Sample handling

PRODUCT SPECIFICATIONS

TriPlus RSH SMART Autosampler

Benefits

- Enhance laboratory efficiency through workflow automation
- Improve data quality with highly precise automated operations
- Gain higher confidence in your analytical results with validated SMART consumables
- Streamline good laboratory practice with SMART consumable traceability
- Optimize SMART consumable management with usage tracking and health notifications from Thermo Scientific™ Chromeleon™ Chromatography Data System (CDS)

The Thermo Scientific™ TriPlus™ RSH SMART Autosampler offers exceptional precision, flexibility, and productivity in robotic sample-handling solutions.

Thanks to the SMART technology, it provides a fully documented usage-based approach for syringes and SPME fibers management, resulting in increased reliability and uptime, reduced consumption, high confidence in the results and full traceability.

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 sample handling

The TriPlus RSH SMART Autosampler expands automated capabilities beyond sample injections, with advanced sample-handling operations. Automating the entire workflow, from sample preparation to injection, increases precision of the results and enables unprecedented flexibility and productivity in GC and GC-MS analyses.

Improved data confidence

Thanks to the SMART technology, consumable usage information is stored on the SMART chip of each syringe type or SPME/SPME Arrow fibers and directly accessible from the chromatography data system. This capability takes the worry out of consumables replacement, allowing for scheduled maintenance and optimized life span for consumables, while eliminating the risk of overuse which can compromise analytical results. The combination of TriPlus RSH SMART, SMART consumables and Chromeleon CDS is ideal for laboratories with high or variable sample loads, different methods or multiple operators interacting with the instrument, offering a fully documented usage-based approach for consumable management and operation traceability for GLP compliance.

Ultimate productivity

Designed for maximum productivity, the TriPlus RSH SMART accommodates large sample capacities supporting full, unattended 24/7 operation. As an example, a maximum of 972 x 2 mL vials combined with multiple 100 mL wash/waste bottles enable weekend-long unattended operations.

Unmatched flexibility

The robotic sample-handling system offers different sampling techniques, such as liquid, headspace and solid-phase microextraction, which can be automated with common sample-handling procedures like dilution, mixing, vortexing, heating/cooling, and centrifugation, to deliver the precision of high quality results.

Scalable capabilities enable expanded GC and GC-MS application ranges and the best matching of techniques to sample types.

Seamless operation

Accurate automation of a multitude of traditionally manual tasks is enabled by the Automatic Tool Change capability (ATC). The ATC enables a sequence setup using up to six different syringes, automatically loaded by the autosampler to accurately perform dilutions, standard additions, calibrations, and sample injections. The ability to exchange syringes for different tasks provides accurate and highly precise sample-handling operations in a single, unattended sequence prior to automated sample injection.

Configurations

The TriPlus RSH SMART Autosampler is available in two models with a different level of automation:

- **TriPlus RSH SMART Standard** allows switching the injection tool with a quick and easy manual operation, providing a cost-effective solution for multi-purpose GC systems.
- **TriPlus RSH SMART Advanced** performs the change of the injection tool automatically for unattended sequence with different sampling techniques, and supporting the automation of multi-step sample preparation workflows.

Upgrade kits, tools and accessories are available for both the Standard and Advanced base configurations 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.

