electronic Control) Gas Specification

- Up to 18 channels of integrated electronic gas control
- Pressure Set Points Minimum Increments: 0.01 kPa-0.001 psi in all ranges

#### Carrier Gas Control Common to all Injectors

- Split Ratio: Up to 12500:1
- Pressure Range: 0–1000 kPa (0–145 PSI)
- Modes: Constant and programmed pressures and flows
- Total Flow Setting:
  - Control of split flow in 1 mL/min from 0 to 1250 mL/min
  - Purge flow from 0 to 50 mL/min

#### Optional Instant Connect Auxiliary Gas Module

- Allows for the control of three additional gas channels

#### Injectors

- Maximum Number Injectors Installed: 2
- Available as Instant Connect, user-exchangeable modules

#### Instant Connect Split/Splitless

- Suitable for all capillary columns (50 µm to 530 µm i.d.)
- Compatible with 1/8" and 1/16" packed column using adapters. Supports P&T/TD/HS by special adapter. Compatible Merlin Microseal™ septum.
- Dedicated split/splitless injector with integrated backflush capabilities
- Maximum Temperature: 400 °C

#### Instant Connect Programmable Temperature Vaporizer

- Supports hot/cold split and splitless modes as well as large volume injections (solvent split) and On Column (TPOC). Compatible Merlin Microseal septum.
- Dedicated PTV injector with integrated backflush capabilities
- Temperature Range: Air forced cooling to ambient +5 °C up to 450 °C
- Cryogenic Option Minimum Temperature: -100 °C with liquid nitrogen; -50 °C with CO<sub>2</sub>
- Temperature programming of up to 3 ramps at up to 870 °C/min

### Detectors

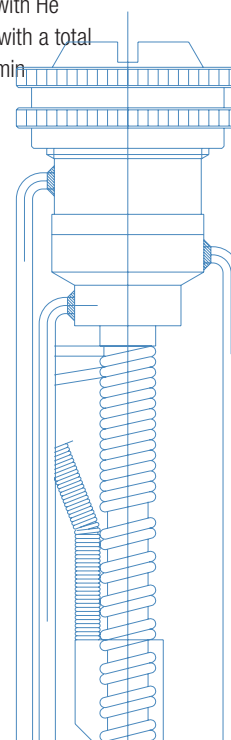
- Detectors Available: Flame Ionization Detector, Thermal Conductivity Detector, Electron Capture Detector, Nitrogen Phosphorus Detector, full range of Thermo Scientific mass spectrometers
- Available as Instant Connect, user-exchangeable modules
- Maximum number Installed: 3 including a mass spectrometers on the same oven
- Fast Data Acquisition Rate: up to 300 Hz for FID, TCD, ECD, and NPD

#### Instant Connect Flame Ionization Detector

- Capillary column optimized compatible with 1/8" and 1/16" packed column
- Flameout detection and automatic re-ignition
- MDL: <1.8 pg C/s
- Sensitivity: >0.03 Coulombs/gC
- Linear Dynamic Range: >10<sup>7</sup> (±10%)
- Maximum Temperature: 450 °C in steps of 0.1 °C
- IEC:
  - Air: 0–500 mL/min in 0.1 steps
  - H<sub>2</sub>: 0–100 mL/min in 0.1 steps
  - Makeup gas (N<sub>2</sub> or He) 0–50 mL/min in 0.1 steps

#### Instant Connect Thermal Conductivity Detector

- Capillary column optimized (micro TCD) compatible with 1/8" and 1/16" packed column
- Maximum Temperature: 400 °C in steps of 0.1 °C
- MDL: <400 pg tridecane/mL with He carrier or <20 pg tridecane/s with a total flow through the cell of 3 mL/min
- Linear Dynamic Range: 10<sup>5</sup>



### Instant Connect Electron Capture Detector

- Radioactive Source: 370 MBq equal to 10 mCi, 63Ni
- MDL: <6 fg/s lindane
- Linear Dynamic Range: >10<sup>4</sup> with lindane
- Maximum Temperature: 400 °C in 0.1 °C steps
- IEC: 0 to 500 mL/min makeup in 0.1 steps
- Make-up Gas: Nitrogen or 95% argon/5% methane

### Instant Connect Nitrogen Phosphorus Detector

- NPD available with ceramic beads and compatible with element-specific sources
- MDL: <20 fg P/s and <100 fg N/s with standard ceramic bead
- Selectivity: gP/gC = 200000; gN/gC = 80000
- Linear Dynamic Range: 10<sup>4</sup>
- Maximum Temperature: 450 °C in steps of 0.1 °C
- IEC:
  - Air: 0–500 mL/min in 0.1 steps
  - H<sub>2</sub>: 0–10 mL/min in 0.1 steps
  - Makeup gas (Nitrogen): 0–50 mL/min in 0.1 steps

