TriPlus RSH SMART robotic sampling system

Automated sampling solutions to solve your chromatography challenges

A step ahead in automated sampling

The quality of gas chromatography results depends on many factors – the stability of the gas chromatograph, the ruggedness and sensitivity of the detector, and the skill of the chemist in executing the proper sample workflow. Within this process, sample preparation and introduction provide the foundation for repeatability and reliability that are essential for quality data. The Thermo Scientific™ TriPlus™ RSH SMART autosampler utilizes robotic sample handling to expand automated capabilities beyond liquid, headspace and solid-phase microextraction (SPME) injections to advanced sample handling cycles, for simple and more complex sample preparation workflows. Your results benefit from improved precision and reproducibility, while your laboratory gains efficiency and productivity from the system's unattended operations.

The TriPlus RSH SMART autosampler brings together technological innovations to ensure highly reliable and safer operations through SMART consumables ID recognition and usage tracking. Thanks to the direct integration in the Thermo Scientific™ Chromeleon CDS, the SMART technology offers a fully documented usage-based approach for consumable management and operation traceability, supporting GLP compliance.

High quality results

- Reproducible performance
- Automated basic sample handling and standard preparation
- Accuracy you can count on

Unmatched flexibility

- Scalable capabilities to expand GC and GC-MS application range
- Accurate micro-sample injections
- Sampling techniques matched to sample types

Ultimate productivity

- Large sample capacity
- Standard and custom sample preparation workflows' automation
- Unattended 24/7 operation

Enhanced efficiency

- Enabled consumables usage tracking and health notifications
- Error free operations with automatic SMART syringes and fibers ID recognition
- Optimized consumables management

Expand productivity with powerful capabilities

Experience seamless operation with the automatic tool change

In modern laboratories, basic sample handling tasks, including standard or stock sample dilutions, internal standard addition and derivatization, require manual pipetting of precise amounts of solutions. To accurately automate these steps, the TriPlus RSH SMART autosampler utilizes the Automatic Tool Change (ATC) capability. The ATC 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 highly precise sample-handling in a single, unattended sequence prior to on-line sample injection. Developed for increased analytical flexibility and lab productivity, this unique capability automates complex sample preparation and injection workflows, thus eliminating human error. Combining the robotic automation capability with the possibility to serve two GC or GCMS with a single unit, expands productivity while saving precious lab space.
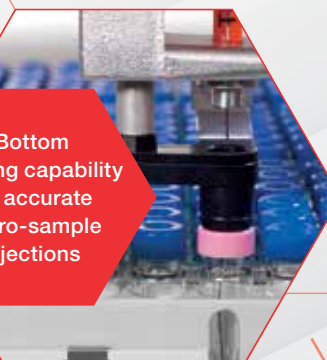
5 microliters of a liquid sample in a 300 microliter vial

1 µL splitless injection	40 ppm C20 in toluene
Volume in vial (microliters)	Peak area
50	81244277
40	80268993
30	82088809
20	82095395
10	84436788
5	84312030
RSD%	2.0

The TriPlus RSH SMART autosampler provides excellent repeatability with micro-samples, down to 5 µL in a vial, particularly interesting in case of precious samples, radioactive samples, or samples requiring expensive internal standards.

Bottom sensing capability for accurate micro-sample injections

Expand unattended operations with high sample capacity and injection mode flexibility

Unequivocal lab throughput is attainable by using the largest sample capacity available for an autosampler. With a maximum of 972, 2 mL vials combined with multiple 100 mL wash/waste bottles, the TriPlus RSH SMART autosampler enables week-end long unattended operations. Longer sequences can be developed for one autosampler to serve two GC systems, enabling the powerful combination of screening on a single GC or GC-MS system while simultaneously performing positive confirmation/quantitation on another GC-MS or GC-MS/MS system. Further productivity is achieved by utilizing various injection modes that match techniques to sample types. Liquid, Headspace, SPME and ITEX/DHS injections can all be used within a single sequence, running unattended with the use of the ATC capability, switching the syringe tool automatically as needed.