Features and technical specifications

Product Description	
	XYZ robotic sample-handling apparatus integrating the technology for reading the information stored in a chip on SMART consumables, like consumable ID, operational parameters range, and customizable usage information. Available with two levels of automation: **TriPlus RSH SMART Standard** • Expandable to HS, SPME, SPME Arrow and ITEX-DHS • Compatible with all the available tools/accessories for sample handling • Features manual replacing of the tools • Programmable with the Thermo Scientific Sampling Workflow Editor software **TriPlus RSH SMART Advanced** • Expandable to HS, SPME, SPME Arrow and ITEX-DHS • Compatible with all the available tools/accessories for sample handling • ATC capability for automatic tool change, allowing different injection techniques executed within the same sample sequence in a fully unattended way • Up to six different tools can be managed at the same time, using two ATC stations • Tool Releasing Station with one parking slot, available as alternative to ATC • Using optional accessories and dedicated programmed workflows, the system is also capable of automating the most common sample preparation steps and deliver the highest level of sample-handling flexibility • Programmable with the Thermo Scientific Sampling Workflow Editor software
SMART technology	
	• A dedicated control board placed in the Z-head axis allows the reading of the information contained in the SMART chip embedded into SMART consumables (liquid, headspace and ITEX syringes, SPME and SPME Arrow fibers)* • The chip contains information on part number, lot number, usage history, usage parameters and operational parameters range. This ensures that the consumable item in use is regularly giving updates to the autosampler. The information stored on the chip can be read and reported by Chromeleon CDS
Communication	
	• Two independent LAN ports
Local user interface	
	• LED status indicators • Optional control panel with 4 keys, round knob and graphical LCD display
Instrument control	
	• Local controller for direct access to instrument configuration and movements (optional) • Thermo Scientific chromatography data systems integrated with Virtual Terminal software to completely mimic the local controller
Teaching functions	
	• Manual without using tools or external devices
Injector compatibility	
	• Compatible with on-column (COC), programable temperature vaporizing (PTV), packed (PKD), purged packed (PPKD), split-splitless (SSL) injectors

*The TriPlus RSH SMART is not compatible with syringes or SPME/SPME Arrow fibers without the SMART chip

High throughput configuration	
	• Dual Injector/Dual GC setup with Double Pro and Confirmation modes: single TriPlus RSH SMART executes two parallel injections on the same GC or on two independent GC or GC-MS systems, for liquid, HS or SPME sample injection • Clone Mode to serve up to four injectors on two GC or GC-MS systems: it controls the TriPlus RSH SMART as two independent autosamplers with separate methods, using the same or two different software systems (for liquid injection only) • 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 sample mixing with an agitation speed up to 2000 rpm. Compatible with 0.5, 0.7, 2, 5, 10, or 20 mL vials
Incubator/agitator	
	• Capacity 6 × 20 mL vials (compatible with 2 mL and 10 mL vials with adapters) • 30–200 °C temperature range • 250–750 rpm agitation speed
Temperature-controlled vial trays	
	• Heated and cooled trays expand the range of applications from sample injection to sample/standard preparation
Dilutor	
	• Single- or multi-solvent (up to four) dispensing tool • Dispensing syringe volume of 0.1, 1 (standard), 5, 10 mL • Dedicated PrepCycles for in-batch single- or multi-solvent addition, optional pre- and post-washing step, optional mixing step (requires Vortexer module)
Centrifuge	
	• Centrifuge Combi for 4 x 2 mL or 2 x 10 mL or 2 x 20 mL vials. RCF up to 2000 x g at 4800 rpm • Centrifugation of up to 20 mL total volume. Compatible with the following solvents: acetone, acetonitrile, ethyl acetate, methyl tert-butyl, ether, methanol, isopropanol, n-pentane, n-hexane, or cyclohexane • Full control with Chromeleon CDS
Flow-Cell	
	• Suitable for sampling from liquid or gaseous streams • Accommodates up to six flow cells
Mounting kits	
	• Thermo Scientific™ TRACE™ 1300 Series GC mounting kit included. Extra legs with different lengths for extended X-rail configurations available • Mounting brackets for standalone bench installation available • Mounting kits for TRACE GC Ultra, FOCUS GC and for major GCs on the market also available
Sampling techniques	
	• Liquid, Static Headspace, SPME, SPME Arrow, ITEX-DHS
Advanced sample prep	
	• Dedicated PrepCycles available to perform routine sample handling workflows, with automated tool changes • Accessories such as Vortexer, Incubator/Agitator or Dilutor, as well as multiple large volume syringes, large solvent station, µSPE option can be used in combination with the ATC to automate routine sample preparation procedures, such as standard dilution, standard addition, sequential dilution, derivatization and sample clean-up • Automated tool change requires the TriPlus RSH SMART Advanced with ATC station

Sampling Workflow Editor software

- Standalone software application allows the user to easily program custom sample preparation workflows through an intuitive drag-and-drop visual programming interface

Liquid Sampling

Vial volumes

- 300 µL fixed insert vials, 0.5, 0.7, 2, 2.5, 10, and 20 mL vials. 96/384 microtiter or deep well plates with Automatic Foil Cutter to pierce alumina or plastic foils prior to needle penetration