### General Specifications

- Heated Zones: Up to 7
- Time Events: 63. Support up to 8 valves
- Operating Altitude: Up to 3500 m above sea level
- Dimensions (H × W × D): 45 × 44 × 67 cm
- Weight (Kg): 35 Kg main unit plus 0.8 Kg each module

### Certifications

Conforms to the following safety standards:

- International Electrotechnical Commission (IEC):  
61010-1:2001 - 61010-2-010:2003 - 61010-2-081:2001 + A1:(2003)
- CAN/CSA C22.2 No. 61010-1 and UL 61010-1
- EuroNorm (EN): 61010-1:2001 - 61010-2-010:2004 - 61010-2-081:2002

Conforms to the following regulations on Electromagnetic Compatibility (EMC) and Radio Frequency Interference (RFI):

- CISPR 11/EN 55011: Group 1 Class A
- IEC/EN 61326-1:2006

## Thermo Scientific TriPlus RSH Autosampler

The Thermo Scientific TriPlus RSH Autosampler offers exceptional precision, flexibility, and productivity in robotic, sample-handling solutions. Compatible with Thermo Scientific GC and GC/MS systems, the autosampler sets new standards in automation and provides advanced liquid-handling cycles that enable automated functionality beyond traditional liquid, headspace, and solid-phase microextraction (SPME\*) injections.

### Integrated Sampling System

The TriPlus™ RSH autosampler expands automated capabilities beyond sample injections to advanced sample-handling cycles. Automating the whole workflow, from sample preparation to injection, increases precision and reproducibility and enables unprecedented flexibility and productivity in GC and GC-MS sampling.

### Ultimate Productivity

Designed for expanded productivity, this integrated sampling system accommodates large sample capacities supporting full, unattended 24/7 operation. As an example, a maximum of 972, 2 mL vials combined with multiple 100 mL wash/waste bottles enable week-end long unattended operations – a goal not attainable with most other sampling systems currently on the market.

### Unmatched Flexibility

The TriPlus RSH robotic sample-handling system offers liquid, headspace, and solid phase microextraction – capabilities you expect as being a standard part of a multi-axis autosampler. In these modes, the sampling system delivers the precision you demand for achieving exceptional results. Scalable capabilities enable expanded GC and GC-MS application ranges, accurate micro-sample injections, and the matching of techniques to sample types.

\* Sold under license from Supelco®

## Seamless Operation

Accurate automation of a multitude of traditionally manual tasks is enabled by a new and innovative ATC (Automatic Tool Change) capability. The ATC feature enables the user to set up a sequence using up to six different syringes, automatically loaded by the autosampler to accurately perform dilutions, calibrations, and sample injections. The ability to exchange syringes for different tasks enables high-precision sample handling in a single, unattended sequence prior to automated sample injection.

### TriPlus RSH Configurations

The TriPlus RSH Autosampler is available in the following configurations:

- TriPlus RSH for automated liquid sampling
- TriPlus RSH for static headspace automation
- TriPlus RSH for automated liquid and headspace sampling and injection

Additional upgrade kits are available to transform existing versions into multitechnique platforms.

**Description** | XYZ robotic sample handling apparatus with automatic syringe switch concept. When the optional accessories are installed, the system is capable of automating sample preparation steps like standard dilution, standard addition, sequential dilution, derivatization and vortexing.

**Communication** | Two independent LAN

**Local User Interface** | LED status indicators. Optional control panel with 4 keys, round knob, and graphical LCD display.

**Instrument Control** | Thermo Scientific chromatography data systems integrated with Virtual Terminal software to completely mimic the physical controller

**Teaching Functions** | Manual without using tools or external devices

**Injector Compatibility** | Compatible with on-column, programmable temperature vaporizing, packed, purged packed, split-splitless injectors

### High Throughput Configuration

Dual GC set-up with Double Pro and Confirmation modes: Single TriPlus RSH serving two independent GC or GC/MS systems, for liquid, HS or SPME sample injection or for sample preparation, using the same or two different software systems. Two different methods can be used. Rapid Mode starts the syringe

washing cycle during the current GC cooling phase.

**Barcode Reader** | Two active laser scanners for all standard vials using 1-dimension barcodes in a horizontal orientation.