Achieve the best results for your sample type

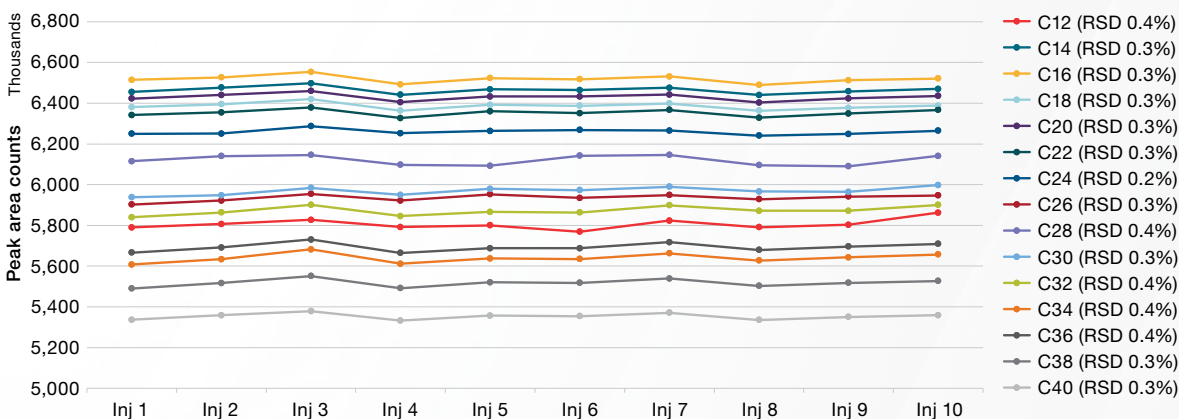## Flexible liquid sampling and injection

The TriPlus RSH SMART autosampler offers optimized liquid injection modes to support a wide range of sample types, inlets, and techniques for syringe filling. Parameters like pull-up strokes, viscosity delay, washing cycles, and needle depths can all be programmed, thus achieving high precision sampling and injection.

High flexibility in withdrawing samples in regular mode or using sandwich techniques provides the optimum sampling conditions even for the most critical samples.
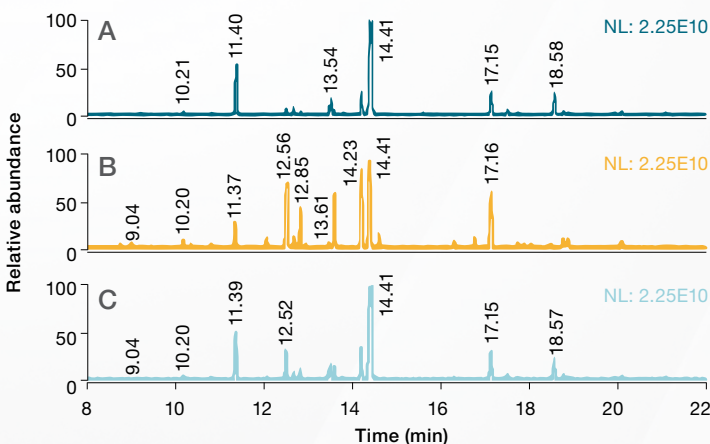
In addition to standard split/splitless injection modes, the TriPlus RSH SMART guarantee high quality results also with PTV and cold on-column methods. Depending on the sample type, a fast cold needle injection with cycle times lower than 100 ms is also available.

Simple and reliable headspace injection

Static headspace is a straightforward method for volatiles analysis. By using a high temperature resistant gas-tight syringe for direct headspace injection, the TriPlus RSH SMART offers a simple and reliable approach for headspace analysis, ideal to be combined with complementary sampling techniques such as SPME, ITEX/DHS or liquid injection. Overlapping sample incubation capability offers higher productivity. Every sample is ready for injection based on the GC cycle time. The optional Multiple Headspace Extraction (MHE) mode enables accurate quantification of volatiles in solids or samples with interfering matrices.