Bottom sensing for vials

- Capable of liquid injection starting from small-volume samples. Capability to inject from samples as low as 5 µL into a vial. Possibility of performing up to three 1 µL injections from a 5 µL sample, depending on vial type

Height from vial bottom

- User selectable between 0.1 and 32 mm in 0.1 mm increments

Injection speed for liquid samples

- Selectable from 0.1 µL/sec up to 2000 µL/sec and fully programmable

Sample capacity

Depending on autosampler configuration:

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

Syringes

- Capable of handling liquid volumes in the range 0.1 µL – 10 mL
- Capable of using 0.5 µL, 1.0 µL, 5 µL, 10 µL (standard), 25 µL, 50 µL, 100 µL, 250 µL, 500 µL, 1000 µL, 10000 µL syringes for sample injection and/or volume transfer
- Needle lengths: 57 mm or 85 mm

Syringe cleaning

- Standard wash station for up to 4 different solvents for a total of 40 mL and 1 x 10 mL waste
- Optional large wash station for up to 2 × 100 mL solvent bottles and one drain position
- Optional large solvent station for up to 3 x 100 mL solvent bottles
- Possibility to install multiple solvent stations to expand solvent and waste volumes

Injection volume

- Range from 0.1 to 10,000 µL in 0.1 µL steps up to 100 µL, and 1 µL steps between 100 µL and 10 mL

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

Optional tools	
	• Peltier-controlled drawer for well plates, 300 µL fixed insert vials, 2 and 10 mL vials. Temperature selectable between 4 and 40 °C • Cooled tray holders for well plates, 300 µL fixed insert vials, 2, 10 and 20 mL vials. Temperature selectable between 4 and 70 °C. Requires external circulator bath • Large Solvent Station – 3 × 100 mL • Large Wash Station – 2 × 100 mL and drain • Fast Syringe Washing module with two solvents – 2 × 1000 mL and one waste position
Typical liquid injection repeatability	
	• RSD <0.3% obtained under standard Thermo Scientific instrument conditions

Headspace Sampling	
Vial volumes	
	• Compatible with 2, 10 and 20 mL vials
Syringe sizes	
	• Gastight 1, 2.5, and 5 mL, standard (max 110 °C) or high-temp (max 150 °C)
Needle length	
	• 65 mm, compatible with every injector port
Sample capacity	
	Depending on autosampler configuration: • Up to 180 × 10 or 20 mL vials or 300 × 10 or 20 mL vials with the extended X-rail
Injection volume range	
	• 0.1 to 5 mL in 0.1 mL steps, depending on syringe
Injection speed	
	• 1 to 100 mL/min, in 1 mL/min increments
Syringe temperature	
	• OFF or 40 °C to 150 °C in 1 °C steps
Incubation oven	
	• Capacity 6 × 20 mL vials (compatible with 2 and 10 mL vials with adapters) • 30–200 °C temperature range, in 1 °C steps • 250–750 rpm agitation speed
Incubation time	
	• 0.1 to 600.0 min in 0.1 min increments
Syringe flush capability	
	• With inert gas
Multiple Headspace Extraction (MHE)	
	• Yes (optional accessory)
Enrichment sampling	
	• Yes, with optional kit for cold trap
Optional tools	
	• Peltier-cooled tray holder for 300 µL fixed insert vials, 2 and 10 mL vials; temperature selectable between 4 °C and 40 °C • Cooled tray holders for 300 µL fixed insert vials, 2, 10 and 20 mL vials; requires external circulator bath; temperature selectable between 4 °C and 70 °C
Typical headspace injection repeatability	
	• RSD <0.7% under Thermo Scientific standard conditions

Solid-phase microextraction (SPME)	
Tool	
	• Fitting SMART SPME fibers with no need of fiber holder • Compatible with SSL and PTV injectors
Vial volumes	
	• Compatible with 2, 10 and 20 mL vials
Sample capacity	
	• Depending on autosampler configuration: • Up to 648 × 2 mL sample vials or 972 × 2 mL vials with the extended X-rail • Up to 180 × 10 or 20 mL vials or 300 × 10 or 20 mL vials with the extended X-rail
Incubation oven	
	• Capacity 6 × 20 mL vials (compatible with 2 and 10 mL vials with adapters) • 30–200 °C temperature range, in 1 °C increments • 250–750 rpm agitation speed
Incubation time	
	• 0.1 to 600.0 min in 0.1 min increments
Vial penetration depth	
	• Standard or custom between 20 mm and 70 mm, suitable for headspace or direct immersion (DI) extraction
Fiber conditioning station	
	• Optional, 2-ports, 40 – 350 °C, inert gas purged • Suitable for both SPME and SPME Arrow fibers
Fiber types	
	• 10 mm fiber length • PDMS (7, 30, 100 µm), Polyacrylate (85 µm), Carbon WR/PDMS (95 µm), DVB/PDMS (65 µm), DVB/Carbon WR/PDMS (50-30 µm)