**Vortexer** | Intensive mixing of 0.5, 0.7, 2, 5, 10, or 20 mL vials with an agitation speed up to 2000 rpm

**Vial Trays** | Heated and cooled trays expand the range of available applications from sample injection to sample/standard preparation

**GC Mounting Kits** | Thermo Scientific TRACE 1300 GC, TRACE 1310 GC, TRACE GC Ultra and FOCUS GC

### Configuration for Liquid Sampling

**Vial Volumes** | 300  $\mu$ L fixed insert vials, 0.5, 0.7, 2, 2.5, 10, and 20 mL. 96/384 Microtiter or Deep Well plates with Automatic Foil Cutter to pierce alumina or plastic foils prior the needle penetration

**Bottom-Sensing Vials** | Capable of liquid injection starting from small-volume samples. Capability to inject from samples as low as 5  $\mu$ L into a vial. Possibility of performing up to three 1  $\mu$ L injections from a 5  $\mu$ L sample, depending on vial type.

**Height from Vial Bottom** | User selectable between 0.1 and 32 mm in 0.1 mm steps

**Injection Speed for Liquid Samples**  
Selectable from 0.1  $\mu$ L/sec up to 2000  $\mu$ L/sec and fully programmable

### Sample Capacity (Depending on autosampler, GC and MS configurations)

- Up to 4608 well plates or 6912 well plates with extended X-arm
- Up to 840 0.5/0.7 mL vials or 1260 0.5/0.7 mL vials with the extended X-arm
- Up to 648 2 mL sample vials or 972 2 mL vials with the extended X-arm
- Up to 240 10 mL or 20 mL vials or 360 10 mL or 20 mL vials with the extended X-arm

### Syringes (Capable of handling liquid volumes in the range 0.1 $\mu$ L – 10 mL)

Capable of using 0.5  $\mu$ L, 1.0  $\mu$ L, 5  $\mu$ L, 10  $\mu$ L (standard), 25  $\mu$ L, 50  $\mu$ L, 100  $\mu$ L, 250  $\mu$ L, 500  $\mu$ L, 1000  $\mu$ L, 10000  $\mu$ L syringes for sample injection and/or volume transfer

**Syringe Cleaning** | Wash stations for up to 4 different solvents for a total of 40 mL (standard). Optional large washing stations for up to 3  $\times$  100 mL solvent bottles. Waste: 1  $\times$  10 mL or drain to external waste bottle. Possibility to install multiple solvent stations to expand solvent and waste volumes.

### Options

- Upgrade to headspace option and its own accessories
- Upgrade to SPME option (with or without headspace option)
- Peltier-controlled drawer for well plates, 300  $\mu$ L fixed insert vials, 2 and 10 mL vials. Temperature selectable between 0 and 40  $^{\circ}$ C
- Cooled trayholders for well plates, 300  $\mu$ L fixed insert vials, 2, 10 and 20 mL vials. Temperature selectable between 4 and 70  $^{\circ}$ C. Requires external circulator bath.
- Solvent/reagent reservoir
- Large Volume Wash Station

**Injection Volume** | Range from 0.1 to 10,000  $\mu$ L in 0.1  $\mu$ L steps to 100  $\mu$ L and 1  $\mu$ L steps between 100  $\mu$ L and 10 mL. Needle lengths: 57 mm or 85 mm Liquid Injection Modes – 8 fully customizable method-specific preset menus available:

- Basic enrichment
- Enrichment needle solvent wash
- Internal standard double
- Internal standard post
- Needle solvent wash
- Solvent flush double
- Solvent flush post

**Typical Performance** –  $\leq$ 0.3 RSD % obtained under Thermo Scientific standard conditions

### Configuration for Headspace

**Vial Volumes** | 2, 10 and 20 mL

**Syringe Sizes** | 1, 2.5, and 5 mL

**Sample Capacity (Depending on autosampler, GC and MS configurations)** | Up to 180 10 or 20 mL vials or 300 10 or 20 mL vials with the extended X-arm

**Injection Volume Range** | 0.1 to 5 mL in 0.1 mL steps depending on syringe

**Syringe Temperature** | OFF or 40  $^{\circ}$ C to 150  $^{\circ}$ C in 1  $^{\circ}$ C steps

**Incubation Oven Capacity** | 6 vials

**Incubation Oven Temperature Range**  
40 to 200  $^{\circ}$ C in 1  $^{\circ}$ C steps, with agitation

**Incubation Time** | 0.1 to 600.0 min in 0.1 min increments

**Syringe Flush Capability** | With inert gas

**Solvent Syringe Cleaning** | Optional washing stations (4  $\times$  10 mL or 2  $\times$  100 mL vials)

### Multiple Headspace Extraction

Yes (optional accessory)