Peak area repeatability of a splitless injection of a "Florida Mix" standard

Legend: C12 (RSD 0.4%), C14 (RSD 0.3%), C16 (RSD 0.3%), C18 (RSD 0.3%), C20 (RSD 0.3%), C22 (RSD 0.3%), C24 (RSD 0.2%), C26 (RSD 0.3%), C28 (RSD 0.4%), C30 (RSD 0.3%), C32 (RSD 0.4%), C34 (RSD 0.4%), C36 (RSD 0.4%), C38 (RSD 0.3%), C40 (RSD 0.3%)

Total Ion Chromatograms of native oregano (A), thyme (B) and adulterated oregano sample (C) by SPME-Arrow and HRAM Orbitrap GC-MS

Solvent-free sample extraction with SPME

The TriPlus RSH SMART autosampler automates SPME sample extraction, ideal for volatile and semi-volatile organic compounds, through classic SPME fibers or high-robust, high-capacity SPME Arrow fibers. Optimum performance is achieved through precise control of all steps, from fiber preconditioning, to adsorption and desorption. Samples can be heated and shaken to reduce analysis times. Compounds of interest are extracted from liquid or headspace phases by simply setting the depth of fiber penetration into the vials. A great productivity boost is delivered by the fiber conditioning station, which flushes and heats fibers after the injection.

Increased automation and error-free sample handling

Move beyond automated sample injections to more advanced tasks, such as sample preparation, dilutions, standard curve generation, and derivatization routines by taking advantage of the latest technology in sample handling systems. Easily program your TriPlus RSH SMART with the Thermo Scientific Sampling Workflow Editor software, an intuitive visual-programming single screen application, or apply available customized workflows.

Sequential dilution
A high concentration standard is automatically diluted to easily meet your requirements.

Calibration dilution
Reliability and precision for your quantitative calibration. Prepare your calibration points with or without internal standards.

Standard addition
Add precise amounts of standards to any vial. Calibrating by standard addition is commonly used in headspace and SPME analyses. The accurate addition of standards is now a reliable, automated step in the measurement cycle.

Mixing
Vials undergo automatic agitation after the addition of standard volumes. Used also in Headspace, SPME and ITEX/DHS applications to reach a favorable and reproducible equilibrium in a shorter time.

Vortexing
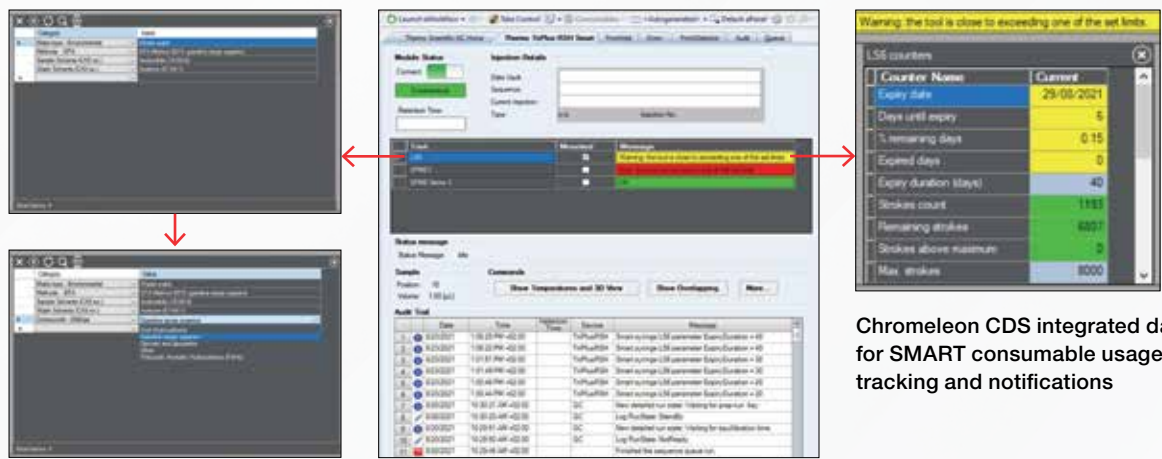Physical vortexing for thorough mixing can be used for homogenization of liquids and extraction steps with solvents.

Centrifugation
Essential tool for phase separation, supporting automated solvent extraction with micro volumes.

Flow-cell
A continuous stream of liquid or gaseous sample can be monitored with regular sampling from the flow-cell. Suitable for multi-stream applications.

Derivatization
Precise volumes, internal standard and reagent additions, with programmed incubation times – an all-in-one automated procedure that occurs just prior to injection.