SPME Arrow	
Tool	
	• Fitting SMART SPME Arrow fibers with no need of a fiber holder • Compatible with SSL injector with an adapter (one adapter included)
Vial volumes	
	• Compatible with 10 and 20 mL vials
Sample capacity	
	Depending on autosampler configuration: • Up to 180 × 10 or 20 mL vials or 300 × 10 or 20 mL vials with the extended X-rail
Incubation oven	
	• Capacity 6 × 20 mL vials (compatible with 2 and 10 mL vials with adapters) • 30 – 200 °C temperature range, in 1 °C steps • 250 – 750 rpm agitation speed
Incubation time	
	• 0.1 to 600.0 min in 0.1 min increments
Vial penetration depth	
	• Standard or custom between 20 mm and 70 mm, suitable for headspace or direct immersion (DI) extraction
Heatex-Stirrer	
	• For intensive heating and stirring during the extraction step, 40 – 200 °C, 0 – 1600 rpm

Fiber conditioning station	
	• Optional, 2-ports, 40 – 350 °C, inert gas purged • Suitable for both SPME and SPME Arrow fibers
Fiber types	
	• 20 mm fiber length • PDMS (100 µm/1.1 mm o.d., 250 µm/1.5 mm o.d.), Polyacrylate (100 µm/1.1 mm o.d.), Carbon WR/PDMS (120 µm/1.1 mm o.d.), DVB/PDMS (120 µm/1.1 mm o.d.), DVB/Carbon WR/PDMS (120 µm/1.1 mm o.d.)

In-Tube Extraction Dynamic Headspace (ITEX-DHS)	
Tool	
	• Includes sampling gas-tight ITEX-DHS SMART syringe, focusing trap, built-in trap, heating and cooling fan and trap cleaning capability
Temperatures	
	• Trap 30 – 350 °C • Syringe 40 – 150 °C
Extraction parameters	
	• Flow rate 10 – 1000 µL/s, stroke cycles 0 – 1000, volume 0 – 1300 µL, incubation time up to 600 min, water removal step
Vial volumes	
	• Compatible with 20 mL vials
Vial penetration depth	
	• Standard or custom between 10 and 35 mm
Sample capacity	
	Depending on autosampler configuration: • Up to 180 × 10 or 20 mL vials or 300 × 10 or 20 mL vials with the extended X-rail
Incubation oven	
	• Capacity 6 × 20 mL vials (compatible with 2 and 10 mL vials with adapters) • 30 – 200 °C temperature range, in 1 °C steps • 250 – 750 rpm agitation speed
Incubation time	
	• 0.1 to 600.0 min in 0.1 min increments
Traps	
	• Tenax TA 80/100 mesh as standard, other single- or multi-layer microtraps available for volatile and semi-volatile compound enrichment

Micro Solid-Phase Extraction (µSPE)	
µSPE tool kit	
	• Includes hardware for µSPE handling, script, standard operation procedure and quick installation guide • Requires TriPlus RSH SMART Advanced with ATC tool
Sample capacity	
	• 54 (standard) – 108 (optional) × 2-mL sample vials, elution vials and µSPE cartridges
µSPE syringe volume	
	• 1000 µL for conditioning/elution solvent and raw sample
Liquid syringe volume	
	• 10 and 25 µL for ISTD/protectant addition and clean sample injection

Elution speed	
	• Optimized at 2 µL/s
Elution solvent	
	• 3 × 100 mL
Washing solvent	
	• 2 × 1000 mL
µSPE workflow	
	• Optimized QuEChERS extracts clean-up workflow with internal standard and analyte protectant addition (optional), µSPE cartridges conditioning (optional) and online or offline GC injection

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