**Enrichment Sampling** | Yes with optional kit for cold trap

**Injection Speed** | 1 to 100 mL/min, in 1 mL/min increments

**Typical Performance** |  $\leq$ 0.7 RSD % under Thermo Scientific standard conditions

**Needle Lengths** | 65 mm, compatible with every injector port

### Options

- Upgrade to Liquid option
- Upgrade to SPME option
- Peltier-cooled trayholder for 300  $\mu$ L fixed insert vials, 2 and 10 mL vials; temperature selectable between 0  $^{\circ}$ C and 40  $^{\circ}$ C
- Cooled trayholders for 300  $\mu$ L fixed insert vials, 2, 10 and 20 mL vials; requires external circulator bath; temperature selectable between 4  $^{\circ}$ C and 70  $^{\circ}$ C
- SPME Fiber Cleaning Station
- Solvent/reagent reservoir
- Large Volume Wash Station

### Solid Phase Micro Extraction Option

**Vial Volumes** | 2, 10 and 20 mL

**Sample Capacity** | Depending on Autosampler, GC and MS configurations:

- Up to 840 0.5/0.7 mL vials or 1260 0.5/0.7 mL vials with the extended X-arm
- Up to 648 2 mL sample vials or 972 2 mL vials with the extended X-arm
- Up to 180 10 or 20 mL vials or 300 10 or 20 mL vials with the extended X-arm

**Incubation Oven Capacity** | 6 vials

**Incubation Oven Temperature Range**  
40  $^{\circ}$ C to 200  $^{\circ}$ C in 1  $^{\circ}$ C steps, with agitation

**Vial Penetration Depth** | Standard or custom between 5 mm and 20 mm, suitable for liquid or headspace extraction

**Fiber Conditioning Station** | Optional, 2-ports and a needle guide, 40-350  $^{\circ}$ C, inert gas purged. Fiber: 23 gauge. One fiber holder to automate all fibers.



## Installation Requirements

Detailed installation requirements are provided in the DFS Preinstallation Requirements Guide PN/1194630

### Recirculating Water Chiller

The DFS mass spectrometer can be configured with the optional Thermo Scientific NESLAB ThermoFlex TF25 recirculating chiller. The chiller is compact, quiet and efficient. The ThermoFlex TF25 is available in both air-cooled and water cooled configurations, for a quiet laboratory for stable and precise cooling of magnet and turbo molecular pumps. The cooler is controlled by a temperature sensor mounted on the DFS magnet.

- Precise temperature control and temperature stability of up to  $\pm 0.1$  °C
- Adjustable high and low temperature safeties with audible alarm
- Environmentally-friendly CFC-free air-cooled refrigeration system ThermoFlex TF25 - 79.6 Kg, 44 x 67 x 73 cm

## Supplies

### Power

The DFS mass spectrometer 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 (Part No. 026 1850).

### Space Requirement

#### DFS Mass Spectrometer

- 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

**CPU:** 42 x 18 x 44.5 cm (16.5 x 7 x 17")

**Monitor:** 42 x 40 x 43 cm (16.5 x 16 x 17")

**Keyboard:** 2.5 x 47 x 18 cm (1 x 18 x 7")

## 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).

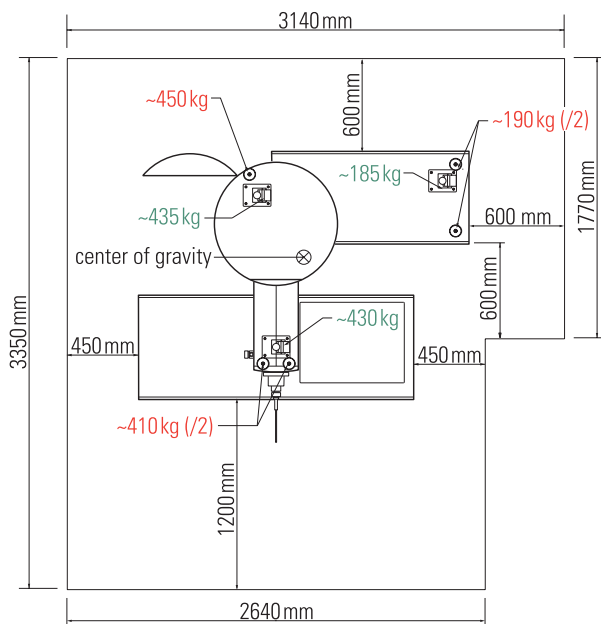
### Air Conditioning Load

The average power dissipation during analysis operation for a basic DFS system, 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



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