Micro-SPE
Sample clean up is achieved through miniaturized SPE cartridges applying a positive controlled pressure for optimum separation and minimizing solvents' consumption. Reduced dwell volume limits the dilution factor eliminating the need of re-concentration.

Achieve SMART results with SMART consumables management

The unique SMART technology offers a traceable usage-based approach for syringes, SPME and SPME Arrow fibers management, resulting in increased reliability, instrument up-time, confidence in the results and full traceability.

Syringe/SPME fibers SMART chip exchanges information on ID and usage history

Liquid syringe with SMART chip

SPME fibers with SMART chip

Chromeleon CDS integrated dashboard for SMART consumable usage tracking and notifications

Ultimate SMART technology
SMART syringes, SPME and SPME Arrow fibers are equipped with an ID chip which stores all important parameters such as part number, lot number, usage parameters, operational ranges and history for that specific consumable. Tracking the usage history removes any risk of cross contamination or overuse.

Highly reliable results
Gain higher confidence in analytical results with validated SMART consumables and ensure error free usage of syringes or SPME fibers through automatic ID. Reliable consumables ensures reliable results.

Usage history traceability
Improve GLP compliance with full ID and usage history traceability. The information stored on the chip can be directly accessed and reported via Chromeleon CDS, integrating consumables identification and usage tracking into audit trail log file.

Improved consumables management
Optimize consumables consumption by monitoring of usage conditions and lifetime thanks to color-coded health notification dashboard integrated in Chromeleon CDS.
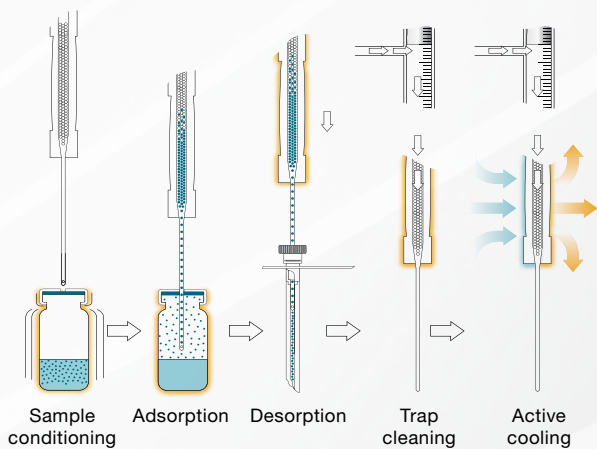
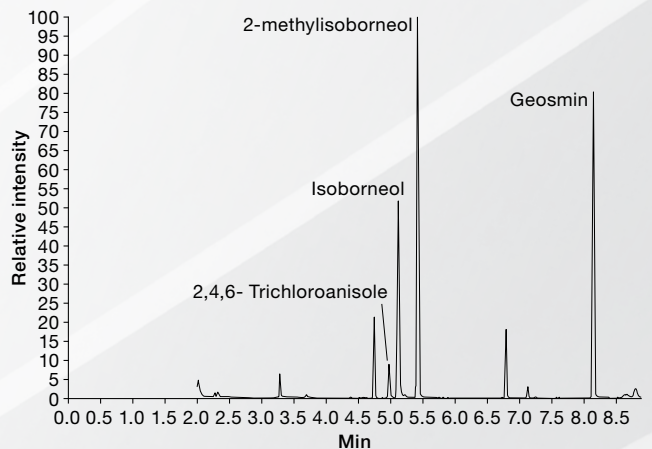# Powerful options to expand applications and sample traceability
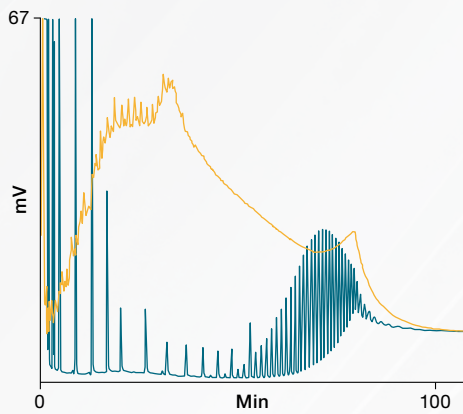
HT SimDist – Heavy fraction crude oil sample analysis and POLYWAX® 1000 standard. Automated On-Column injection systems

Expand applicability to unstable compounds or viscous samples

Temperature-controlled tray options protecting sensitive samples can be incorporated into the TriPlus RSH SMART autosampler quickly at any time. An affordable solution for large 10/20 mL vials can control temperatures from 4 ˚C up to 70 ˚C with an external thermostatic bath. Alternatively, a temperature-controlled option can accommodate a wide range of vial types, providing stable temperature control for accurate sampling of very volatile solvents, unstable compounds, or extremely viscous samples.

Enhanced sensitivity with dynamic headspace analysis

Sample enrichment is a valuable tool for the analysis of trace levels of volatile organics. Through dynamic headspace sampling a larger headspace volume is sampled and enriched on a trap before the injection. The In-Tube Extraction (ITEX-DHS) tool available on the TriPlus RSH SMART makes dynamic headspace very easy to achieve. The SMART ITEX syringe features a packed trap in the needle to enrich the headspace at each stroke. Modulating the number of strokes allows to modulate the required sensitivity. The trap is then rapidly heated to release the compounds for the injection.

GC-MS SIM chromatogram of tap drinking water sample by ITEX-DHS extraction

Schematic of the ITEX-DHS sample extraction and desorption process

Utilize barcode reading for error-free sample traceability

The convenient dual-laser barcode reader can read vertical 1-D barcode labels on 2, 10 and 20 mL vials. The dual-scanner capability allows the TriPlus RSH SMART autosampler to reliably read vial barcodes, making it easier to build sequences and ensure complete and error-free sample traceability.

A fully validated laboratory solution making you productive from day one

Validated consumables for trusted results

Combine the wide choice of liquid and gas-tight SMART syringes, SPME and SPME Arrow fibers with a complete selection of Thermo Scientific consumables. They include micro vials, vials for liquid and headspace, magnetic and plastic caps, snap-on, screw- and crimp-top caps, well plates, and much more. All these consumables are designed and tested to work problem-free with the TriPlus RSH SMART autosampler.

Integrated software control for quick setup and intuitive workflow

The TriPlus RSH SMART instrument control – from installation and setup to the most complex sequence – is fully embedded on standard Thermo Scientific Chromatography Data Systems including Chromeleon and Thermo Scientific™ TraceFinder™ software. Despite the large number of configurations and options offered within the basic injection modes, instrument setup and methods are created quickly with just a few mouse clicks. Sample preparation cycles for common operations are available as add-ons through pre-compiled sequence of steps. More complex workflows can be easily programmed with the Sampling Workflow Editor software and the cycles imported into the CDS for execution. A virtual terminal, fully integrated within the same software control, enables easier installation and initial setup from the PC.

Convenient handheld option for local control

The handheld controller is the ideal solution for displaying instrument status and facilitating setup and maintenance. Laboratories equipped with multiple TriPlus RSH and TriPlus RSH SMART autosamplers will also benefit from the operational flexibility provided by this controlling tool, using a single handheld device to set up all TriPlus RSH autosamplers in the lab.

A SMART solution for every need

The TriPlus RSH SMART can satisfy every laboratory workflows with different level of automation, maintaining SMART capabilities and ensuring the same benefits in terms of precision, robustness and reliability on all configurations.

Upgrade kits, tools and accessories are available to extend the sample vial capacity, or to expand the sample handling capability, and transform any configuration into a multi-technique, multi-purpose robotic platform.
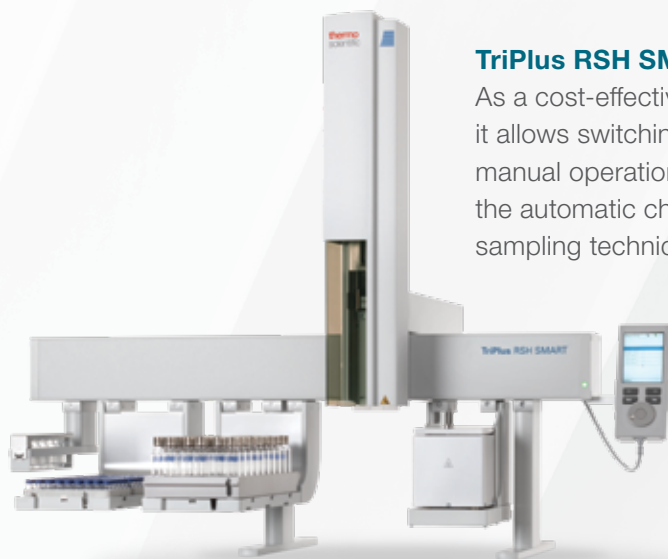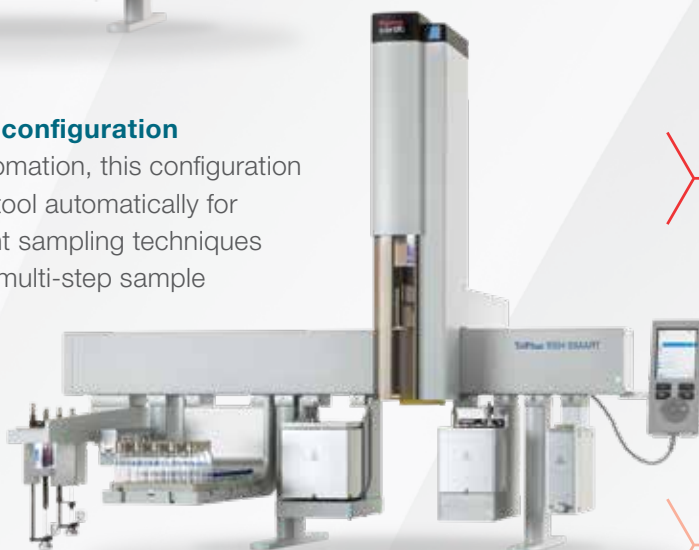
TriPlus RSH SMART Standard configuration

As a cost-effective solution for multi-purpose GC systems, it allows switching the injection tool with a quick and easy manual operation. Ideal for high sample throughput when the automatic change of different syringe types or sampling techniques is not required.

TriPlus RSH SMART Advanced configuration

To achieve the highest level of automation, this configuration allows the change of the injection tool automatically for unattended sequence with different sampling techniques and supporting the automation of multi-step sample preparation workflows.

Boost productivity with high throughput configuration

Boost productivity with the TriPlus RSH SMART Dual GC setup. Single TriPlus RSH SMART serving two injectors on the same GC, or two independent GC or GC/MS systems, for liquid, HS or SPME sample injection or for sample preparation. To further optimize the cycle time, Rapid Mode starts the syringe washing cycle during the current GC cooling phase.

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Thermo Scientific solutions for your gas chromatography needs

TSQ 9000 Triple Quadrupole GC-MS/MS
Highest selectivity and sensitivity with high-speed, high-capacity MS/MS selected reaction monitoring (SRM) for quantitation of target compounds in complex matrices.

ISQ 7000 Single Quadrupole GC-MS
Extended uptime and robustness maximize sample throughput for targeted and untargeted screening, confirmation and quantitation using library-searchable full-scan mass spectra or selected ion monitoring (SIM).

TRACE 1300 Series GC
Unique modular Gas Chromatograph offering a full line of user interchangeable injector and detector modules. The Thermo Scientific™ TRACE™ 1300 offers a single-button local interface ideal when minimum instrumental interaction is preferred. The Thermo Scientific™ TRACE™ 1310 offers a deeper interaction with the instrument through the icon-driven touch screen for direct instrument control.

Orbitrap Exploris HRAM GC-MS
For unknown compound identification or analysis of difficult matrices, Thermo Scientific™ Orbitrap™ technology provides high-resolution accurate-mass (HRAM) data with sub-ppm mass accuracy. Acquire full-scan data for targeted and untargeted screening, confirmation, unknown identification, quantitation, and retrospective analysis.

DFS Magnetic Sector High Resolution GC-MS
Access the ultimate confidence, robustness, and productivity of high-resolution sensitivity for full-scan and SIM-targeted screening and quantitation to meet worldwide compliance needs for analysis of dioxins and persistent organic pollutants (POPs). Exceptional productivity and flexibility with robotic TriPlus RSH SMART serving two GCs and DualData XL option, for up to doubled sample throughput.

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

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